**Project Manual**
For

# Maine Eye Retina & Surgery Center - 161 Marginal Way

**Maine Eye Center**
**Portland, Maine**

**Issue for Permit – 95% Progress Construction Documents**
**April 12, 2016**


Prepared by:

PDT ARCHITECTS

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Interior Design ■
Planning ■

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## 1.1 LIST OF DRAWINGS

Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled MAINE EYE – RETINA & SURGERY CENTER, dated 04.12.2016, as modified by subsequent Addenda and Contract modifications.

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

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# 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. Section Includes:

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

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

### 1.3 PROJECT INFORMATION

A. Project Identification: Maine Eye – Retina & Surgery Center.

1. Project Location: 161 Marginal Way, Portland, Maine 04101.

B. Architect Identification: The Contract Documents were prepared for Project by PDT Architects, 49 Dartmouth Street, Portland, Maine 04101. Telephone 207-775-1059.

C. Construction Manager: Hebert Construction, LLC., Lewiston, Maine.

1. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.

### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. The Work involves the renovations of the building at 161 Marginal Way, Portland, ME. Work includes but is not limited to, selective demolition, earthwork, site utilities and site improvements, and paving. Work also includes concrete foundations and slab-on-grade, steel structure, steel joists and decking, roof membrane over roof insulation, sheet metal, metal stud partitions, insulation, gypsum board walls and ceilings, ceramic tile, acoustical ceilings, resilient flooring, carpeting, custom cabinets and fixtures, carpentry, glass storefront system, painting, metal doors, wood doors, metal frames, door hardware, toilet accessories, signage, lockers, fire protection and detection systems, security systems, electrical, and heating, ventilating, and air conditioning complete and ready for use.

## 1.5 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. Selected toilet accessories and specialties.

## 1.6 ACCESS TO SITE

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

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

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

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

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

## 1.7 WORK RESTRICTIONS

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

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

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 and Noisy Activity: 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 providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

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 Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

## 1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 33-division format and CSI's "2004 MasterFormat" numbering system.

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

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

1. 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.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on 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 011000

# 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. 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. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. 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: Revise 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 revisions 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 – Suspended Architectural (hanger-rod) Canopies

1. Base Bid: Steel framed canopies as detailed in the construction documents, located over exterior doors 112A.2 and 140.1.
2. Alternate: Suspended Architectural (hanger-rod) Canopies in lieu of canopies as detailed in construction documents. Flashing details and general notes regarding attachments to the building and penetrations of masonry veneer still apply or will require Landlord approval.
   a. Products for Basis of Design:
      Company: Mapes Architectural Canopies
      Model: Super Lumideck
      Website: http://mapescanopies.com/super-lumideck/
      Notes: Provide downspouts at face of building for drainage.
      Unit has internal gutter beam system.

      Company: Perfection Architectural Systems
      Model: suspended canopies
      Website: http://www.perfectionarch.com/products/suspended-canopy.php
      Notes: Provide downspouts at face of building for drainage.
      Unit has internal gutter beam system.

END OF SECTION 012300

# 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 Requirements:

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

### 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 ACTION SUBMITTALS

A. Substitution Requests: Submit electronic copy 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. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section.

Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

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

## 1.5 QUALITY ASSURANCE

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

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions: Architect will consider requests for substitution if received within 60 days after commencement of the Work. 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)

END OF SECTION 012500

# SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

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

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

### 1.3 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. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within 20 days, when not otherwise specified, 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 bonds, insurance, taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include quotes on supplier’s and subcontractor’s letterhead for the requested change.
e. 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 changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable bonds, insurance, 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 Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

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

1.4 CHANGE ORDER PROCEDURES

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

1.5 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 012600

# 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. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

### 1.3 DEFINITIONS

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

### 1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate 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. Submittal schedule.
c. Items required to be indicated as separate activities in 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 coordinated with each element.

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

1. Identification: Include the following Project identification on the schedule of values:

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

2. Arrange schedule of values consistent with format of AIA Document G703.
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 Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

    a. Include separate line items under Contractor and principal subcontracts for 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 required, include evidence of insurance.

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. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

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

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

C. Draw-Down Schedule: The Contractor shall furnish to the Architect, at the beginning of the project, an expected monthly requisition estimate for the Owner’s use in planning funding.

## 1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial 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. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 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.

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. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three 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 conditional 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. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

H. Record Drawing Updates: With each Application of Payment, record documents shall be maintained and current for all trades, available for viewing at a central location.

I. 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. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Submittal schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits and other required 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.

J. Progress Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of progress Applications for Payment include the following:

1. Contractor's Construction Schedule update.
2. Submittals for Work being requisitioned for are complete and approved.
3. Submit list of completed tests, checklists, commissioning, reports, and similar requirements for the work are submitted and in compliance with the Contract Documents.
4. Minutes of previous month’s progress meeting have been distributed.
5. Record drawings and documents are current.

K. Application for Payment at Substantial Completion: After Architect issues 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 Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

L. Final Payment Application: After completing Project closeout requirements, 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, maintenance data and demonstration and training.
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. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.
6. Evidence that claims have been settled.
7. 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.
8. Final liquidated damages settlement statement, if applicable.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

# SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Requests for Information (RFIs).
3. Project meetings.

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

C. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

### 1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

### 1.4 INFORMATIONAL SUBMITTALS

A. 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.

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

## 1.5 GENERAL COORDINATION PROCEDURES

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.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical. Coordinate location of pipes, conduits, ducts and similar items in confined areas to assure proper fit and access. Contractor is responsible for handling interferences created by the work of subcontractors (example, sprinkler pipe interfering with installation of duct work; duct work interfering with installation of light fixtures, overhead construction interfering with installation of finish ceilings at proper height).
5. Coordinate the work to provide smoke and fire seals for component interfaces and penetrations of smoke walls and fire rated construction.

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.

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

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

1.6 REQUESTS FOR INTERPRETATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor 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 information or 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 resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination 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. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

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

D. Architect's Action: Architect will review each RFI, determine action required, and respond. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
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 Section 012600 "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. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. 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.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

## 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: Entity responsible for conducting meeting will 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 and conduct 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.

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

    a. Tentative construction schedule.
    b. Critical work sequencing and long-lead items.
    c. Designation of key personnel and their duties.
    d. Lines of communications.
    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. Preparation of record documents.
    l. Use of the premises and existing building.
    m. Work restrictions.
    n. Working hours.
    o. Owner's occupancy requirements.
    p. Responsibility for temporary facilities and controls.
    q. Procedures for moisture and mold control.
    r. Procedures for disruptions and shutdowns.
    s. Construction waste management and recycling.
    t. Parking availability.
    u. Office, work, and storage areas.
    v. Equipment deliveries and priorities.
    w. First aid.
    x. Security.
    y. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting 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. 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 requirements.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written instructions.
    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. 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 other parties requiring information.
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. 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, 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 operations and maintenance data.
    e. Requirements for delivery of material samples, attic stock, and spare parts.
    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.

E. Progress Meetings: Conduct progress meetings at monthly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. 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. Application for Payment: Contractor shall bring copy of Application for Payment to meeting. Review Application for Payment and required attachments, including record drawing and documents status, waivers of mechanic's liens, list of completed tests, checklists, commissioning, reports, and similar requirements for the work are submitted and in compliance with the Contract Documents.
    c. 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.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

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.

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: 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 meetings 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. Conduct coordination meetings with the mechanical, plumbing, sprinkler and electrical trades. Before the trades start work in an area of the building, make field measurements, review structural clearances and locations of ducts, pipes, conduits, light fixtures, equipment and other items that affect location and proper fit. Prepare coordination sketches to maximize utilization of space for efficient installation of different components. Verify depths and clearances before fabrication of ductwork.
4. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

# SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
2. Section 014000 "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 Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. 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.

## 1.4 INFORMATIONAL SUBMITTALS

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

1. PDF electronic file.

B. Startup construction schedule.

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

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Daily Construction Reports: Submit at weekly intervals.

F. Material Location Reports: Submit at monthly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

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

I. Qualification Data: For scheduling consultant.

## 1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "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. Discuss constraints, including work stages area separations and milestones.
2. Review delivery dates for Owner-furnished products.
3. Review submittal requirements and procedures.
4. Review time required for review of submittals and resubmittals.
5. Review requirements for tests and inspections by independent testing and inspecting agencies.
6. Review time required for Project closeout and Owner startup procedures.
7. Review and finalize list of construction activities to be included in schedule.
8. Review procedures for updating schedule.

## 1.6 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.
3. Allow for time in the construction schedule for materials to dry before they are enclosed to prevent the growth of mold and bacteria

## PART 2 - PRODUCTS

### 2.1 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 main 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 Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer 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 completion of punch list items 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. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
2. 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.

3. 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. Building flush-out.
m. Startup and placement into final use and operation.

4. Construction Areas: 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. Temporary enclosure and space conditioning.
c. Permanent space enclosure.
d. Completion of mechanical installation.
e. Completion of electrical installation.
f. 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 Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

## 2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, 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.

## 2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

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

## 2.4 REPORTS

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

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Services connected and disconnected.
16. Equipment or system tests and startups.
17. Partial completions and occupancies.
18. Substantial Completions authorized.

B. 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. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.

3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site 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.

## 2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner 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. 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 final completion percentage for each activity.

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

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

END OF SECTION 013200

# SECTION 013300 - SUBMITTAL PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

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

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017839 "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."

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

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

## 1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and 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. Submittals shall be scheduled in an orderly fashion that spreads the submissions out over a period of time to permit Architect adequate opportunity to schedule personnel for timely reviews. Where submittals are not required to be submitted concurrently, or do not require coordination with other submittals, Contractor shall review, stamp, and submit as submittals are received. Contractor shall not receive submittals, hold them, and then release them to the Architect all at once.
3. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
4. 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.

5. 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 date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

B. Arrange to have all submittals processed to the Architect within 60 days.

## 1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

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

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
2. Contractors requesting files shall sign the “Electronic Files Request Form and Waiver” and submit agreement included at the end of this section.

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

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

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

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

1. Initial Review: Allow 28 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 28 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 selection: The Contractor shall deliver to Architect a list of submittals for the interior color package and a list for the exterior color package. The Contractor shall deliver all items for exterior color selection at one time. The Architect needs to coordinate the colors of all exterior items and the Contractor shall allow 4 weeks for return of exterior color selections. The Contractor shall deliver all items for interior color selection at the same time. The Architect needs to coordinate the colors of all interior items and the Contractor shall allow 6 weeks for return of interior color selections.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., ABCD-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., ABCD-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner**,** containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Contractor.
    e. Name of firm or entity that prepared submittal.
    f. Names of subcontractor, manufacturer, and supplier.
    g. Category and type of submittal.
    h. Submittal purpose and description.
    i. Specification Section number and title.
    j. Specification paragraph number or drawing designation and generic name for each of multiple items.
    k. Drawing number and detail references, as appropriate.
    l. Location(s) where product is to be installed, as appropriate.
    m. Related physical samples submitted directly.
    n. Indication of full or partial submittal.
    o. Transmittal number, numbered consecutively.
    p. Submittal and transmittal distribution record.
    q. Other necessary identification.
    r. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

    a. Project name.
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name.
    d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: 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 identification information as related submittal.

G. 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.

H. 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.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action 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. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.

a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. 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.

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 published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable. Mark with dark colored pen that permits photocopying.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.

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

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

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

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

a. PDF electronic file.

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 on 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 42 inches.
3. Submit Shop Drawings in the following format:

a. PDF electronic file.

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 applicable Specification Section.
e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. 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.

5. 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.

6. 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. Mark up and retain one returned Sample set as a project record sample.

        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 Section 013200 "Construction Progress Documentation."

F. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

I. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

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

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

L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

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

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

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

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

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

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

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

7. Limitations of use.

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

T. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

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

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

## 2.2 DELEGATED-DESIGN SERVICES

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

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

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

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

# PART 3 - EXECUTION

## 3.1 CONTRACTOR'S REVIEW

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

1. The Contractor shall review submittals for completeness and compliance with the Contract Documents. If submittal contains substitutions, Contractor shall process substitutions in accordance with Section 012500 “Substitution Procedures,” and not part of specified Shop Drawings or Product Data submittals. Contractor is responsible for keeping Subcontractors on time with the submittal schedule. If the Contractor submits submittals that are repeatedly rejected, requiring the Architect to perform multiple reviews of the same submittal because of the failure to properly prepare and complete the submittals.

    a. Owner will compensate Architect for such additional services.
    b. Owner will deduct the amount of such compensation from the final payment of the Contractor.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "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. Action Submittals: Architect will review each submittal, provide a cover sheet with marks to indicate corrections or modifications required, and return it. Architect will provide a cover sheet with each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

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

4. Submit Specified Item: Resubmit using a specified item. Where submittal is rejected and returned for resubmittal of a specified product. Consult product section for list of acceptable manufacturers.
5. Rejected: Where submittal is returned for other reasons, with Architect's explanation included.

B. 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.

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

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

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

END OF SECTION 013300

Electronic File Release

Date: [Date]

To/Company:

Project: [Project Name]

RE: Transfer and use of electronic 3D model file

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[Contractors Representative]:

At your request PDT Architects will provide electronic files for your convenience and use in performing your work relating to the above referenced project, subject to the following terms and conditions:

1. Our electronic files are compatible with the specific software and hardware in use at PDT Architect's office. PDT Architects makes no representation as to the compatibility of these files with your software or your hardware.

2. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic data agrees that it will perform acceptance tests upon receipt, after which the receiving party shall be deemed to have accepted the data. PDT Architects makes no representations to the Recipient or others as to the long-term usability or readability of electronic media or of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the creating party.

3. The electronic files contain a 3D model prepared in the current version of Revit. The model is not and does not represent or imply construction documents. As a model, it is subject to change as the project proceeds. The construction requirements of the project will not be determined until the final construction documents are issued as 2D electronic files or paper copies. Any use of the 3D model for construction purposes is at the sole risk of the user and in violation of this agreement.

4. Since the electronic 3D model is intended for the sole purpose of PDT Architects developing its ongoing work, use of the model in determining estimating quantities or conditions shall be at the sole risk of the estimator.

5. Data contained on these electronic files are part of our instruments of service and shall not be used by [Contractor] or anyone else receiving these data through or from [Contractor] for any purpose other than as a convenience in your performing preconstruction services. Any other use or reuse by [Contractor] or by others will be at [Contractor] sole risk and without liability or legal exposure to PDT Architects. [Contractor] agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against PDT Architects, its officers, directors, employees, agents or subcontractors that may arise out of or in connection with [Contractor] use of the electronic files.

6. In the event that [Contractor] 's or its subcontractors, or anyone for whom [Contractor] is legally liable makes or permits to be made any changes to the 3D model without obtaining our written consent, [Contractor] shall assume full responsibility for the results of such changes. Therefore, [Contractor] agrees to waive any claim against PDT Architects and to release PDT Architects from any liability arising directly or indirectly from such changes.

7. Furthermore, [Contractor] shall, to the fullest extent permitted by law, indemnify and hold PDT Architects harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from [Contractor] 's use of these electronic files.

8. Under no circumstances shall delivery of the electronic files for use by [Contractor] be deemed a sale by PDT Architects.

Accepted by:

[Contractors Representative] September 3, 2014

# 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. 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.
4. Specific test and inspection requirements are not specified in this Section.

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

D. 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 specified requirements.

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

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

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

H. 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. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

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

## 1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: 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 conflicting 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. Qualification Data: For Contractor's quality-control personnel.

C. 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.

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

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for 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 or Notice to Proceed, 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: In quality-control plan, include 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.

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. 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.

C. 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.

D. 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.

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 in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections 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. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

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. 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, and 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.

## 1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated 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 from testing and inspecting allowances, as authorized by Change Orders.
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.

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 Section 013300 "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 as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

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.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: 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 revisions 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 or matching existing substrates and finishes. Restore patched areas

and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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 014000

# 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": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

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: The stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. Minor corrections and repairs that can be performed while the Owner has occupied the building and without undue annoyance to personnel will be acceptable under the definition of Substantial Completion. It shall also include major final cleaning required under the Contract, removal of all surplus equipment and material

not required for completion or remaining work, and the placement of remaining materials and equipment in convenient locations as approved by the Owner.

## 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 Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

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. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

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. Information is subject to change and is up-to-date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; http://dodssp.daps.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.

8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; http://eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeia; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. MDEP - State of Maine Department of Environmental Protection.
2. MDOT - State of Maine Department of Transportation

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

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

### 1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

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

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

D. Heating Fuel: Fuel required for temporary heating of exterior work will be the responsibility of the Contractor.

E. Telephone Service: Pay installation, service and use charges for telephone 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. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. 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.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- 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 work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

F. 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: Engage Installer of each permanent service to 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 and slabs from freezing temperatures and prevent frost from occurring beneath footings and slabs. 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. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

E. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

F. 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.

### 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 office activities and to accommodate Project meetings specified in other Division 01 Sections. 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 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
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. HVAC Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space 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, interior open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

## 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 Section 011000 "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. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

D. 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.

E. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

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.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
2. All spaces shall be mechanically ventilated to protect occupants from application and installation of odor causing materials. The area where odor-causing material is being used shall be isolated from the new and existing ventilation system.
3. Negative pressure shall be maintained within the construction areas inside the existing building to prevent the spread of dust and odors. Route ductwork from the negative-air fans to the exterior of the building, filtering the air in the duct prior to being discharged, by means of a standard furnace air filter. The negative air pressure system shall be activated prior to the commencement of work each day, and remain operating until one-half hour after the stop of work for each day.
4. No work creating fumes shall be done in occupied areas of existing building while it is occupied by the Owner. Ventilation shall be maintained for a period of 24 hours or until release of fumes has subsided, whichever is longer.
5. The permanent ventilation system shall be fully operational and run full time for a minimum of 2 weeks before date established for Substantial Completion. Cost of operation shall be included as part of the work.

G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to 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.

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

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

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

2. Provide an answering service on superintendent's telephone.

## 3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. 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.

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

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

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

E. 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.
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.

F. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

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

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

H. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

I. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

## 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to 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 Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

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

E. 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.

F. Site Enclosure Fence: Prior to commencing earthwork, 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 portion of site determined sufficient to accommodate construction operations.

G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

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

I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

J. 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 incomplete, insulate temporary enclosures.

K. 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; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

## 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 readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that cannot 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 roads and paved areas not intended for or acceptable for integration into permanent construction. 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, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

# 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. 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; and comparable products.

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 012300 "Alternates" for products selected under an alternate.
3. Section 012500 "Substitution Procedures" for requests for substitutions.
4. Section 014200 "References" for applicable industry standards for products specified.

### 1.3 DEFINITIONS

A. Products: Items obtained 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. 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: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," 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 additional manufacturers named in the specification.

## 1.4 ACTION SUBMITTALS

A. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "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, select product 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 and vandalism. 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 determine compliance with the Contract Documents and to determine 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. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

D. During the construction process, meet or exceed the following minimum requirements to prevent the growth of mold and bacteria:

1. Keep building materials dry. Wood, porous insulation, paper, fabric, and similar absorptive materials shall be kept dry to prevent the growth of mold and bacteria. Cover these materials to prevent rain damage, and if resting on the ground, use spacers to allow air to circulate between the ground and the materials.
2. Replace water-damaged materials, or dry within 24 hours, due to the possibility of mold and bacterial growth. Materials that are damp or wet for more than 24 hours shall be discarded if evidence of mold occurs.
3. Immediately remove materials showing signs of mold and mildew, including materials with exposed moisture stains, from the site and properly dispose of them. Replace moldy materials with new, undamaged materials.
4. Require that moisture sensitive materials be delivered dry and protected from the elements.
5. Allow for time in the construction schedule for materials to dry before they are enclosed.

## 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: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for 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 indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

# PART 2 - PRODUCTS

## 2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, 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. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. 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.

B. 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. 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.

C. 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 Section 012500 "Substitution Procedures" for proposal of product.

D. 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 016000

# 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. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Installation of the Work.
2. Cutting and patching.
3. Progress cleaning.
4. Starting and adjusting.
5. Protection of installed 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 QUALITY ASSURANCE

A. 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 Architect before proceeding. Shore, brace, and support structural elements 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.

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

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 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. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

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

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

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. 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 Owner 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 Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

## 3.3 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.

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. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

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

G. 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.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

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.

I. 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.

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

## 3.4 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. 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.

C. Temporary Support: Provide temporary support of work to be cut.

D. 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.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

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

G. 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 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.

H. 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 and ensures thermal and moisture integrity of building enclosure.

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

## 3.5 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. 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 waste materials more than seven days during normal weather or three 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.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

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.

    a. Clean interior spaces prior to the start of finish painting, and continue cleaning on an as-needed basis until painting is finished.
    b. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

3. Remove materials and debris that create tripping hazards.

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 dirt, debris and garbage from concealed spaces, including stud cavities 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 Section 017419 "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.

## 3.6 STARTING AND ADJUSTING

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

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

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: Comply with qualification requirements in Section 014000 "Quality Requirements."

## 3.7 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.

END OF SECTION 017300

# SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

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

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

### 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.

### 1.4 PERFORMANCE REQUIREMENTS

A. General: Salvage/recycle as much percent by weight as possible of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

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. Gypsum board.
t. Equipment.
u. Cabinets.
v. Piping.
w. Supports and hangers.
x. Valves.
y. Sprinklers.
z. Mechanical equipment.
aa. Electrical conduit.
bb. Copper wiring.
cc. Switchgear and panelboards.

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 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

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

B. 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.

3.2 RECYCLING DEMOLITION WASTE

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

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

1. Pulverize concrete to maximum 4-inch size.

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

1. Pulverize masonry to maximum 4-inch size.

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

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

E. 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.

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

G. 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.

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

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

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

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

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

## 3.3 RECYCLING CONSTRUCTION WASTE

A. Packaging:

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

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

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.

## 3.4 DISPOSAL OF WASTE

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

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

B. Burning: Do not burn waste materials.

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

END OF SECTION 017419

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

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

### 1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

### 1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

### 1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

## 1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Advise Owner of changeover in heat and other utilities.
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. 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.

## 1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. 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.

C. Re-Inspection Fees:

1. If the Architect Perform Re-inspections Due to Failure of the Work to Comply with the Claims of Status of Completion Made by the Contractor, Or, Should the Contractor fail to complete the work, Or, Should the Contractor fail to promptly correct warranty items or work later found to be deficient:

    a. Owner will compensate Architect for such additional services.
    b. Owner will deduct the amount of such compensation from the final payment to the Contractor.
2. If the Work is not completed by the date set in the agreement, and the Architect needs to perform additional Contract Administrative and on site observation duties:

    a. Owner will compensate Architect for such additional services.

b. Owner will deduct the amount of such compensation from the final payment to the Contractor.

## 1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization 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:

    a. PDF electronic file. Architect will return annotated file.

## 1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: 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, or when delay in submittal of warranties might limit Owner's rights under warranty.

1. Unless indicated otherwise, all warranties shall commence on the date of Substantial Completion.

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 Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper. Submit final warranties as a package for the entire project, assembled and identified as described below.
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.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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

E. Warranty Response Time: The Contract shall respond and begin to take necessary action within 7 days of receipt of written notification from the Owner. Response time for life safety items, and for building perimeter security shall be within 24 hours of receipt of written notification from the Owner.

## 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.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

A. General: Perform 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 designated 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; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Resilient flooring shall be scrubbed and cleaned with cleaner recommended by the flooring manufacturer just prior to occupation by Owner. No-wax floors shall cleaned and buffed in accordance with flooring manufacturer's requirements.
k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces. Cleaning of windows shall be done just before Owner occupancy.
l. Remove labels that are not permanent.
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. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

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

q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
r. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

## 3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

    1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

# 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. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

### 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. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

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

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

b. Enable inserted reviewer comments on draft submittals.

2. One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect 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 will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Subcontractor list.
5. Warranties
6. 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: 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 and primary subcontractors.
6. Name and contact information for Architect.
7. Name and contact information for Commissioning Authority.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. 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, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. 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. Maximum size of drawings to be included in the binders shall not exceed 11-by-17-inch.
    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 EMERGENCY MANUALS

A. Emergency operations and shutdown information that must be immediately available during emergency situations to protect life and property and to minimize disruptions to building occupants.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.

5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

## 2.4 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. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has 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. Use designations for products indicated on Contract Documents.
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.

## 2.5 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 and drawing or schedule designation or identifier where applicable.

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.

## 2.6 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 and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard 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 video recording, 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. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. 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.

E. 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.

F. 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 Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

# 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. 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.
5. Directories.

B. Related Requirements:

1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

### 1.3 CLOSEOUT SUBMITTALS

A. Submit all project record documents as one submittal package.

B. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.

C. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.

D. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

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 provide information for preparation of corresponding 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 acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

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 and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
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 annotated PDF electronic file.

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

## 2.4 DIRECTORIES

A. Directories: Contractor/Subcontractor directory.

1. Submit one hard copy and one copy on electronic media CD-R or USB storage device in PDF format.

B. Directory: Name, address and telephone number for General Contractor, all major subcontractors, organized by specification section. Provide a separate list in alphabetical order.

## 2.5 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 PDF electronic file.

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 revisions to project record documents as they occur; do not wait until 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 017839

# SECTION 024119 - SELECTIVE DEMOLITION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.
4. Temporary ventilation.
5. Repair procedures for selective demolition operations.
6. Patching and repairs.
7. Coordination with Owner for renovations adjacent to existing occupied spaces.

### 1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

### 1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

### 1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

5. Review areas where existing construction is to remain and requires protection.
6. Review requirements to keep existing construction in place to minimize disruption of Owner's operations.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Submit before Work begins.

F. 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.

G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

## 1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

## 1.7 QUALITY ASSURANCE

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

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
2. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, or preconstruction videotapes and templates.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

## 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."
2. All air-handling ducts shall be shut down or covered whenever possible during demolition activities. This covering or shut down of air-handling ducts shall be approved by the Owner prior to modifying existing conditions.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

## 3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Flooring Protection:

a. At existing buildings where existing flooring is to remain, cover flooring with protection board that will prevent damage from construction activities, including moving of equipment and lifts, metal cuttings from steel cutting and threading operations, oils and fluids that could discolor flooring, water, construction worker traffic and activities.

5. Cover and protect furniture, furnishings, and equipment that have not been removed.
6. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes

to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

## 3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

## 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

## 3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

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

## 3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

# SECTION 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 90 00

D. Underslab Vapor Retarders/Wall Waterproofing: Division 7

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.

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. Hardcopy Submittals: 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.

H. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.

2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.

3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Bluebeam version 12 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.

4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/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. Electronic submittals without the Contractor's approval will be rejected and returned.

5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

I. 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.

J. 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.

    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.

    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.**

K. 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.

L. Samples: Submit samples of materials as specified and as otherwise requested by Architect, including names, sources and descriptions.

M. Curing Methods: Submit documentation of curing methods to be used for review. Account for anticipated project temperature ranges and conditions in curing methods.

N. Contraction/Construction Joints: Submit plan indicating proposed location of contraction and construction joints in walls and slabs.

O. Test Reports: Test reports shall be submitted to the Owner, Architect and Engineer within 48 hour after completion of each test.

## 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:

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. Blast Furnace Slag: ASTM C989

L. Fly Ash: ASTM C618, Class C or F

M. 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.

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).

2.05 PROPORTIONING AND DESIGN OF MIXES:

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: 3,500 psi at 28 days.
    b. Aggregate: 3/4"
    c. W/C Ratio: 0.55 maximum
    d. Entrained Air: 6% +/- 1.5%
    e. Slump: 4" maximum
2. Interior Structural Slab Repair/Replacement:
    a. Strength: 3,000 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: 5,000 psi at 28 days
    b. Aggregate: 3/4"
    c. W/C Ratio: 0.40 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.
5. 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.

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. 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.

F. 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.

G. 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.

H. 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.

I. 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.

J. 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:

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. Concrete reinforcing and/or welded wire fabric shown on structural drawings is provided for structural purposes only; additional reinforcement may be necessary for reinforcing support, the anchorage of structural embedded items, and the anchorage of non-structural embedded items including, but not by limitation, radiant tubing. This reinforcing is not shown on the structural drawings as it is part of the contractor's means and methods and shall be included at no cost to the Owner.

3. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

4. 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.

5. 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.

6. 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.

3.04 INSTALLATION OF EMBEDDED ITEMS:

A. General: Set, securely anchor and build into work prior to concrete placement all anchorage devices and all other embedded items, including but not by limitation reinforcement, reinforcing dowels, embedded plates, anchor rods, anchor inserts, sleeves, load transfer plates, diamond dowels and shelf bulk heads required for other work that is attached to, bear upon, 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 without disturbance. Embedments shall be placed in a timely fashion to permit the inspection of embedments prior to concrete placement. **"Wet Setting" of embedded items into plastic concrete is strictly prohibited.**

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:

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 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.

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.

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.

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: $F_F35/F_L25$

2. Minimum Local F Number: $F_F25/F_L15$

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.

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.

C. Curing of Slabs-on Grade:

1. Slabs-on-grade shall be cured by wet curing methods unless otherwise noted.

2. Slabs-on-grade to receive floor coverings with moisture sensitive adhesives shall be cured by means of a moisture retaining covering. Coordinate curing with flooring adhesive manufacturer and flooring installer. Submit curing methods to Architect for review and approval.

D. 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.

E. 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.

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.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION:

A. Project Special Inspector shall verify reinforcement, including foundation reinforcement and slab reinforcement (WWF or reinforcing bar). Inspector 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 ASTM C31 for additional requirements for Test Specimens.

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**

# SECTION 035416 - HYDRAULIC CEMENT UNDERLAYMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes hydraulic-cement-based, polymer-modified, self-leveling underlayment for application below interior floor coverings.

### 1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.

C. Minutes of preinstallation conference.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.

C. Preinstallation Conference: Conduct conference at Project site.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

## 1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place hydraulic-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

## 1.7 COORDINATION

A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

# PART 2 - PRODUCTS

## 2.1 HYDRAULIC-CEMENT-BASED UNDERLAYMENTS

A. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ARDEX GmbH; K-15 Self-Leveling Underlayment Concrete.
b. Dayton Superior; LeveLayer I.
c. L&M Construction Chemicals, Inc.; Levelex Underlayment.
d. Maxxon Corporation; Level-Right.

2. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
3. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg F.

D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.

E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

1. Primer shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D.
2. Primer shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance.

1. Proceed with application only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

### 3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.

3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to product surface.
2. Feather edges to match adjacent floor elevations.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

## 3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 035416

# SECTION 042200 - CONCRETE UNIT MASONRY

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Cutting and patching existing concrete masonry units.
2. Mortar and grout.
3. Masonry-joint reinforcement.
4. Miscellaneous masonry accessories.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

    a. Include data on material properties material test reports substantiating compliance with requirements.
    b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 year experience.

B. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

## 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. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## 1.7 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates or setting beds. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with the following requirements:

1. Cold-Weather Construction: When the anticipated daytime low temperature is within the limits indicated, use the following procedures:

   a. 40 to 32 deg F: Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F.
   b. 32 to 25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Heat masonry units to 40 deg F. Maintain mortar and grout above freezing until used in masonry. Use heat on both sides of walls under construction.
   c. 25 to 20 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F.
   d. 20 deg F and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F.

2. Cold-Weather Protection: When the anticipated daytime low temperature is within the limits indicated, coordinate with the General Contractor to provide the following protection. This is in addition to construction procedures specified above:

   a. 40 to 32 deg F: Cover masonry with insulating blankets for 48 hours after construction.
   b. 32 deg F and Below: Provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 72 hours after construction.

3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.

E. Hot-Weather Requirements: Coordinate with the General Contractor to protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

### 2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Where indicated, provide units that comply with U.L. requirements for fire-resistance ratings indicated.

### 2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Decorative 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. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Pattern and Texture:

    a. Standard pattern, ground finish to match existing.

5. Colors: Match existing.
6. Available Products: Trendstone by Trenwyth.

## 2.4 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 and hydrated lime containing no other ingredients.

1. Available Products:

a. Lafarge: Eaglebond Portland and Lime, Type "S".
b. Ciment Quebec, Inc.: Portland and Lime / Type S.
c. Dragon Cement and Concrete: Type S Masonry Cement.
d. Quikrete: Portland and lime Quikrete.

E. Aggregate for Mortar: ASTM C 144.

F. Aggregate for Grout: ASTM C 404.

G. Water: Potable.

## 2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry-Joint Reinforcement, General: Truss type complying with ASTM A 951/A 951M.

1. Exterior Walls: Hot-dip galvanized, carbon steel.
2. Wire Size for Side Rods: 0.148-inch diameter.
3. Wire Size for Cross Rods: 0.148-inch diameter.
4. Spacing of Cross Rods: Not more than 16 inches o.c.
5. Provide in lengths of not less than 10 feet.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Truss type with single pair of side rods.

1. Available Products:

a. Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Truss.
b. Hohmann & Barnard; Truss-Mesh, #120.
c. Wire-Bond; Series 300, Single Wythe.

## 2.6 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.

C. 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. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch- thick steel sheet, galvanized after fabrication.
3. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch-diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. 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. Product:

1) Hohmann & Barnard, Inc.: 2-Seal™ Tie (Wing Nut).

## 2.7 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.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Holmann & Barnard: #NS – Closed Cell Neoprene.
b. Sandell: Closed Cell Neoprene.
c. Wire Bond: 3000 Horizontal.

## 2.8 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.

## 2.9 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.
1. Use portland cement-lime mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For reinforced masonry, use Type S.
2. For interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. 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.

D. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.
2. In addition to ASTM C90 requirements for defects in CMU units, do not install interior CMU units with defects larger than 1/4 inch, and defects visible from 5 feet away.

## 3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

## 3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Where cutting and patching of existing masonry walls, tooth in new work where finished product will be exposed to view.

F. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

G. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

## 3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

C. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is necessary, remove mortar and replace.

## 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.
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.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

## 3.7 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. 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.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. 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.

## 3.8 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste and legally dispose of off Owner's property.

END OF SECTION 042200

# 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 30 00 – Metal Deck

2. 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 and edges 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.

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. AWS D1.1 - "Structural Welding Code" - Steel.

5. AWS D1.3 - "Structural Welding Code" - Sheet Steel.

6. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."

7. "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.

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. Hardcopy Submittals: 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.

H. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.

2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.

3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Bluebeam version 12 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.

4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/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. Electronic submittals without the Contractor's approval will be rejected and returned.

5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned

electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

I. 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).

J. 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.

K. 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.

L. 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.

b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings indicating all members, braced frames, moment frames and connections. Incomplete submittals will not be reviewed.

2. Alternate 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.

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.

PART 2 PRODUCTS

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. Unless otherwise noted, specified embedment it to top face of head or nut.

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, connections to relieving angles, connections within masonry veneer cavity walls exposed to moisture, and all connections exposed to moisture or exterior environments.

H. 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.

I. Structural Steel Coatings shall be as specified in the Structural Steel Coatings section of this specification, and as specified in Division 9.

J. 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.

K. Non Shrink Cement-Based Grout: See Section 03 30 00

L. Drilled Anchors: Expansion and adhesive by HILTI unless specifically noted.

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 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. Coordinate steel markings with coating system to eliminate “bleed through” on steel permanently exposed to view.

D. 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”.

E. 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.

F. Follow manufacturer’s installation and safety instructions when applying coatings. Adhere to recoat time recommendations set forth by manufacturer.

G. General: Shop priming of structural steel is not required for heated, interior steel not exposed to view unless noted otherwise.

H. Coatings for steel which is to receive spray-on fireproofing shall be coordinated with architect. Primer/paint shall be omitted for such members when specified by the Architect.

I. Coatings: All exterior steel and/or steel permanently exposed to view shall receive a coating. Unless noted otherwise, refer to Division 9 specifications for products and surface preparation requirements.

J. Brick masonry loose lintels and relieving angle assemblies, including fasteners, shall be hot dipped galvanized, unless noted otherwise on the Architectural Drawings. Complete all shop fabrication prior to galvanizing assemblies.

K. 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 10 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.

L. 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.

M. 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

### 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 shims until fully grouted support is provided. If shown on drawings, anchor bolt nuts under base plates are not intended for erection support of base plate or column.

4. Pack non-shrink grout solidly between bearing surfaces and bases or leveling 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. 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.

H. 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.

I. Tolerances: Erection tolerances shall meet the "Code of Standard Practice" except as noted. Cumulative tolerances of framing elements shall not exceed the available tolerances of façade support systems to ensure and provide a plumb façade face.

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:

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.

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.

    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. Testing and inspection reports shall be submitted to the Owner, Architect and Engineer within 48 hours of completion of each test or inspection.

E. 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**

# SECTION 05 30 00 – METAL DECKING

## 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 metal roof deck is shown on the drawings and includes cell closures, end plates, metal lath column closures, welding washers and sump plates or pans.

### 1.03 RELATED WORK

1. Section 05 12 00 - Structural Steel

2. Section 05 50 00 - Metal Fabrications

### 1.04 QUALITY STANDARDS

A. Codes and Standards: Comply with provisions of the following codes and standards, except where more stringent requirements are indicated or specified:

1. AISI "Specification for the Design of Cold Formed Steel Structural Members”.

2. AWS D1.1 "Structural Welding Code" - Steel

3. AWS D1.3 "Structural Welding Code" - Sheet Steel

4. Steel Deck Institute (SDI) " Design Manual for Floor Decks and Roof Decks”.

5. “Code of Federal Regulations, Part 1926” per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Qualification of field welding: Qualify welding process and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."

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 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.

G. Hardcopy Submittals: 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.

H. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.

2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.

3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Bluebeam version 12 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.

4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/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. Electronic submittals without the Contractor's approval will be rejected and returned.

5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

I. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.

J. Shop Drawings:

1. Shop Drawing Review: Electronic files of structural drawings **will not** be provided to the contractor for preparation of shop drawings.

   a. Submit detailed drawings showing layout and types of deck panels, galvanizing, shop paint, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing, and all other accessories. 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.

   b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings. Incomplete submittals will not be reviewed**.**

K. DELIVERY, STORAGE AND HANDLING:

1. Deliver materials to site at such intervals to insure uninterrupted progress of work.

2. Store materials to permit easy access for inspection and identification. Keep deck sheets off ground, using pallets, platforms, or other supports. Protect deck sheets and packaged materials from corrosion and deterioration.

3. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

## PART 2 PRODUCTS

### 2.01 GENERAL:

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. United Steel Deck

2. Wheeling Corrugating Co.

3. Epic Metals Corporation

4. Vulcraft

B. Materials:

1. Steel for Metal Deck Units:

a. Roof Deck Units: ASTM A1008, Grade C, D, or E, or ASTM A653, Structural Quality, grade 33 or higher.

2. Miscellaneous Steel Shapes: ASTM A36 minimum.

3. Sheet metal Accessories: ASTM A526, commercial quality, galvanized.

C. Galvanizing: Conform to ASTM 924-94 with minimum coating class of G60 (Z180) as defined in ASTM A653-94.

D. Paint: Manufacturer's baked on, rust inhibitive paint, for application to metal surfaces which have been chemically cleaned and phosphate chemical treated.

E. Flexible closure Strips: Manufacturer standard vulcanized, closed-cell, synthetic rubber.

2.02 FABRICATION:

A. General: Form deck units in lengths to span 3 or more supports, unless otherwise noted on the drawings, with flush, telescoped or nested 2" laps at ends and interlocking or nested side laps, unless otherwise indicated. For roof deck units, provide deck configurations complying with SDI "Roof Deck Specifications," of metal thickness, depth and width as shown.

B. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6" wide.

C. Metal Closure Strips: Fabricate metal closure strips, cell closures, "Z" closures, column closures, pour stops, girder fillers and openings between decking and other construction, of not less than 0.045" min. (18 gage) sheet steel or as indicated on the drawings. Form to provide tight fitting closures at open ends of cells or flutes and sides of decking.

D. Roof Sump Pans: Fabricate from a single piece of 0.071" min. (14 gage) galvanized sheet steel with level bottoms and sloping sides to direct water flow to the drains, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess pans not less than 1 1/2" below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before permanently fastened. Deck shall be in full contact with members parallel to ribs and attached as indicated. Do not stretch or contact side lap interlocks.

C. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.

D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

E. Coordinate and cooperate with the structural steel erector in locating decking bundles to prevent overloading of structural members.

F. Do not use decking units for storage or working platforms until permanently installed.

3.02 FASTENING:

A. Roof Deck: Each deck is to be fastened with a minimum of 5/8" diameter puddle welds spaced in a 36/7 pattern (1.5B deck) with a minimum of 2 welds per unit at each support if incomplete sheet is utilized. Where support is parallel to support, at edge of building, at brace lines, at edge of opening or deck discontinuity provide puddle welds at 6" o.c. Secure deck to each supporting member in ribs where sidelaps occur. Deck units shall bear over the ends of supports by a minimum of 1.5". Sidelaps: #10 Tek screws at 6" o.c. (1.5B deck).

B. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

C. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.

D. Reinforcement at openings: Provide additional metal reinforcement and closures pieces as required for strength, continuity of decking and support of other work shown.

1. Deck penetrations affecting no more than (1) deck rib need not be reinforced.

2. For deck penetration affecting more than (1) deck rib, but less than 10", reinforce the opening with a 0.057" thick plate spanning between unaffected ribs, unless otherwise shown on the Design Drawings or supporting a piece of mechanical equipment (see item 3).

3. Reinforce deck penetrations larger than 10" with the structural frame described in the Design Drawings.

E. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.

F. Roof Sump Pans: Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12" on center with at least 1 weld in each corner. Cut opening in roof sump bottom to accommodate drain size indicated.

G. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.

H. Touch-Up Painting:

1. Painted Deck: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

a. Touch up painted surfaces with same type paint used on adjacent surfaces.

b. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

3.03 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.

B. 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.

C. Testing: Owner shall engage an Independent Testing Agency to inspect all puddle 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.

D. Deck Testing Requirements (to be performed by the Independent Testing Agency):

1. Deck and accessory welding and/or attachments subject to inspection and testing. Work found to be defective will be removed and replaced at the Contractor's expense.

2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. If re-certification of welders is required, re-testing will be the Contractor's responsibility.

**END OF SECTION**

# SECTION 054000 - COLD-FORMED METAL FRAMING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Exterior non-load-bearing wall framing.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1. Include structural analysis calculations signed and sealed by the qualified professional engineer responsible for their preparation.

a. Review of structural analysis calculations is for general conformance with requirements and completeness. The responsibility for correctness rests soley with the designer. The Architect reserves the authority to require resubmittal for observed deficiencies, or incompleteness.

2. Include complete details for all member connections at openings and other discontinuities of the wall system.
3. Specify connections to supports at top and bottom of wall including spacings at jambs of openings.

### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.

4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

## 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed cold-formed metal framing 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.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

1. Provide seal of professional engineer on calculations and shop drawings.
2. Same engineer shall provide on-site review of installation.

C. 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 cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

E. SSMA Section Properties: Provide cold-formed metal framing members with section properties that equal or exceed the properties indicated in SSMA's "Product Technical Information" publication.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dale/Incor.
2. Dietrich Metal Framing; a Worthington Industries Company.
3. EB Metal, U.S.
4. MarinoWare; a division of Ware Industries.
5. Super Stud Building Products, Inc.
6. The Steel Network, Inc.

7. United Metal Products, Inc.

## 2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on the structural drawings or otherwise approved.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

    a. Exterior Non-Load-Bearing Curtain-Wall Framing: Horizontal deflection of 1/360 of the wall height for siding.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

    a. Upward and downward movement of 3/4 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards:

1. Wall Studs: AISI S211.
2. Headers: AISI S212.
3. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 2.3 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H or ST50H as required by structural performance.
2. Coating: G90.

B. Steel Sheet for Vertical Deflection or Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 50, Class 1.
2. Coating: G90.

## 2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (43 mils or 18 gage).
2. Flange Width: 1-5/8 inches (162).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (125).

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. VertiClip, by The Steel Network. Series: SL, SLT, SLB, AND SLS as required by attachment condition.
b. Fast Top Clips by Dietrich, with FastClip deflection screws.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: As required to resist design loads.
2. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.

E. Approved alternates to double studs for openings: ASTM A653/A653M, Grade 50 (340), 50ksi (340MPa), minimum yield strength, 65ksi (450 MPa), minimum tensile strength, G-60 (Z180) hot-dipped galvanized coating.

1. JamStud™ by The Steel Network, Inc.

a. Approved engineered connections for openings: StiffClips® as manufactured by The Steel Network, Inc.

2. HDS by Dietrich.

## 2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.

## 2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
2. Minimum size; No. 10-16 (D=0.19”), with length adequate for 3 threads to project through the connected members.

## 2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

### 3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing is to be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw or bolt wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Locate mechanical fasteners and install according to Shop Drawings, and complying with the following:
    b. Power-actuated fasteners: In concrete, minimum spacing = 3”, minimum edge distance = 3”. In structural steel, minimum spacing = 1 ½”, minimum edge distance = ½”.
    c. Screws: Minimum spacing and edge distance = ½”.

E. Install framing members in one-piece lengths or multiple lengths as required by the design and load requirements.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place,

undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings or as indicated in the shop drawings.

I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

## 3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As required by design, but not greater than 24 inches on center.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to infill studs and anchor to building structure.
4. Connect drift clips to cold-formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
2. Bridging: Cold-rolled steel channel, mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

## 3.5 FIELD QUALITY CONTROL

A. Engineer of cold-form metal framing shall review on-site installation and provide written documentation that installation conforms to design intent. If corrective work is required, same engineer shall specify repair work necessary to provide conforming installation.

B. Remove and replace work where test results indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

## 3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

# SECTION 055000 - METAL FABRICATIONS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

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. Metal framing for exterior fence.
4. Steel support for surgery lights.

### 1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

### 1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. 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. Metal framing for exterior fence.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

E. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

## 2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

1. Available Products:

a. Sealmastic, Type 1; W. R. Meadows
b. Hydrocide 600; Sonneborn Building Products.
c. Karnak 100 AF; Karnac Chemical Corp.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

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, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

## 2.7 FRAMING FOR EXTERIOR FENCE

A. Provide materials as indicated on the drawings. Galvanize all materials and fasteners.

## 2.8 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## 2.9 STEEL AND IRON FINISHES

A. Galvanizing: Provide coating for iron and steel fabrications applied by the hot-dipped process, Duragalv 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.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

# PART 3 - EXECUTION

## 3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

## 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 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

# SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, furring and nailers.
3. Miscellaneous sheathing.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

### 1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

## 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings.

## 2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.4 MISCELLANEOUS SHEATHING

A. Plywood Wall Sheathing: Exposure 1, Structural I (CDX) sheathing.

1. Span Rating: Not less than 24/0 or 32/16.
2. Nominal Thickness: As indicated on the drawings.

## 2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Screws for Fastening to Metal Framing: ASTM C 1002 or ASTM C 954, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Chemical anchor or expansion anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material for 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. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking and similar supports to comply with requirements for attaching other construction.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Do not splice structural members between supports unless otherwise indicated.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

H. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

## 3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

## 3.3 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

a. Nail to wood framing.
b. Screw to cold-formed metal framing.
c. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 061053

# SECTION 061600 - SHEATHING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Sheathing joint and penetration treatment.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

### 1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

### 2.2 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. GlasRoc Sheathing; CertainTeed (BPB America, Inc.)
    b. Dens-Glass Gold; Georgia-Pacific Corporation.
    c. eXP Extended Exposure Sheathing; National Gypsum Company.
    d. Securock Sheathing; United States Gypsum Co.

2. Type and Thickness: Type X, 5/8 inch thick.

## 2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

## 2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. General: If required by the selected Air Barrier manufacturer, provide the following joint sealant:

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Available Product: 895 Silicone building Sealant by Pecora Corporation.
2. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

## PART 3 - EXECUTION

### 3.1 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with nails or screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

# SECTION 062013 - EXTERIOR FINISH CARPENTRY

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Exterior decking for wall cladding.

### 1.2 ACTION 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 Selection: For each type of product involving selection of colors, profiles, or textures.

### 1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's warranties.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack decking flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### 1.5 FIELD CONDITIONS

A. 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.

### 1.6 WARRANTY

A. Manufacturer's Warranty for Decking: Manufacturer agrees to repair or replace trim that fails due to defects in manufacturing within specified warranty period. Failures include, but are not limited to, deterioration, delamination, and excessive swelling from moisture.

1. Warranty Period: 25 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 EXTERIOR PLASTIC DECKING

A. Plastic Lumber, General: Products acceptable to authorities having jurisdiction with current model code evaluation reports that show compliance with building code in effect for Project for indicated type of construction.

1. Allowable loads and spans, as documented in evaluation reports or in information referenced in evaluation reports, shall not be less than design loads and spans indicated.

B. Composite Plastic Lumber (.9 inch thick): Solid shapes made from a mixture of cellulose fiber and polyethylene or polypropylene.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GAF Materials Corp.; DuraLife Siesta Collection (formerly CorrectDeck CX).
b. Trex; Select.
c. TimberTech; ReliaBoard.
d. Veranda; Horizon.

2. Decking Size: .9 by 5.4 inches actual.
3. Configuration: Provide product with square edges designed for face fastening.
4. Surface Texture: Woodgrain.
5. Color: As selected by Architect from manufacturer's full range.

### 2.2 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Decking: Provide No. 7 galvanized trim-head screws, 2-1/2 inches long. Provide Fastenmaster TrapEase composite decking screws by Olympic Fasteners.

## 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 DECKING INSTALLATION

A. Install decking in accordance with manufacturer's recommendations.

B. Decking to span a minimum of three framing members.

C. Pre-drill holes for fasteners and provide 1 inch clearance from deck edges.

D. 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 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.

## 3.4 CLEANING

A. Clean exterior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

## 3.5 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

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 062013

# SECTION 062023 - INTERIOR FINISH CARPENTRY

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Interior wood wall.
3. Shelving and clothes rods.

### 1.2 ACTION 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 Selection: For each type of product involving selection of colors, profiles, or textures.

### 1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under 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.

### 1.4 FIELD 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. Lumber: DOC PS 20 and the following grading rules:

1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."
2. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
3. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
4. SPIB: The Southern Pine Inspection Bureau, "Standard Grading Rules for Southern Pine Lumber."
5. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
6. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

1. 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.

C. Softwood Plywood: DOC PS 1.

D. Hardboard: AHA A135.4.

E. MDF: ANSI A208.2, Grade 130.

F. Particleboard: ANSI A208.1, Grade M-2 or Grade M-2-Exterior Glue, where indicated.

G. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

1. Color: As selected by Architect from manufacturer's full range.

### 2.2 INTERIOR TRIM

A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: White maple; Clear; NHLA.
2. Finger Jointing: Not allowed.
3. Gluing for Width: Use for lumber trim wider than 6 inches.
4. Face Surface: Surfaced (smooth).
5. Matching: Selected for compatible grain and color.

B. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade: Eastern white pine, Finish or No. 2; NeLMA or,
2. Species and Grade: Poplar; B finish; NHLA.
3. Finger Jointing: Allowed.
4. Face Surface: Surfaced (smooth).

## 2.3 WOOD WALL

A. Board Paneling: Reclaimed river wood by Maine Heritage Timber, Heritage Plank.

1. Species: Mixed.
2. Pattern: Square edge.
3. Sizes: 3, 4 and 5 inch width and random lengths from 1 to 4 feet.
4. Thickness: 1/2 inch.

B. Board Paneling: Reclaimed river wood by Maine Heritage Timber, TimberChic.

1. Species: Mixed.
2. Pattern: Square edge.
3. Sizes: 3, 4 and 5 inch width and random lengths from 1 to 4 feet.
4. Thickness: 1/4 inch.

C. Trim: Provide matching wood trim at exposed wall ends.

## 2.4 SHELVING AND CLOTHES RODS

A. Closet Shelving: Made from the following material, 3/4 inch thick.

1. Melamine-faced particleboard with applied-PVC front edge.

B. Shelf Cleats: 3/4-by-3-1/2-inch boards, eastern white pine or poplar.

C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

D. Clothes Rods: 1-5/16-inch-diameter, chrome-plated-steel tubes.

E. Rod Flanges: Clear, kiln-dried, white maple turnings.

## 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.

C. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.

D. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

## 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, too small to fabricate with proper jointing arrangements, or 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. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
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. 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**] [**Miter**] at returns, miter at outside corners, and cope at inside 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. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

## 3.5 PANELING INSTALLATION

A. Board Paneling: Install according to manufacturer's written instructions. Arrange in random-width pattern suggested by manufacturer unless boards or planks are of uniform width.

1. Install in full lengths without end joints.
2. Stagger end joints in random pattern to uniformly distribute joints on each wall.
3. Install with uniform end joints with only end-matched (tongue-and-groove) joints within each field of paneling.
4. Install with uniform end joints. Locate end joints only over furring or blocking.
5. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards. Install with uniform tight joints between boards.
6. Fasten paneling by face nailing, setting nails, and filling over nail heads.

## 3.6 SHELVING AND CLOTHES ROD INSTALLATION

A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.

B. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches o.c. Use 2 fasteners at each framing member.

1. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing. Remove adhesive that is squeezed out after fastening shelf cleats in place.

C. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

D. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.

1. Fasten shelves to cleats with finish nails or trim screws, set flush.
2. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

E. Install rod flanges for rods as indicated. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Install rods in rod flanges.

## 3.7 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.

## 3.8 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

## 3.9 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

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 062023

# SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Plastic-laminate cabinets.
2. Plastic-laminate countertops.
3. Solid-surfacing-material countertops, backsplash and window sills.
4. Quartz agglomerate-material countertops.
5. Decorative acrylic panels.
6. Locker bench and shoe rack.
7. Adjustable height work station.
8. Interior window inserts.

### 1.2 ACTION SUBMITTALS

A. Product Data: For panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures installed in architectural woodwork.

C. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Shop-applied opaque finishes.
3. Plastic laminates.
4. PVC edge material.
5. Thermoset decorative panels.
6. Solid-surfacing materials.
7. Quartz agglomerate-material countertops.
8. Decorative acrylic panels.

D. Samples for Verification:

1. Lumber with or for transparent finish, not less than 50 sq. in. or 5 inches wide by 24 inches long, for each species and cut, finished on 1 side and 1 edge.

2. Veneer-faced panel products with or for transparent finish, 8 by 10 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.
3. Lumber and panel products with shop-applied opaque finish, 50 sq. in. for lumber and 8 by 10 inches for panels, for each finish system and color, with 1/2 of exposed surface finished.
4. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish.
5. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish.
6. Solid-surfacing materials, 6 inches square.
7. Quartz agglomerate-material countertops, 6 inches square.
8. Decorative acrylic panels.
9. Exposed cabinet hardware and accessories, one unit for each type and finish.

## 1.3 QUALITY ASSURANCE

A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

B. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

## 1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

## 1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## 1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: White maple, rift sawn or cut.

C. Wood Products: Comply with the following:

1. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
2. Particleboard: ANSI A208.1, Grade M-2.

D. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Colors: Provide full color options available from Panolam or Panval not just standard white, putty, almond, and grey.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:

a. Formica Corporation.
b. Lamin-Art, Inc.
c. Nevamar Company, LLC; Decorative Products Div.
d. Panolam Industries International Incorporated. (Pionite)
e. Westinghouse Electric Corp.; Specialty Products Div.
f. Wilsonart International; Div. of Premark International, Inc.

F. Solid-Surfacing Material (CT-2): Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

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. E. I. du Pont de Nemours and Company.

2. Type: Standard type, unless Special Purpose type is indicated.
3. Colors and Patterns: As indicated in the Interior Materials Legend.

G. Quartz Agglomerate (CT-1): Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Caesarstone.

2. Colors and Patterns: As indicated in the Finish Schedule or Legend.

H. Resin Panels RP-1 thru 4): Specially-formulated co-polyester resin embedding natural birch twigs.

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. Lumicor.

2. Thickness: 3/8 inch.
3. Color: As indicated in the Interior Materials Legend.

## 2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.

1. Available Products:

a. Blum: BH75T1550.
b. Grass: GHA3703M.
c. MEPLA: CS04 (MH146304550015).

C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

D. Shelf Rests: BHMA A156.9, B04013; plastic, two-pin type with shelf hold-down clip.

1. Plastic double pin shelf clip: Provide 1/4 inch diameter hole, clear or white color as selected by the Architect.

a. Available Products:

1) Hardware Concepts, Inc.: Series 5033.
2) AllenField: No. 55 Double Pin.

E. Drawer Slides: BHMA A156.9, B05091; Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.

1. Available Products:

a. Grass 6610.
b. Mepla-Alfit: AL 5300.
c. KV 8417.
d. Blum 430E Series.

F. Pantry Pull-Out Slides: full-extension type; zinc-plated steel ball-bearing slides.

1. Available Manufacturers:

a. Grass
b. Mepla
c. KV
d. Blum

G. Counter Support Brackets: Provide one of the following

1. Heavy gage aluminum angle, MIG welded corners, 5/16 inch holes for mounting, and primed finish for field painting. Provide Rakks Counter Support, Model No. EH-1818, by Ragine Corporation (800-826-6006) or approved substitution.

H. ADA Counter Support Brackets: Provide the following:

1. Heavy gage aluminum angle, MIG welded corners, 5/16 inch holes for mounting, and primed finish for field painting. Provide Rakks EHV Vanity Bracket, 18 by 21-1/2 inch, by Ragine Corporation (800-826-6006) or approved substitution.

I. Drawer and Door Locks: Provide Locks by Olympus Lock, Inc.; 100 DR door lock and 200 DW drawer lock. No substitutions.

1. Provide 6 master keys with all locks keyed alike.
2. Provide on all drawers and doors.
3. Provide epoxy adhesive to retain lock attachments in place.

J. Grommets for Cable Passage through Countertops: 3-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Provide No. 35-3" by Outwater Plastics, Woodridge, NJ, (800) 631-8375.

K. Wall Hooks: To be determined.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
2. Satin Stainless Steel: BHMA 630.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

## 2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

E. Adhesive for Bonding Plastic Laminate: Contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for

shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

## 2.5 PLASTIC-LAMINATE CABINETS

A. Grade: Custom, unless noted otherwise.

B. AWI Type of Cabinet Construction: Flush overlay without face frame.

C. Component Materials:

1. Body members - ends, bottom, divisions, rails and tops: .028" exterior laminate over 3/4 inch thick particleboard, interior Thermoset Decorative Overlay (melamine) with 3 mm PVC edging, all exposed and semi-exposed sides. Provide Type B or C flush joint for underside of wall cabinets as required by AWI 400-G-7.
2. Shelves: Minimum 3/4 inch thick particleboard, Thermoset Decorative Overlay (melamine) each side with 3 mm PVC edging. Provide material and thickness required to meet AWI 400-G-8.
3. Backs: 1/4 inch thick particleboard, Thermoset Decorative Overlay (melamine) each side.
4. Drawer sides, backs and subfronts: 1/2" hardwood plywood or solid lumber.
5. Drawer Bottoms: 1/4" hardwood plywood.
6. Drawer Fronts: .028" exterior laminate over 3/4 inch thick particleboard, interior Thermoset Decorative Overlay (melamine) with 3 mm PVC edging.
7. Cabinet Doors: .028" exterior laminate over 3/4 inch thick particleboard, interior Thermoset Decorative Overlay (melamine) with 3 mm PVC edging.
8. Edging: Band all exposed edges with 3 mm PVC.
9. Base Toe Kick: Hardwood plywood.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors, matte finish.
b. Patterns, matte finish.

## 2.6 POST-FORMED COUNTERTOPS (CT-3 and 4)

A. Post-formed Countertops: HGP, nominal thickness .038" (1.0 mm), phenolic resin particleboard with .020" phenolic backer sheet. Provide contemporary design with 3/8 inch radius edges and 3/16 inch radius coves.

B. Core Material at Sinks: Exterior-grade plywood.

C. Seal all countertop miters with silicone sealant during assembly.

## 2.7 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Premium.

B. Solid-Surfacing-Material Thickness: 1/2 inch.

C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.
2. Fabricate tops with field-applied backsplashes.

D. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

## 2.8 SOLID-SURFACING-MATERIAL WINDOW SILLS

A. Grade: Premium.

B. Solid-Surfacing-Material Thickness: 1/2 inch.

C. Fabricate sills in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate sills with shop-applied edges of materials and configuration indicated.

## 2.9 QUARTZ-AGGLOMERATE-MATERIAL COUNTERTOPS

A. Material Thickness: 1-1/4 inch.

B. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.
2. Fabricate tops with shop-applied backsplashes.

C. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### 3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes to walls with adhesive.

4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

## 3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

# SECTION 066400 - PLASTIC PANELING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

### 1.3 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

### 2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Composites, Inc.; Glasbord.
b. Marlite; Standard FRP.
c. Nudo Products, Inc.; FiberLite FRP.

2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 200 or less.
b. Smoke-Developed Index: 450 or less.

3. Nominal Thickness: Not less than 0.075 inch.
4. Surface Finish: Smooth.
5. Color: White.

## 2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece or two-piece, snap-on vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, and caps as needed to conceal edges.

1. Color: White.

B. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

C. Adhesive: As recommended by plastic paneling manufacturer.

D. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.

1. Mark plumb lines on substrate at trim accessory or panel joint locations for accurate installation.
2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

## 3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Follow adhesive manufacturer's recommendations for appropriate height of adhesive bead left by trowel. Use a "crosshatch" type pattern. Make sure adhesive extends to all edges of the panel. Adhesive should be applied directly to the back of the FRP panel.

C. Start in corner. Install one piece corner molding. Apply silicone sealant in molding. Slide panel into molding and withdraw 1/8" (3.2mm). This will provide the appropriate gap as recommended. Begin in corner nearest molding and with laminate roller begin rolling out towards the edge without the molding.

D. Continue rolling down and out working your way across the panel away from the previously installed panel or initial molding to remove all trapped air.

E. Install one piece division bar and caps or next molding by laying down bead of silicone sealant in molding and sliding onto the panel. Withdraw the molding 1/8" (3.2mm), again to provide proper spacing. The free edge of the molding may be tacked in place if preferred before installing the next panel.

F. Repeat the process working in one direction across the ceiling.

G. Apply silicone sealant in all moldings and around all panel edges, fasteners, and fixtures to provide a moisture proof installation.

H. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

# SECTION 072100 - THERMAL INSULATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Mineral-wool blanket.
3. Mineral-wool board.
4. Sprayed Foam insulation.
5. Vapor retarders.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

## PART 2 - PRODUCTS

### 2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

B. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Dow Chemical Company (The); Styrofoam Square Edge Insulation.
    b. Owens Corning; Foamular® 250.
    c. Pactiv Corporation; GreenGuard Type IV 25 PSI Insulation Board.

2. R-Value: 5.0 per inch.
3. Application: Foundation and below slab insulation.

### 2.2 MINERAL-WOOL BLANKETS

A. Mineral-Wool Blanket, Unfaced: 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, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Industrial Insulation Group, LLC (IIG-LLC).
    b. Roxul Inc.
    c. Thermafiber Inc.; an Owens Corning company.

2. R-Value: 4.2 per inch.
3. Application: Exterior wall insulation.

### 2.3 MINERAL-WOOL BOARDS

A. Mineral-Wool Board, Unfaced: ASTM C 612, Type IVB; consisting of fibers; with maximum flame-spread and smoke-developed indexes of 0 and 0, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Roxul Inc.; CavityRock DD.

b. Thermafiber Inc.; an Owens Corning company; RainBarrier HD.

2. R-Value: 4.2 per inch.
3. Application: Exterior wall insulation.

B. Mechanical fasteners in accordance with insulation manufacturer's written recommendations.

## 2.4 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. Zerodraft Insulating Air Sealant by Zerodraft.

B. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 1.5 lb/cu. ft..

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Corbond® Performance Insulation System.
b. Henry Permax 1.8 Closed Cell Foam Insulation.
c. Styrofoam™ SPF Insulation.

2. Flame/Smoke Properties: 25/450 in accordance with ASTM E84.
3. R-Value, Aged: 6.2 per inch.

## 2.5 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.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

### 3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### 3.3 INSTALLATION OF SLAB INSULATION

A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 48 inches in from exterior walls.

### 3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. On vertical foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line.

B. Butt panels together for tight fit.

### 3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install 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 the cavities, 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. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

C. Sprayed Foam Insulation: Comply with insulation manufacturer's written instructions applicable to products and applications. Spray insulation to envelop entire area to be insulated and fill voids. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam. Install into cavities formed by framing members to achieve thickness indicated on Drawings.

1. At Locations Exposed To View: Apply Flame-Resistive Coating in accordance with manufacturer’s recommendations.

## 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 072100

# 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. Cutting and patching existing EIFS-clad barrier-wall assemblies.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory.

B. Samples for Verification: 24-inch-square panels for each type of finish-coat color and texture required to match existing, prepared using same tools and techniques intended for actual work including custom trim, each profile, and an aesthetic reveal.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each EIFS assembly and component, for tests performed by a qualified testing agency.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. 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.

## 1.7 FIELD 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.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Match products and manufacturer of existing EIFS.

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

## 2.2 EIFS MATERIALS

A. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate and complying with one of the following:

1. Job-mixed formulation of portland cement complying with ASTM C 150/C 150M, Type I, and polymer-based adhesive specified for base coat.
2. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
3. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.

B. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation (EPS): Comply with ASTM C 578, Type I; and with EIFS manufacturer's requirements for most stringent

requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:

1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks.
2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E 84.
3. Dimensions: Provide insulation boards of not more than 24 by 48 inches and in thickness indicated, but not more than 4 inches thick or less than the thickness allowed by ASTM C 1397.
4. Foam Build-Outs: Provide with profiles and dimensions indicated on Drawings.

C. 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. according to ASTM E 2098 and the following:

1. Reinforcing Mesh for EIFS, General: Not less than weight required to match existing.

D. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following to match existing:

1. Job-mixed formulation of portland cement complying with ASTM C 150/C 150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
3. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
4. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.

E. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; designed to resist Project's design loads; capable of pulling fastener head below surface of insulation board; and complying with the following:

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.

F. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

G. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating complying with the following:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
2. Colors: Match approved mockup sample.
3. Textures: Match approved mockup sample.

H. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.

I. Water: Potable.

J. 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 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. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
4. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.

## 2.3 MIXING

A. 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 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.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

## 3.2 EIFS INSTALLATION, GENERAL

A. Comply with ASTM C 1397, ASTM E 2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate.

## 3.3 INSULATION INSTALLATION

A. Board Insulation: Adhesively or mechanically attach insulation to substrate in compliance with ASTM C 1397 and the following:

1. Sheathing: Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to substrate. Apply adhesive to a thickness of not less than 1/4 inch for factory mixed and not less than 3/8 inch for field mixed, measured from surface of insulation before placement.
2. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
3. Allow adhered insulation to remain undisturbed for not less than 24 hours, before installing mechanical fasteners, beginning rasping and sanding insulation or before applying base coat and reinforcing mesh.
4. Mechanically attach insulation to substrate. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:

    a. Steel Framing: 5/16 inch.

5. Apply insulation over dry substrates in courses with long edges of boards oriented horizontally.
6. Begin first course of insulation from a level base line and work upward.
7. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
8. 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.

    a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
    b. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.

9. Interlock ends at internal and external corners.
10. 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.
11. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
12. 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. Prevent airborne dispersal and immediately collect insulation raspings or sandings.

13. 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.
14. Install foam build-outs and attach to structure.
15. Interrupt insulation for expansion joints where indicated.
16. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
17. 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.
18. Fully wrap board edges with strip reinforcing mesh.
19. 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.

20. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS lamina.

## 3.4 BASE-COAT INSTALLATION

A. Base Coat: Apply to exposed surfaces of insulation and foam build-outs in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.

B. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, 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 invisible.

C. Foam Build-Outs: Fully embed reinforcing mesh in base coat.

## 3.5 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.

## 3.6 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 072413

# SECTION 072500 - WEATHER BARRIERS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Building wrap.
2. Flexible flashing.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

B. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

## PART 2 - PRODUCTS

### 2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DuPont Building Innovations: E. I. du Pont de Nemours and Company; Tyvek CommercialWrap.

2. Water-Vapor Permeance: Not less than 10 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
4. Allowable UV Exposure Time: Not less than six months.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

## 2.2 FLEXIBLE FLASHING

A. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

C. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F 1667.

# PART 3 - EXECUTION

## 3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch 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 overlap unless otherwise indicated.

C. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

## 3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over water-resistive barrier at bottom and sides of openings.
4. Lap water-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 072500

# SECTION 072616 - BELOW-GRADE VAPOR RETARDERS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Vapor retarders under slabs-on-grade.

### 1.2 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.

### 1.3 SUBMITTALS

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

B. Samples for Verification: 12 inch square units for each type of vapor retarder, vapor barrier, or air barrier indicated.

### 1.4 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.

### 1.5 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 with extremely low permeance for critically sensitive, low permeance floor coverings such as rubber, vinyl, urethane, epoxy and methyl methacrylate, as well as linoleum and wood, having the following qualities:

| | | |
|---|---|---|
| 1. | Minimum Permeance: | ASTM E-96, not greater than 0.01 perms. |
| 2. | Tensile Strength: | ASTM E154 or D638, Class A – over 45 lbf/in. |
| 3. | Puncture Resistance: | ASTM E-154, Class B – over 1700 grams. |
| 4. | Water Vapor Barrier: | ASTM E-1745, meets or exceeds Class B. |
| 5. | Thickness of Barrier (Plastic) | ACI 302.1R-96, not less than 15 mils. |

B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Stego Wrap, 15 mil thick vapor retarder by Stego Industries LLC, (877) 464-7834.
2. Griffolyn® 15 by Reef Industries.
3. Sealtight Perminator 15 mil Underslab Vapor-Mat by W.R. Meadows, Inc.
4. Viper VaporCheck 16 by Insulation Solutions, Inc.

C. Vapor-Retarder Tape (for slabs): Stego Warp red polyethylene tape or tape as recommended by the manufacturer.

D. Double-Stick Edge Tape: Preformed 1-1/2" wide two-sided adhesive. Available products include “Fab Tape” by Reef Industries.

E. Expansion Joint Filler: Installer may elect to use Deck-O-Foam Expansion Joint Filler by WR Meadows or equal. Foam expansion joint filler with pre-scored removable strip for installation of joint sealant.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Clean substrates of substances harmful to vapor retarders, including removing projections capable of puncturing vapor retarders, or of interfering with attachment.

B. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

## 3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions applicable to products and application indicated.

B. Extend retarders in thickness indicated to envelop entire area to be covered. Cut and fit tightly around obstructions. Remove projections that interfere with placement.

## 3.4 INSTALLATION OF UNDER-SLAB VAPOR RETARDERS

A. Moisture vapor retarder system shall be installed at all interior floor slabs and as otherwise indicated in the drawings in strict accordance with the manufacturer's printed instructions and as follows:

1. Snap chalk line along inside perimeter of foundation walls at top of slab elevation.
2. Without wetting, clean a 3" wide band on the surface of the concrete below the chalk line at approximately mid-slab height. Remove dirt, residual form release, or other bond inhibiting surface contaminates. Grind smooth any surface projections within the band.
3. While removing the contact paper on the backside, firmly press 2" wide double-stick edge tape onto wall, parallel to the chalk line on the cleaned band at mid-slab elevation.
4. Remove contact paper on the face side.
5. Apply a 12" wide strip of vapor retarder covering only the bottom 1" of contact surface on the edge tape. Cut, fit, and seal corner details with vapor retarder seaming tape.
6. Align top edge of Deck-O-Foam expansion joint material to chalk line, and press material onto remaining 1" of exposed perimeter strip adhesive.
7. Roll out vapor retarder material, overlapping edge rolls and all seams by 3". Tape all seams with vapor retarder seaming tape.
8. All tears, punctures, etc. to be repaired and taped as required to maintain the watertight integrity of the vapor retarder system.

## 3.5 PROTECTION

A. Protect installed vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where vapor retarders are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072616

# SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers.

### 1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
2. Include details of interfaces with other materials that form part of air barrier.

### 1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.

B. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

C. Warranty: Provide sample warrantee for Installer and Manufacturer.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

## 1.6 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

## 1.7 WARRANTY

A. Material Warranty: Manufacturer agrees to repair or replace components of air barrier system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

B. Special Project Warranty: Submit air barrier Installer's warranty, signed by Installer, covering Work of this Section, including all components of air barrier system for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 283, ASTM E 783 or ASTM E 2357.

## 2.3 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 40-mil-thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlisle Coatings & Waterproofing Inc.; CCW-705.
    b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Perm-A-Barrier Wall Membrane.
    c. Henry Company; Blueskin SA.
    d. Tremco Incorporated; ExoAir 110/110LT.

2. Physical and Performance Properties:

    a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
    b. Tensile Strength: Minimum 250 psi; ASTM D 412, Die C.
    c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
    d. Puncture Resistance: Minimum 40 lbf; ASTM E 154.
    e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F; ASTM D 570.
    f. Vapor Permeance: Maximum 0.05 perm; ASTM E 96/E 96M, Water Method.

## 2.4 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.

B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

C. Termination Sealant: Dow Corning, Dow 758 Sealant, or manufacturer’s approved silicone sealant for adhering to polyethylene facer.

D. Liquid Membrane: Air barrier manufacturer’s two component liquid membrane.

E. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

F. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

G. Sprayed Foam Sealant: Refer to Division 07 Section “Thermal Insulation” for spray foam insulation applied at doors and windows.

H. Membrane Strip Flashing: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Carlisle Coatings & Waterproofing Inc.; CCW-705.
    b. Grace, W. R., & Co. - Conn.; Perm-A-Barrier Wall Flashing.
    c. Henry Company; Blueskin® SA.
    d. Tremco Incorporated, an RPM company; ExoAir TWF.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

E. At changes in substrate plane, apply liquid membrane fillets at sharp corners and edges to form a smooth transition from one plane to another.

F. Cover gaps in substrate plane greater than 1/2 inch and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

### 3.3 INSTALLATION

A. General: Install modified bituminous sheets and accessory materials according to air-barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F.

B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strip flashing centered over vertical inside corners. Install 3/4-inch fillets of termination sealant on horizontal inside corners.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination sealant and according to ASTM D 6135.

D. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

E. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
2. Roll sheets firmly to enhance adhesion to substrate.

F. Apply continuous modified bituminous sheets over membrane strip flashing bridging substrate cracks, construction, and contraction joints.

G. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch-wide, membrane strip flashing.

H. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with sealant.

I. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install membrane strip flashing on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

J. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

K. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply membrane strip flashing so that a minimum of 3 inches of

coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

1. Membrane Strip Flashing: Roll firmly to enhance adhesion.

L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier membrane with foam sealant.

M. At end of each working day, seal top edge of air-barrier material to substrate with termination sealant.

N. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.

P. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

## 3.4 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 072713

# SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system.
2. Roof insulation.
3. Walkway pads.
4. Fascia system.

### 1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

### 1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, 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. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: 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. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

## 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing and fastening spacings and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
5. Fascia system.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Fascia system.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer’s installation rating of the roofing contractor.

C. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of complying with performance requirements.

D. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

E. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

F. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

G. Sample Warranties: For manufacturer's special warranties.

## 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.

B. Installer Qualifications: 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. 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. 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.

## 1.8 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.

## 1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

## 1.10 WARRANTY

A. A manufacturer’s sole source 20-year written Total Roofing System Warranty shall be provided with a peak gust wind speed limitation of 70 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. Total Roofing System is defined as the following materials and provided by the roof system manufacturer: membrane, flashings, counterflashings, adhesives, sealants, insulation, cover boards, fasteners, fastener plates, fastener bars, metal work.
2. The warranty shall be for twenty (20) 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 total 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.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind speed of 70 mph (measured 30 feet above the ground).

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

## 2.2 EPDM ROOFING

A. EPDM: ASTM D 4637, Type I, nonreinforced, 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. Versico Incorporated.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: White on black.

## 2.3 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. 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. Other Adhesives: 250 g/L.
   g. Single-Ply Roof Membrane Sealants: 250 g/L.
   h. Nonmembrane Roof Sealants: 300 g/L.
   i. Sealant Primers for Nonporous Substrates: 250 g/L.
   j. Sealant Primers for Porous Substrates: 775 g/L.

B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.

C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced 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, State of Maine VOC Compliant.

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 Global 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, molded pipe boot 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.

1. Provide white flashing accessories for white EPDM membrane roofing.

## 2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

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: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Cover Board: 1/2 inch thick, high-density polyiso insulation panel designed for use as cover board.

1. Compressive Strength: 100 psi.
2. R-Value: 2.5.
3. Density: 4 lbs/pcf.

## 2.6 FASCIA SYSTEM

A. Provide fasciae in shapes and sizes indicated. Include anchor plates; cleats or other attachment devices; concealed splice plates; and trim and other accessories indicated or required for complete installation, with no exposed fasteners.

1. Provide scupper components where indicated on the drawings.

B. Provide exposed fascia components fabricated from the following metal:

1. Extruded aluminum in thickness indicated, but not less than 0.040 inch.
2. Finish: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 1402, Test Method 7. Color as selected by the Architect.
3. Product:

a. Carlisle: Sure-Seal SecurEdge.
b. Firestone Edgegard System.
c. GAF: EverGuard EPDM Snap-On Roof Edge.
d. Hickman: Econosnap Roof Edging.
e. Metal-Era: Perma-Tite 200 Fascia System.
f. Provide face size as indicated on the drawings.

## 2.7 EXPANSION JOINTS

A. Deck-To-Deck and Deck-To-Wall Expansion Joints: Provide manufacturers standard joint system consisting of expansion joint support or support sponge, anchor plates, and flashing.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

## 3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

## 3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft., and allow primer to dry.
2. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
3. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
4. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. Loosely Laid Insulation: Loosely lay insulation units over substrate.

I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.

1. Fasten cover boards according to requirements of manufacturer for specified warranty and performance.

## 3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere 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. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.

F. Apply roofing with side laps shingled with slope of roof deck where possible.

G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.

H. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

I. 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 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.

E. Terminate and seal top of sheet flashings.

## 3.7 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.

## 3.8 FASCIA SYSTEM INSTALLATION

A. Comply with manufacturer's written installation instructions. Anchor products securely to structural substrates to withstand lateral and thermal stresses and inward and outward loading pressures.

B. Expansion Provisions: Install running lengths to allow controlled expansion for movement of metal components in relation not only to one another but also to adjoining dissimilar materials,

including flashing and roofing membrane materials, in a manner sufficient to prevent water leakage, deformation, or damage.

## 3.9 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Architect or Owner 48 hours in advance of the date and time of inspection.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

## 3.10 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove 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 075323

# SECTION 078100 - APPLIED FIREPROOFING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes patching of existing sprayed fire-resistive materials.

### 1.2 DEFINITIONS

A. SFRM: Sprayed fire-resistive materials.

### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

### 1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fireproofing.

B. Evaluation Reports: For fireproofing, from ICC-ES.

C. Preconstruction Test Reports: For fireproofing.

D. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

## 1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

C. Asbestos: Provide products containing no detectable asbestos.

## 2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. Concealed SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.

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. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 5GP.
b. Grace, W. R. & Co. - Conn.; Grace Construction Products; Monokote MK-6 Series.
c. Isolatek International; Cafco 300.

1. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.

2. Density: Not less than 15 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E 605.
3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
4. Combustion Characteristics: ASTM E 136.
5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 10 or less.
    b. Smoke-Developed Index: 0.

6. Compressive Strength: Minimum 1,200 lbf/sq. in. according to ASTM E 761.
7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
10. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.
12. Finish: Spray-textured finish.

## 2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.

1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning fireproofing work.

C. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

## 3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.
2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

L. Cure fireproofing according to fireproofing manufacturer's written instructions.

M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Spray-Textured Finish: Finish left as spray applied with no further treatment.

## 3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, Subsection 1705.13, "Sprayed Fire-Resistant Materials."

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

## 3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

## 3.6 FIRE RATING SCHEDULE

A. Columns: Hourly Rating _____; UL _____.

B. Floor Decks: Hourly Rating _____; UL _____.

C. Floor Supports: Hourly Rating _____; UL _____.

D. Roof Decks: Hourly Rating _____; UL _____.

E. Roof Supports: Hourly Rating _____; UL _____.

END OF SECTION 078100

# SECTION 078413 - PENETRATION FIRESTOPPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product proposed. Include product characteristics, typical uses, performance and limitation criteria, test data, and installation instructions.

B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition required.

C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Provide a list of at least 3 completed projects and name and contact information for installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

## 1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: A person 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. Preinstallation Conference: Conduct conference at Project site.

C. Special Inspections: Allow for 1 of each type of firestopping system to be removed and inspected for conformance with approved submittals. All firestopping shall be inspected prior to the installation of ceilings.

D. Above Ceiling review: Prior to the installation of ceilings, a review of construction completion shall be conducted for firestopping and other items that will not be visible when the ceilings have been installed.

## 1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

## 1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

    a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

        1) UL in its "Fire Resistance Directory."
        2) Intertek Group in its "Directory of Listed Building Products."
        3) FM Global in its "Building Materials Approval Guide."

## 2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. 3M Fire Protection Products.
    b. A/D Fire Protection Systems Inc.
    c. Hilti, Inc.
    d. RectorSeal.
    e. Specified Technologies, Inc.
    f. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

1. For fire-resistive joint systems exposed to view in public spaces upon completion of Work, provide products that are paintable.

a. Mechanical, electrical and elevator machine rooms are not considered public spaces.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

## 2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. 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.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant

additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

## 2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping 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 the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

## 3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

## 3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
2. Do not install identification on exposed finished wall locations.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

## 3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

D. Reinstall firestopping materials that have been removed for inspection.

## 3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping 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 penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

# SECTION 078443 - JOINT FIRESTOPPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product proposed for use. List product characteristics, typical uses, performance and limitation criteria, test data, and installation instructions.

B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.

C. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

## 1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Preinstallation Conference: Conduct conference at Project site.

C. Special Inspections: Allow for 1 of each type of joint firestopping system to be removed and inspected for conformance with approved submittals.

D. Above Ceiling review: Prior to the installation of ceilings, a review of construction completion shall be conducted for joint firestopping and other items that will not be visible when the ceilings have been installed.

## 1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

## 1.8 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.

2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

    a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

        1) UL in its "Fire Resistance Directory."
        2) Intertek Group in its "Directory of Listed Building Products."

## 2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. 3M Fire Protection Products.
    b. A/D Fire Protection Systems Inc.
    c. W.R. Grace & Co., Construction Products Division.
    d. Hilti, Inc.
    e. Nelson Firestop; a brand of Emerson Industrial Automation.
    f. RectorSeal.
    g. Specified Technologies, Inc.
    h. Tremco, Inc.
    i. United States Gypsum Company.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. 3M Fire Protection Products.
    b. A/D Fire Protection Systems Inc.
    c. W.R. Grace & Co., Construction Products Division.
    d. Hilti, Inc.
    e. Nelson Firestop; a brand of Emerson Industrial Automation.
    f. RectorSeal.
    g. Specified Technologies, Inc.
    h. Tremco, Inc.
    i. United States Gypsum Company.

2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures. Provide systems with L-rating where walls and partitions also are smoke barriers. Where a fire-resistive joint system is not available with the ability to resist smoke, provide smoke sealant material to one side of wall to stop the passage of smoke.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1. For fire-resistive joint systems exposed to view in public spaces upon completion of Work, provide products that are paintable.

a. Mechanical, electrical and elevator machine rooms are not considered public spaces.

E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping 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.

## 3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

## 3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

B. Before installation of ceilings, walls, and adjacent construction that would conceal fire-resistive joint systems, inspect joints to verify complete installation of fire-resistive joint systems materials.

C. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

D. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

E. Reinstall firestopping materials that have been removed for inspection.

## 3.5 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 078443

# SECTION 079200 - JOINT SEALANTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Mildew-resistant joint sealants.
3. Latex joint sealants.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. 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.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

C. Sample Warranties: For 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: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.5 FIELD 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: 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.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, 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. 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, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, 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; 756 SMS for cold applications.
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. Pecora Corporation; 890.
d. Sika Corporation, Construction Products Division; SikaSil-C990.
e. Tremco Incorporated; Spectrem 1.

B. Sealant Type 2: Not used.

C. Sealant Type 3: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and 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. Pecora Corporation; 301 NS (VOC 50).
b. Tremco Incorporated; Spectrem 800 (VOC 1).

D. Sealant Type 4: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C 920, Type S, Grade NS, Class 25, 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: Acrylic Latex: 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. Sherwin-Williams 950A
e. Tremco Incorporated; Tremflex 834.

## 2.4 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and 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 performance of the Work.

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.

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. 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, remove, and repair 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. 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.

E. 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.

F. 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.

G. 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.

H. 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.

I. Perimeter Joints Between Interior Wall Surfaces and Frames of Interior Doors and Windows.

1. Latex Joint Sealant: Sealant Type 5.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

J. 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.

K. 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 079200

# SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes hollow-metal work.

### 1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

### 1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

### 1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review tie-in to air barrier system.

### 1.6 ACTION SUBMITTALS

A. General: Submittals for Sections 081113, 081416 and 087100 shall be made concurrently.

B. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

C. Shop Drawings: Include the following:

1. Elevations of each door type.

2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

## 1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Standard Steel Doors and Frames:

a. Ceco Door Products; an Assa Abloy Group company.
b. Curries Company.
c. J/R Metal Frames Manufacturing, Inc.
d. Steelcraft; a division of Ingersoll-Rand.

2. Trimless Steel Doors and Frames:

a. EZY Jamb by Studco Building Systems.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

## 2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

## 2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
d. Edge Construction: Model 2, Seamless.
e. Core: Kraft-paper honeycomb.

3. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Knocked down.

4. Exposed Finish: Prime.

C. Trimless Door Frames: Where indicated, provide flush finish trimless door frame by EZY Jamb or equal. Split-frame unit with anchoring flanges for drywall compound.

## 2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:

    a. Type: As indicated in the Door and Frame Schedule.
    b. Thickness: 1-3/4 inches
    c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A60 coating.
    d. Edge Construction: Model 2, Seamless.
    e. Core: Manufacturer's polyurethane core.

        1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 10 when tested according to ASTM C 1363.

3. Frames:

    a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
    b. Construction: Face welded.

4. Exposed Finish: Prime.

## 2.5 BORROWED LITES

A. Hollow-metal frames of uncoated steel sheet, minimum thickness of 0.053 inch.

B. Construction: Face welded.

## 2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

## 2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 metallic coating.

1. Wipe Coat Galvanneal materials will not be considered acceptable.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Glazing: Comply with requirements in Section 088000 "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.8 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 metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Fire Door Cores: As required to provide fire-protection ratings indicated.
2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
3. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.

4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
6. Full hinge cut-outs for non-handed doors will not be acceptable.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

    b. Compression Type: Not less than two anchors in each frame.

6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.9 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

## 2.10 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

## 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 for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. In-Place Metal-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

## 3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. 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.

C. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

# SECTION 081416 - FLUSH WOOD DOORS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.
4. Factory glazing of wood doors.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Fire-protection ratings for fire-rated doors.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish**.**

### 1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.7 WARRANTY

A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Wood Doors:

a. Algoma Hardwoods Inc.
b. Eggers Industries.
c. Graham Wood Doors; an Assa Abloy Group company.
d. Marshfield Door Systems, Inc..
e. VT Industries Inc.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

1. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Include all requirements as part of the door construction per Category "A" guidelines."
2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Provide wood blocking in particleboard-core doors asneeded to eliminate through-bolting hardware.

F. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf.
b. Screw Withdrawal, Edge: 400 lbf.

2. Provide doors with structural-composite-lumber cores instead of particleboard cores for the following doors:

a. Doors indicated to receive exit devices.
b. Doors where oversized glass lites exceed more than 40 percent of the door surface area.
c. Doors where louvers exceed more than 40 percent of the door surface area.

G. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated asneeded to eliminate through-bolting hardware.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

    a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

## 2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Select white maple.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Pair and Set Match: Provide for doors hung in same openingor separated only by mullions.
7. Exposed Vertical Edges: Same species as faces - edge Type A.
8. Core: Particleboard except where structural composite lumber is required.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

## 2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular 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; factory primed for paint 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 NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated. Attach wood rectangular glazing beads flush with door face. Apply shims and sealant as required to set glazing.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

## 2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
3. Staining: None required.
4. Effect: Open-grain finish.
5. Sheen: Satin.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

## 3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

# SECTION 083113 - ACCESS DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Access doors and frames for walls and ceilings, unless specified elsewhere.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

C. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

D. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

### 1.4 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, electrical or other concealed work, and indicate in the schedule specified in "Submittals" Article.

B. Where access doors are required for access to electrical junction boxes or panels located above non-accessible ceilings, the subcontractor installing the boxes or panels will be responsible for furnishing access doors, or relocate boxes and panels to accessible locations.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

### 2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges: For use with wall coverings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acudor Products, Inc.
    b. Babcock-Davis.
    c. JL Industries, Inc.; a division of the Activar Construction Products Group.
    d. Karp Associates, Inc.
    e. Larsens Manufacturing Company.
    f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
    g. Nystrom, Inc.
    h. Williams Bros. Corporation of America (The).

2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall.
4. Door Size: <**Insert door size**>.
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
6. Frame Material: Same material and thickness as door.
7. Latch and Lock: [**Cam latch, screwdriver operated**] [**Cam latch, key operated**] [**Cam latch, hex-head wrench operated**] [**Cam latch, pinned-hex-head wrench operated**] [**Cam latch, spanner-head wrench operated**] [**Latch bolt, knurled-knob operated**] [**Latch bolt, key operated**] [**Prepared for mortise cylinder**] [**As indicated on Drawings**] [**As indicated in schedule**] <**Insert operator**>[ **with interior release**].

B. Recessed Access Doors with Concealed Flanges: For use with ceramic wall tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acudor Products, Inc.
    b. Babcock-Davis.
    c. JL Industries, Inc.; a division of the Activar Construction Products Group.
    d. Karp Associates, Inc.
    e. Larsens Manufacturing Company.
    f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
    g. Nystrom, Inc.
    h. Williams Bros. Corporation of America (The).

2. Description: Door face recessed [**1/2 inch**] [**5/8 inch**] [**1 inch**] for [**gypsum board**] [**plaster**] [**acoustical tile**] <**Insert material**> infill; with concealed flange for [**gypsum board**] [**plaster**] [**no bead for acoustical tile**] installation and concealed hinge.
3. Locations: [**Wall**] [**Ceiling**] [**Wall and ceiling**] <**Insert location or substrate**>.
4. Door Size: <**Insert door size**>.
5. Uncoated Steel Sheet for Door: [**Nominal 0.060 inch, 16 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].
6. Metallic-Coated Steel Sheet for Door: [**Nominal 0.064 inch, 16 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].
7. Stainless-Steel Sheet for Door: [**Nominal 0.062 inch, 16 gage**] <**Insert thickness**>, [**No. 4**] [**No. 2b**] finish.
8. Latch and Lock: [**Cam latch, screwdriver operated**] [**Cam latch, key operated**] [**Cam latch, hex-head wrench operated**] [**Cam latch, pinned-hex-head wrench operated**] [**Cam latch, spanner-head wrench operated**] [**Latch bolt, knurled-knob operated**] [**Latch bolt, key operated**] [**Prepared for mortise cylinder**] [**As indicated on Drawings**] [**As indicated in schedule**] <**Insert operator**>[ **with interior release**].

## 2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acudor Products, Inc.
    b. Babcock-Davis.
    c. JL Industries, Inc.; a division of the Activar Construction Products Group.
    d. Karp Associates, Inc.
    e. Larsens Manufacturing Company.
    f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
    g. Nystrom, Inc.
    h. Williams Bros. Corporation of America (The).

2. Description: Door face flush with frame, [**with a core of mineral-fiber insulation enclosed in sheet metal**] [**uninsulated**]; with exposed flange, self-closing door, and concealed hinge.
3. Locations: [**Wall**] [**Ceiling**] [**Wall and ceiling**] <**Insert location or substrate**>.
4. Door Size: <**Insert door size**>.
5. Fire-Resistance Rating: Not less than [**that indicated**] [**that of adjacent construction**] [**45 minutes**] [**1 hour**] [**1-1/2 hours**] [**2 hours**] [**3 hours**] <**Insert requirement**>.
6. Temperature-Rise Rating: [**450 deg F**] [**250 deg F**] at the end of 30 minutes.
7. Uncoated Steel Sheet for Door: [**Nominal 0.036 inch, 20 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].
8. Metallic-Coated Steel Sheet for Door: [**Nominal 0.040 inch, 20 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].
9. Stainless-Steel Sheet for Door: [**Nominal 0.038 inch, 20 gage**] <**Insert thickness**>, No. 4 finish.
10. Frame Material: [**Same material, thickness, and finish as door**] <**Insert material, thickness, and finish**>.

11. Latch and Lock: Self-latching door hardware, [**operated by knurled-knob**] [**operated by key**] [**prepared for mortise cylinder**] [**as indicated on Drawings**] [**as indicated in schedule**] <**Insert operator**>[ **with interior release**].

## 2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

## 2.5 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.

E. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.
3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in [**Section 087100 "Door Hardware."**] [**Section 087111 "Door Hardware (Descriptive Specification)."**]

## 2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

## 3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

# SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Exterior and interior manual-swing entrance doors and door-frame units.

### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review 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 tie-in to air barrier system.
5. Review use of Rivnuts for hardware.
6. Review sill flashing details and components.
7. Review coordination with electrical or additional hardware provided by others.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.

b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.5 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

C. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

D. Sample Warranties: For special warranties.

## 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

## 1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: [**10**] [**20**] years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Structural Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

    a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..

2. Entrance Doors:

    a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
    b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.2 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. Tubelite.
4. Oldcastle Building Envelope company.
5. YKK AP America Inc.

B. Products:

1. Exterior Aluminum-Framed Storefronts:

a. EFCO: System 403.
b. Kawneer: Trifab VG 451 T.
c. Tubelite: 14000 Series.
d. Oldcastle: 3000 Thermal MultiPlane.
e. YKK AP: YES 45 TU (center glazed only)

2. Interior Aluminum-Framed Storefronts:

a. EFCO: System 402.
b. Kawneer: Trifab VG 450.
c. Tubelite: 4500 Series.
d. Oldcastle: 3000 non-thermal MultiPlane.
e. YKK AP: YES 45 FI (center glazed only)

3. Doors and Entrances:

a. EFCO: Series D518 DuraStile.
b. Kawneer: 500 Heavy Wall.
c. Tubelite: Monumental Wide Stile Entrance.
d. Oldcastle: MS 500 Rugged Wide Stile
e. YKK AP: 50M Entrance Door.

## 2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction:

a. Exterior: Thermally broken
b. Interior: Nonthermal.

2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finishes:

a. Interior Frames: Clear anodic finish.
b. Exterior Storefront: Match existing black anodic finish.

5. Fabrication Method: Field-fabricated stick system.
6. Exterior Jambs and Head Framing: Provide manufacturer's standard extruded aluminum continuous thermal flat filler for use at jambs and head framing. This extrusion provides the necessary profile for sealing with the building air barrier system. Channel type jamb components will not be acceptable.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Subsills for Exterior Storefronts: Manufacturer's standard thermally broken extruded aluminum sill flashing, color to match framing.

E. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B 209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

## 2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 2-inch overall thickness, with minimum 0.188-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Wide stile; 5-inch nominal width.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

    a. Provide nonremovable glazing stops on outside of door.

## 2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

C. Silencers: BHMA A156.16, Grade 1.

D. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

## 2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

## 2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

## 2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

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.

B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.10 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

## 2.11 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. | Weatherstripping | Aluminum |
| 2. | Threshold | Aluminum |

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

### 3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

## 3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 084113

# SECTION 084523 – FIBERGLASS-SANDWICH-PANEL CANOPY ASSEMBLIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes the structural canopy system as shown and specified. Work includes providing and installing:

1. Structural aluminum box beam superstructure
2. Factory prefabricated structural insulated translucent sandwich panels
3. Aluminum installation system
4. Flexible flashing

### 1.2 SUBMITTALS

A. Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of components.

B. Submit shop drawings. Include plans, elevations and details.

C. Submit manufacturer's color charts showing the full range of colors available for factory finished aluminum.

1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.

a. Sandwich panels: 7" x 12" units
b. Factory finished aluminum: 5" long sections

D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

E. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Reports required (if applicable) are:

a. International Building Code Evaluation Report (AC 177)
b. Flame Spread and Smoke Developed (UL 723) – Submit UL Card
c. Burn Extent (ASTM D 635)
d. Color Difference (ASTM D 2244)
e. Impact Strength (UL 972)
f. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)

g. Bond Shear Strength (ASTM D 1002)
h. Beam Bending Strength (ASTM E 72)
i. Insulation U-Factor (NFRC 100)
j. NFRC System U-Factor Certification (NFRC 700)
k. Solar Heat Gain Coefficient (NFRC or Calculations)
l. Condensation Resistance Factor (AAMA 1503) (Thermally Broken only)
m. 1200°F Fire Resistance (SWRI)
n. ASTM E1886/1996 or TAS 201, 202 and 203 (Optional-Windborne Debris)
o. Fall Through Resistance (ASTM E 661)
p. Class A Roof Covering Burning Brand (ASTM E 108)

## 1.3 CLOSEOUT SUBMITTALS

A. Provide project maintenance manuals.

## 1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope and location. At least three of the projects shall have been in successful use for ten years or longer.
2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an accredited agency.
3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with AC177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.

B. Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified panel systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

## 1.5 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete canopy system, including the aluminum box beam superstructure.

1. When requested, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Structural Loads; Provide canopy system capable of handling the following loads:

a. Roof Live Load, on horizontal projected surface, minimum: PSF
b. Roof Snow Load, on horizontal projected surface, minimum: 26 PSF

c. Roof Snow Drift Load, on horizontal projected surface, minimum: 0 PSF
d. Base Wind Load 25 PSF factored per applicable Building Code

1.6 DESIGN

A. Description: Canopy System

1. Nominal Size: See Drawings.
2. Aluminum Box Beam Size: Assorted – See Drawings.
3. Roof Pitch: Various – See Drawings.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver canopy system, components and materials in manufacturer’s standard protective packaging.

B. Store canopy system panels on the long edge; several inches above the ground, blocked and under cover to prevent warping in accordance with manufacturer’s storage and handling instructions.

1.8 WARRANTY

A. Provide manufacturer's and installer's written warranty agreeing to repair or replace canopy system work, which fails in materials or workmanship within one year from the date of delivery. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering, defects in accessories, insulated translucent sandwich panels and other components of the work.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The basis for this specification is for products manufactured by Structures Unlimited, Inc. Other manufacturers may bid this project provided they comply with all of the performance requirements of this specification and submit evidence thereof. Listing other manufacturers’ names in this specification does not constitute approval of their products or relieve them of compliance with all the performance requirements contained herein.

B. Structures Unlimited, Inc., Tel: (800) 225-3895 – Fax: (603) 627-0798 – Email: info@structuresunlimitedinc.com Contact: Todd Feeney – Cell: (631) 566-8136 Email: Tfeeney@structuresunlimitedinc.com

2.2 PANEL COMPONENTS

A. Face Sheets:

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
   a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
   b. Face sheets shall not deform, deflect, or drip when subjected to fire or flame.
2. Interior face sheets:
   a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 25 and smoke developed no greater than 250 when tested in accordance with UL 723.
   b. Burn extent by ASTM D 635 shall be no greater than 1".
3. Exterior face sheets:
   a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after 3 years outdoor South Florida weathering at 5° facing south, determined by the average of at least three white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
   b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972.
   c. Strength: Exterior face sheet shall be uniform in strength, with panel meeting ASTM E1996 and ASTM E1886 or TAS 201, 202 and 203.
   d. Erosion Protection: Integral, embedded-glass erosion barrier.
4. Appearance:
   a. Exterior face sheet: Smooth, .070 thick and Crystal in color.
   b. Interior face sheet: Smooth, .045 thick and White in color.
   c. Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

B. Grid Core:

1. Aluminum I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16".

C. Laminate Adhesive:

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".
2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:
   a. 50% Relative Humidity at 68° F: 540 PSI
   b. 182° F: 100 PSI
   c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
   d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

## 2.3 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

1. Thickness: **2 ¾”**
2. Light transmission: 35 %
3. Solar heat gain coefficient: 0.52
4. Panel U-factor by NFRC certified laboratory: .53
5. Grid pattern: Nominal size 12” x 24” ; pattern - Shoji

B. Standard panels shall deflect no more than 1.9” at 30 PSF in 10’-0” span without a supporting frame by ASTM E 72.

C. Standard panels shall withstand 1200° F fire for minimum one hour without collapse or exterior flaming.

D. Thermally broken panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

E. Canopy System:

1. Canopy system shall pass Class A Roof Burning Brand Test by ASTM E 108.

F. Canopy System shall meet the fall through requirements of OSHA 1910.23 as demonstrated by testing in accordance with ASTM E 661, thereby not requiring supplemental screens or railings.

## 2.4 BATTENS AND PERIMETER CLOSURE SYSTEM

A. Closure system: Extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.

B. Sealing tape: Manufacture’s standard, pre-applied to closure system at the factory under controlled conditions.

C. Fasteners: Various series stainless steel screws for aluminum closures, excluding final fasteners to the building.

D. Finish: Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be White.

## 2.5 SUPERSTRUCTURE

A. The superstructure shall be pre-fabricated of extruded aluminum alloy 6005-T5, 6005A-T61 or 6061-T6 box beams. Ferrous metals shall not be allowed. All parts shall be pre-assembled at the factory and knocked down for shipment.

B. Finish: Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be White

C. Aluminum structural system design and calculations must be furnished in accordance with the Aluminum Association “Specifications for Aluminum Structures” and the applicable building code. Design calculations must be prepared and stamped by a Licensed Professional Engineer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Installer shall examine substrates, supporting structure and installation conditions.

B. Do not proceed with structural canopy installation until unsatisfactory conditions have been corrected by the general contractor.

### 3.2 PREPARATION

A. Metal Protection:

1. The general contractor shall prepare foundations, curbs, footings and/or lintels isolating dissimilar materials from aluminum system, which may cause electrolysis.
2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
3. Where aluminum will contact concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

B. The general contractor shall install curbs designed to withstand the thrust generated by the canopy.

C. The general contractor shall provide temporary enclosures required.

### 3.3 INSTALLATION

A. Install the canopy system in accordance with the manufacture’s installation recommendations and approved shop drawings.

1. Anchor component parts securely in place by permanent mechanical attachment system.
2. Accommodate thermal and mechanical movements.

B. After other trades have completed work on adjacent material, carefully inspect translucent panel installation and make adjustments necessary to ensure proper installation.

## 3.4 FIELD QUALITY CONTROL

A. Repair or replace work that does not pass testing or that is damaged by testing and retest work.

## 3.5 CLEANING

A. Clean the canopy system immediately after installation.

B. Refer to manufacture’s written recommendations.

END OF SECTION 084523

# 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. Section includes:

1. Mechanical door hardware for the following:

a. Swinging doors.
b. Sliding doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

### 1.3 ACTION 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 and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:

a. Details of interface of electrified door hardware and building safety and security systems.
b. Schematic diagram of systems that interface with electrified door hardware.
c. Point-to-point wiring.
d. Risers.
e. Elevations doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

D. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.

E. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for

coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.

1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch long Samples for other products.

    a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

F. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

    a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
    b. 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.
    c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    d. Content: Include the following information:

        1) Identification number, location, hand, fire rating, size, and material of each door and frame.
        2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
        3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
        4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
        5) Fastenings and other pertinent information.
        6) Explanation of abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for door hardware.
        8) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

## 1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

C. Warranty: Special warranty specified in this Section.

## 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

## 1.6 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.

B. Architectural Hardware Consultant Qualifications: A person 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 and who is currently certified by DHI as follows:

1. For door hardware, an Architectural Hardware Consultant (AHC) who is also an Electrified Hardware Consultant (EHC) or Architectural Openings Consultant (AOC).

C. Source Limitations: Obtain each type of door hardware from a single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in 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, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

H. Accessibility Requirements: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design for door hardware on doors in an accessible route.

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.
2. 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.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Closers: Adjust door and gate closer sweep periods so that, from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.
5. Spring Hinges: Adjust door and gate spring hinges so that, from an open position of 70 degrees, the time required to move the door to the closed position is 1.5 seconds minimum.

I. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "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.
4. Requirements for access control.

J. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

## 1.7 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 coordinated with the final door hardware schedule, and include 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.

## 1.8 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

## 1.9 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 doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

# 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 Schedule" 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. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

## 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.

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. Electrified Functions for Hinges: Comply with the following:

1. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
2. Available Products:

a. Hagar: ETW 4-1/2 x 4-1/2.
b. McKinney: TA2714-CC4 or QC8.

c. Stanley: CEFBB-179.

G. 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 |
|---|---|---|---|
| 1-3/4” 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 MECHANICAL LOCKS AND LATCHES, GENERAL

A. 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.

B. Lock Backset: 2-3/4 inches, unless otherwise indicated.

C. Lock Trim:

1. Levers: Cast.
2. Escutcheons (Roses): Forged.

3. Dummy Trim: Match lever lock trim and escutcheons.
4. Operating Device: Lever with escutcheons (roses).

D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

## 2.5 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; an Assa Abloy Group company (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 40H 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 |

2.6 BORED 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; an Assa Abloy Group company (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. Best: 9K Series
b. Corbin Russwin: CL3300 Series.
c. Sargent: 10 Line
d. Schlage: ND 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. Best: 15 C
b. Corbin Russwin: NZD
c. Sargent: LL
d. Schlage: Rhodes

E. Lock Functions: Lock functions as indicated in the hardware schedule shall be as follows:

| FUNCTION | SARGENT | SCHLAGE | CORBIN/RUSWIN | BEST |
|---|---|---|---|---|
| (1) (utility) | 04 | 80 | 57 | D |
| (2) (office) | 05 | 53 | 51 | AB |
| (3) (passage) | 15 | 10 | 10 | N |
| (4) (classroom) | 37 | 70 | 55 | R |
| (5) (entrance) | 16 | 60 | 72 | C |
| (6) (privacy) | 65 | 40 | 20 | L |
| (7) Hospital emergency | | 44 | | |

## 2.7 DEADLOCKS

A. Provide Schlage B571 Restroom Indicator Deadlock.

## 2.8 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Available Manufacturers:

a. Door Controls International (DCI).
b. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
c. Rockwood.

2. Available Products for Wood Doors:

a. Door Controls: 790.
b. Glynn-Johnson: FB6W.
c. Rockwood: 557.

## 2.9 SELF-LATCHING FLUSH BOLTS

A. Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Available Manufacturers:

a. Door Controls International (DCI).
b. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
c. Rockwood Manufacturing Company (RM).

2. Available Products for Wood Doors:

a. Door Controls: 945.
b. Glynn-Johnson: FB61P.
c. Rockwood: 1945.

B. Coordinators: Rockwood 1600 series or approved substitute.

## 2.10 EXIT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sargent Manufacturing Company; an Assa Abloy Group company (SGT).
2. Von Duprin; an Ingersoll-Rand Company (VD).

B. Products: All exit devices for this project shall be one of the following:

1. The 80 Series exit device by Sargent & Co.
2. 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. Latch Retraction Exit Devices: Where indicated, provide hardware package consisting of Sargent exit device No. 56-8804 with No. 3510 power supply. Equivalent package by other listed manufacturers will be acceptable.

I. Outside Trim: Pull with cylinder; material and finish to match locksets, unless otherwise indicated.

J. 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.

K. The following functions shall be required where specified:

| FUNCTION | VON DUPRIN | SARGENT |
|---|---|---|
| A | CD98NL-OP | 16-8804 |
| B | CD98EO | 16-8810 |
| C | 98L | 8813ET |
| D | 98L-BE | 8815ET |
| E | 98EO-F | 12-8810 |
| F | 98L-F | 12-8813ET |
| G | 98L-F-BE | 12-8815ET |
| H | CD9827EO | 16-8710 |
| I | 9827L | 8713ET |
| J | 9827L-BE | 8715ET |
| K | CD9827EO x LBR | 16-PP/PR8710 |
| L | 9827L x LBR | PP/PR8713ET |
| M | 9827L-BE x LBR | PP/PR8715ET |

| | | |
|---|---|---|
| N | 9827EO-F | 12-8710 |
| O | 9827L-F | 12-8713ET |
| P | 9827L-F-BE | 12-8715ET |
| Q | 9827EO-F x LBR | 12-PP/PR8710 |
| R | 9827L-F x LBR | 12-PP/PR8713ET |
| S | 9827-L-F-BE x LBR | 12-PP/PR8715ET |
| T | EL9827-TL | 56-8710-306 |
| U | EL98NL-OP | 56-8804 |
| V | 9827Tl | 8710-306 |

2.11 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Same manufacturer as for locking devices.

2. Cylinders for Interior Doors: Same manufacturer as for locks and latches.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; face finished to match lockset.

C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

2.12 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Master Key System: Change keys and a master key operate cylinders.
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.

2.13 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5; 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.

## 2.14 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Burns Manufacturing Incorporated.
b. Don-Jo Mfg., Inc.
c. Hager Companies.
d. IVES Hardware; an Ingersoll-Rand Company (IVS).
e. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
f. Trimco.

B. 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.

C. Push Bars, 1 inch diameter.

## 2.15 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. 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.

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; an ASSA ABLOY Group company.

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

## 2.16 AUTOMATIC DOOR OPERATORS

A. Provide Horton Model 4100 LE Access Operator. No substitutions.

1. [Provide MC Linx interface for use with latch retraction exit devices.]

For interior push/pull vestibule doors and lighter weight door such as wood or aluminum with 1/4 tempered glass, use the following:

B. [Provide Horton Model 7100 Access Operator. No substitutions.

1. [Provide MC Linx interface for use with latch retraction exit devices.]

C. [Provide actuating push plates, inside and outside.]

1. Pushbutton: 1" diameter (25 mm) round, red pushbutton switch. Face plates shall be engraved with the international symbol for accessibility and “Press To Open”. Jamb or wall mounted.

2. Push Plate: 6" diameter (152 mm) round or 4 ½” (114 mm) square, stainless steel switch. Wall mounted. Optional engravings shall be:

    a. International symbol for accessibility and “Press To Open”.

3. [Provide optional wireless transmitters for switches.]

D. [Provide push-button (similar to Sargent No. 4241) to be located in the Admin area. To activate door XXX.]

E. Combination Motion/Presence Sensors: Where indicated, provide self-contained units; consisting of both motion and presence sensors in a single metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10.

1. Motion Sensor: K-band-frequency, microwave-scanner units; with relay hold time of not less than 2 to 10 seconds.

a. Provide capability for switching between bidirectional and unidirectional detection.

F. Coordinate requirements with electrical contractor.

## 2.17 MECHANICAL STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16, Grade 1.

1. Provide wall stops for doors unless floor or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
2. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.

B. Wall Stops: Wall type bumpers with concealed type flange shall be used where ever possible.

1. Available Products:

a. Ives - 407 1/2
b. Door Controls - 3211T
c. Rockwood - 409

C. Floor Stops: Where wall type bumpers cannot be used, provide dome type, floor mounted stops of the proper height as follows:

1. Available Products:

a. Ives - 436, 438
b. Door Controls - 3310X, 3320X
c. Rockwood - 440, 442

D. Exterior doors striking masonry and doors specified to have door stops and holders, shall have cast bronze wall or floor type door stops with hook or staple type holders to selectively hold doors in open position. The following will be acceptable:

1. Available Products:

    a. Ives - 445, 446
    b. Door Controls - 3237X, 3347X
    c. Rockwood - 473, 477

E. Silencers for Wood Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch; fabricated for drilled-in application to frame.

F. 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.

## 2.18 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; 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; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Weatherstripping:

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. 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.

D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

## 2.19 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. National Guard Products, Inc.
    b. Pemko Manufacturing Co.
    c. Reese Enterprises, Inc.

d. Zero International, Inc.

B. Basis-of-Design Product: Provide No. 896 with door bottom sweep No. 95WH by National Guard Products or approved substitute.

## 2.20 SLIDING DOOR HARDWARE

A. Sliding Barn Door Hardware: BHMA A156.14; consisting of complete sets including tracks, hangers, supports, bumpers, floor guides, fascia, end caps and accessories indicated.

1. 9710 Aluminum Wall-Mount System by Hager; anodized aluminum finish.

B. Pocket Sliding Door Hardware: Rated for doors weighing up to 125 lb.

C. Sliding Door Pulls: See Operating Trim.

## 2.21 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Burns Manufacturing Incorporated.
b. Don-Jo Mfg., Inc.
c. Hager Companies (HAG).
d. IVES Hardware; an Ingersoll-Rand Company (IVS).
e. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

B. 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.

C. Fasteners: Manufacturer's standard machine or self-tapping screws.

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.
3. Armor Plates: 40" high by 1-1/2" less than door width for single doors and 1" less than door width for pairs of doors.

E. Door Edge: Provide “U” door edge where indicated.

## 2.22 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 indicated, 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.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with 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. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.
2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

## 2.23 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

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. | Continuous Gear Hinges | 28 |
| 3. | Locks & Lock Trim: | 26D |
| 4. | Exit Devices: | 32D |
| 5. | Door Controls - Closers: | Sprayed Alum. Finish |
| 6. | Mortise Locks & Latches: | 26D |
| 7. | Door Stops | 26D/32D |
| 8. | Weatherstripping | Aluminum |
| 9. | Threshold | Aluminum |
| 10. | Kickplates | 32D |
| 11. | 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-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

## 3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated on Drawings or to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
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. 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. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

I. Strikes for Vertical Rod Exit Devices: Where vertical rod exit devices are used at interior doors, bottom strikes at floor are to be installed so that the top of the strike is flush with the adjacent flooring material.

J. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

K. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

L. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

M. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

## 3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

## 3.5 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. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

## 3.6 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.

## 3.7 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 Section 017900 "Demonstration and Training."

## 3.8 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.

DOUBLE ALUMINUM ENTRANCE DOOR

HW

Doors 145.2

Hinges
Exit Devices (function H w/306 control)
Pulls
Closers with drop plates
Floor Stops

Balance of hardware by aluminum door supplier.

VESTIBULE DOORS

HW

Doors 145.1

Push/Pulls
Closers
Floor Stops

Frame by aluminum door supplier.

SINGLE HOLLOW METAL VESTIBULE DOORS

HW

Doors 112A.1

Hinges
Push bar
Pull
Closer
Silencers

SINGLE OUTSIDE DOOR

HW

Doors 112A.2, 140.1

Continuous gear hinge
Exit Device (function U)
Power transfer
Power supply
Closer
Weatherstripping

Door Bottom Sweep
Kickplate
Threshold

Description of Operation: Door will unlock with use of proximity card.

SINGLE EXTERIOR STORAGE OR MECHANICAL

HW

Doors 155

Hinges
Lockset (function A)
Closer
Weatherstripping
Door bottom sweep
Threshold
Floor stop

JANITOR, ELECTRICAL, MECHANICAL, EMR

HW

Doors 122A, 122B

Hinges
Closer
Lockset (utility function 1)
Kick plate
Wall stop
Smoke gasketing

ENVIRONMENTAL

HW

Doors 105, 261

Hinges
Closer
Lockset (utility function 1)
Kick plate
Wall stop
Smoke gasketing

PRIVATE TOILET - STAFF

HW

Doors 119, 138A, 139A, 245, 246, 268,

Hinges
Lockset (passage function 3)
Restroom indicator deadbolt
Wall Stop
Silencers

PRIVATE TOILET - PUBLIC

HW

Doors 102, 103, 107, 114, 146A, 146B, 202, 203, 263, 264,

Hinges
Lockset (privacy function 7)
Wall Stop
Silencers

LOCKER ROOM

HW

Doors 138.2, 139.1, 139.2

Hinges
Push Plate
Pull
Closer
Kick Plate
Wall Stop
Silencers

SINGLE FIRE RATED EXIT

HW

Doors 100.1, 108, 206.2

Hinges
Closer
Lockset (classroom function 4)
Kickplate
Wall Stop
Smoke gasketing

HW

Doors 110

Hinges
Closer
Lockset (classroom function 4)
Electric strike
Kickplate
Wall Stop
Smoke gasketing

Description of Operation: Door will unlock with the use of proximity card.

DOUBLE ASSEMBLY EXIT - NOT RATED

HW

Doors 126, 144

Hinges
Closers
Exit Devices (function I)
Kickplates
Wall Stops
Smoke gasketing

EXAM, CONSULT, LOUNGE

HW

Doors 115.1, 120, 121, 123, 128, 129, 131, 147, 148, 207, 208, 209, 210, 211, 213, 214, 227, 228, 229, 230, 231, 233, 234, 243.1, 243.2, 266, 272, 273, 274, 275, 276, 277,

Hinges
Locksets (classroom function 4)
Door Stop
Silencers

HW

Doors 152

Hinges
Locksets (classroom function 4)
Electric strike
Door Stop
Silencers

Description of Operation: Door will unlock with the use of proximity card.

OR

HW

Doors 117.1, 117.2, 118.1, 118.2, 126.1, 126.2, 127.1, 127.2,

Hinges
Locksets (passage function 3)
Door Stop
Silencers

STORAGE/OFFICE (not rated)

HW

Doors 113, 124, 204, 206.1, 212, 223, 225, 232, 239, 240, 242, 248, 249, 250, 251, 260.1, 260.2, 265, 267, 278,

Hinges
Lockset (classroom function 4)
Door Stop
Silencers

STORAGE/OFFICE (rated)

HW

Doors 137, 141, 142, 143,

Hinges
Lockset (classroom function 4)
Closer
Door Stop
Smoke gasketing

HW

Doors 115, 116, 135A, 140.2,

Hinges
Lockset (classroom function 4)
Closer
Electric strike
Door Stop
Smoke gasketing

Description of Operation: Door will unlock with the use of proximity card.

DOUBLE STORAGE (not rated)

HW

Doors 132A, 147.3, 238.1, 238.2, 252.1, 252.2, 269,

Hinges
Lockset (classroom function 4)
Flush Bolts
Wall Stops
Silencers

DOUBLE STORAGE (rated)

HW

Doors 136

Hinges
Closers
Lockset (classroom function 4)
Flush Bolts
Wall Stops
Smoke gasketing

SLIDING POCKET DOOR

HW23

Doors 111, 216, 218, 219, 224, 226, 280

Sliding pocket door hardware
Door pulls

SLIDING BARN DOOR

HW23

Doors 148A, 262

Sliding barn door hardware
Door pulls

END OF SECTION 087100

# 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:

1. Glass for doors, interior borrowed lites and storefront framing.
2. Window film.
3. Glazing sealants and accessories.

### 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. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

### 1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

### 1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products; 12 inches square.

1. Insulating glass.
2. Window film.

C. Glazing Accessory Samples: For colored spacers, in 12-inch lengths.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Product Test Reports: For insulating glass, for tests performed by a qualified testing agency.

C. Preconstruction adhesion and compatibility test report.

D. Sample Warranties: For special warranties.

## 1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified 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.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

## 1.9 FIELD 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 are below 40 deg F.

## 1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for 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 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: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
2. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
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.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

## 2.2 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IgCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.3 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

## 2.4 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.

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 a blend of both.

## 2.5 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 and NFPA 257 for window assemblies.

B. Laminated Ceramic Glazing (Type 1): 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 Platinum L.
c. Vetrotech Saint-Gobain; SGG Keralite FR-L.

2. Fire-Protection Rating: [**20 minutes**] [**45 minutes**] [**60 minutes**] [**90 minutes**] [As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency].

C. Laminated Glass with Intumescent Interlayers (Type 2): Laminated glass made from multiple plies of uncoated, clear float glass; with intumescent interlayers; 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. InterEdge, Inc., a subsidiary of AFG Industries, Inc.; Pyrobel.
b. Pilkington Group Limited (distributed by Technical Glass Products); PyroStop.
c. Vetrotech Saint-Gobain; SGG Contraflam N2.

2. Fire-Protection Rating: [**20 minutes**] [**45 minutes**] [**60 minutes**] [**90 minutes**] [As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency].

## 2.6 WINDOW FILM

A. Decorative Film: Window film with sand-blasted glass appearance. SOLYX SX-1002 or equal.

1. Obscuring polyester film intended to be bonded to existing window glass by clear distortion free adhesive. Film shall be scratch resistant and maintained with mild cleaning solutions.
2. Dimensions (minimum), Matching existing glass panel.
3. Adhesive, factory applied to polyester film, water activated, non-water reactivated.

## 2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they 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. 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.

## 2.8 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.

## 2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with 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.

## 2.10 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.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

# 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 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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. 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.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. 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.

G. 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.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

## 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, then to jambs. Cover horizontal framing joints by applying tapes to jambs, 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. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. 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.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces 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.

## 3.8 MONOLITHIC GLASS SCHEDULE

A. Tempered Glass: Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.
3. Application: All interior glass, unless noted otherwise.

## 3.9 INSULATING GLASS SCHEDULE

A. Insulating Glass: Clear insulating glass.

1. Overall Unit Thickness: 5/8 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Float glass.
4. Interspace Content: Air.
5. Indoor Lite: Float glass.
6. Provide tempered glass and safety glazing labeling where required by code.
7. Application: Exterior hollow metal doors and frames.

B. Low E Insulated Glass: Low-e-coated, clear insulating glass. (Meeting MSHA standards)

1. Overall Unit Thickness: 5/8 or 1inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Tempered glass.
4. Interspace Content: Air.
5. Indoor Lite: Tempered glass.
6. Winter Nighttime U-Factor: 0.27 maximum.
7. Solar Heat Gain Coefficient: 0.30 minimum.
8. Provide tempered glass and safety glazing labeling where required by code.
9. Application: Exterior storefronts and entrances.

## 3.10 FIRE-PROTECTION-RATED GLAZING TYPES

A. Fire Rated Glass, Type 1: 45-minute fire-rated glazing; laminated ceramic glazing.

1. Provide safety glazing labeling.

B. Fire Rated Glass, Type 2: 60-minute and 90-minute fire-rated glazing; laminated glass with intumescent interlayers.

1. Provide safety glazing labeling.

END OF SECTION 088000

# SECTION 092119 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes: Gypsum board shaft wall assemblies.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

### 1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For shaft wall assemblies and firestop tracks, from ICC-ES.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

### 1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

### 2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated.

B. STC Rating: As indicated.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: As indicated.
2. Minimum Base-Metal Thickness: 0.033 inch.

D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.

1. Minimum Base-Metal Thickness: Matching steel studs.

E. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.

F. Room-Side Finish: As indicated.

G. Shaft-Side Finish: As indicated.

H. Insulation: Sound attenuation blankets.

### 2.3 PANEL PRODUCTS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.

b. Georgia-Pacific Building Products.
c. National Gypsum Company.
d. Temple-Inland Building Products by Georgia-Pacific.
e. United States Gypsum Company.

2. Thickness: 1 inch.
3. Long Edges: Double bevel.

C. Gypsum Shaftliner Board, Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Georgia-Pacific Building Products.
c. National Gypsum Company.
d. Temple-Inland Building Products by Georgia-Pacific.
e. United States Gypsum Company.

2. Thickness: 1 inch.
3. Long Edges: Double bevel.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

D. Gypsum Board: As specified in Section 092900 "Gypsum Board."

## 2.4 NON-LOAD-BEARING STEEL FRAMING

A. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

B. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire Trak Corp.
b. Metal-Lite.
c. Steel Network, Inc. (The).

## 2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.

E. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

F. Acoustical Sealant: As specified in Section 092900 "Gypsum Board."

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 "Applied Fireproofing."

B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

## 3.3 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

D. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

E. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

F. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

## 3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092119

# SECTION 092216 - NON-STRUCTURAL METAL FRAMING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

### 1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

## 2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Dale/Incor.
    b. Dietrich Metal Framing; a Worthington Industries Company.
    c. EB Metal, U.S.
    d. MarinoWare; a division of Ware Industries.
    e. Super Stud Building Products, Inc.
    f. The Steel Network, Inc.
    g. United Metal Products, Inc.

2. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
3. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:

    a. Minimum Base-Metal Thickness: 0.0179 inch (18 mils) for furring and framing for soffits, 0.0269 inch (27 mils) for wall framing and 0.0296 inch (30 mils) for fire fire-rated wall framing.
    b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
        2) MBA Building Supplies; FlatSteel Deflection Track or Slotted Deflecto Track.
        3) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
        4) Superior Metal Trim; Superior Flex Track System (SFT).
        5) Telling Industries; Vertical Slip Track or Vertical Slip Track II.

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Dietrich: SLP-TRK Slotted Track.
b. Fire Trak Corp.; Fire Trak.
c. Metal-Lite, Inc.; The System.
d. The Steel Network, Inc.; VertiClip SLD or VertiTrack VTD.

E. Flexible Track: Flexible Steel track for curved walls consisting of ASTM A 653, 20 gage galvanized steel channel sections with slotted sides and slide-able straps.

1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Flex-C Trac as manufactured by Flex-ability Concepts, P.O. Box 7145 Edmond, OK 73083, Tel 405-715-1799, www.flexc.com.

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0179 inch.
2. Depth: As indicated on Drawings.

H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical.

I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: 3/4 inch.
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

## 2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.

1. Depth: 1-1/2 inches.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.0179 inch (18 mils).
b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base-Metal Thickness: 0.0179 inch.

4. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical.

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; Drywall Grid System.
c. USG Corporation; Drywall Suspension System.

## 2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

### 3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

## 3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two 0.0296 inch (30 mils) studs at each jamb, unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

## 3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

# SECTION 092900 - GYPSUM BOARD

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Drawings: Submit drawings indicating locations of control joints.

C. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

### 1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

### 1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, 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.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

### 2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### 2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.
8. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch.
2. Long Edges: Tapered.

## 2.4 SPECIALTY GYPSUM BOARD

A. Glass-Mat Interior Gypsum Board (MR): ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Georgia-Pacific Building Products; DensArmor Plus Fireguard.
    b. National Gypsum Company; Gold Bond® Brand eXP Fire-Shield Interior Extreme Gypsum Panel.

2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation: Diamondback® GlasRoc Tile Backer.
    b. Georgia-Pacific Building Products; DensShield Tile Backer.
    c. National Gypsum Company.

2. Core: 5/8 inch, Type X.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material:

    a. Galvanized or aluminum-coated steel sheet or rolled zinc.
    b. Trim-Tex, Super Seal Tear Away™ L Bead where abutting exterior metal doors and windows.

2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. Expansion (control) joint.
    e. Curved-Edge Cornerbead: With notched or flexible flanges.

## 2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: 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.
    b. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: Not required.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

## 2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

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.

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: Available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Glass fiber batt mineral bearing the UL Classification Marking as to Fire Resistance.

D. Acoustical 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation; AC-20 FTR or AIS-919.
b. USG Corporation; SHEETROCK Acoustical Sealant.

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

F. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

G. Fire-Resistive Joint Systems: As specified in Division 07 Section “Fire-Resistive Joint Systems.”

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

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. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Fire-Resistance-Rated Gypsum Board Assemblies: Provide fire-resistive joint system at the top of fire-resistance-rated gypsum board assemblies. Provide firestop system around any structural penetration of wall assembly.

K. 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.

L. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

## 3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Vertical and horizontal surfaces unless otherwise indicated.
2. Flexible Type: As indicated on Drawings.
3. Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

## 3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

## 3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on approved Shop Drawings 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. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. Curved-Edge Cornerbead: Use at curved openings.

## 3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish interior 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: Panels that are substrate for tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
5. Level 5: Not required.

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

## 3.7 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Complete the following in areas to receive gypsum board ceilings:

a. Installation, insulation, and leak and pressure testing of water piping systems.
b. Installation of air-duct systems.
c. Installation of air devices.
d. Installation of mechanical system control-air tubing.
e. Installation of ceiling support framing.
f. Installation of Penetration Firestopping and Joint Firestopping.

## 3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

# SECTION 093013 - CERAMIC TILING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Porcelain tile.
3. Glazed wall tile.
4. Solid surfacing thresholds.
5. Waterproof and crack isolation membrane.
6. Metal edge strips.
7. Tile shower base.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Solid surfacing thresholds in 6-inch lengths.
3. Metal edge strips in 6-inch lengths.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products.

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

B. Tile Maintenance Report: Upon conclusion of the project, the Tiling Contractor shall furnish a tiling maintenance report. Report shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish, including grout, was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, repair procedures, and color samples of each color and finish used.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

## 1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.
2. Waterproof and crack isolation membrane.
3. Waterproof membrane.
4. Crack isolation membrane.
5. Metal edge strips.

## 2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

## 2.3 TILE PRODUCTS

A. Ceramic Tile (CT-1): Unglazed porcelain tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crossville; Basalt.

2. Face Size: 12 by 24 inches.
3. Thickness: 3/8 inch.
4. Face: Plain with square edges.

5. Tile Color: As indicated in the Interior Materials Legend.
6. Grout Color: As indicated in the Interior Materials Legend.

B. Tile Type CT-2: Unglazed ceramic mosaic tile.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Stone Peak; Quartzite.

2. Composition: Porcelain.
3. Module Size: 2 by 2 inches.
4. Thickness: 8 mm.
5. Face: Plain with square edges.
6. Surface: Smooth, without abrasive admixture.
7. Tile Color and Pattern: As indicated in the Interior Materials Legend.
8. Grout Color: As indicated in the Interior Materials Legend.

C. Ceramic Tile CT-3: Glazed wall tile.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Akdo; La Chic.

2. Module Size: 8 by 6 inches.
3. Thickness: 5/16 inch.
4. Face: Plain with modified square edges or cushion edges.
5. Tile Color: As indicated in the Interior Materials Legend.
6. Grout Color: As indicated in the Interior Materials Legend.

## 2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a precoated finish.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Corian; DuPont Polymers.

b. Surell; Formica Corporation.

## 2.5 WATERPROOF AND CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following that complies with ANSI A118.10 and ANSI A118.12, and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Products: Subject to compliance with requirements, provide the following:

a. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane. (2.39 g/L)
b. MAPEI Corporation; Mapelastic AquaDefense. (0 g/L)

## 2.6 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bonsal American, an Oldcastle company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Laticrete International, Inc.
f. MAPEI Corporation.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

## 2.7 GROUT MATERIALS

A. High-Performance Tile Grout (Polymer-Modified): ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bonsal American, an Oldcastle company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Laticrete International, Inc.
f. MAPEI Corporation.

2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

## 2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; satin anodized aluminum exposed-edge material.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Schluter Systems L.P.

1) Dilex-AHK cove trim. Provide at all cove base conditions.
2) Rondec edge trim. Provide at all exterior corners and wainscot top edge conditions.
3) Schiene transition trim. Provide at all floor tile transitions to other materials (equal thickness; carpet, rubber flooring.
4) Reno-TK transition trim. Provide at floor tile transitions from porcelain tile to carpet.
5) Reno-U transition trim. Provide at floor tile transitions from porcelain tile to LVT/VCT.

C. Tile Shower Base: Provide tileable shower base, product code TB-3060-R by KBRS, Inc. or equal. https://www.showerbase.com/store/TileBasin/TB-3060-R

## 2.9 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard sanded acrylic caulking containing a mildew-cide or antimicrobial protection.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. Products: Available products include the following:

1. Keracaulk™ S by Mapei
2. CeramaSeal by Bostik Findley

## 2.10 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

## 3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: [**1/16 inch**] [**1/8 inch**].
2. Porcelain Tile: [**1/4 inch**] [**3/8 inch**].
3. Glazed Wall Tile: [**1/16 inch**] [**1/8 inch**].

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Solid Surfacing Material Thresholds: Install thresholds in bed of adhesive as recommend by the solid surfacing material manufacturer.

1. Fill joints between such thresholds and adjoining tile with elastomeric sealant.

K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

## 3.4 WATERPROOFING/CRACK ISOLATION MEMBRANE INSTALLATION

A. Install waterproofing to comply with manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing/crack isolation membrane has cured.

C. Locations:

1. Toilet Rooms slabs receiving tile flooring. Turn membrane up 2 inches minimum at perimeter walls to keep water from traveling under partitions.
2. Install over all cracks, control and construction joints in concrete floor.

## 3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

## 3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

## 3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Tile Installation: TCNA F122; thinset mortar on waterproof membrane.

a. Ceramic Tile Type: Ceramic and porcelain floor tile.
b. Thinset Mortar: Latex- portland cement mortar.
c. Grout: High-performance unsanded grout.

B. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.

a. Ceramic Tile Type: Ceramic wall tile.
b. Thinset Mortar: Latex- portland cement mortar.
c. Grout: High-performance unsanded grout.

END OF SECTION 093013

# SECTION 095113 - ACOUSTICAL PANEL CEILINGS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

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 6-inch-long Samples of each type, finish, and color.

### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

### 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

## 1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

## 1.9 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.

## 1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

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 according to 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.

## 2.3 ACOUSTICAL PANELS (AC-1)

A. Products: Subject to compliance with requirements, provide one of the following:

1. Certainteed; Performa Vantage 10™, No. VAN 154.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.
2. Pattern: E (lightly textured).

C. Color: White.

D. LR: Not less than 0.83.

E. NRC: Not less than 0.60.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension-system members.

H. Thickness: 5/8 inch.

I. Modular Size: 24 by 24 inches.

J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: 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.

## 2.4 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (AC-2)

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.; To be determined.

B. Color: White.

C. Modular Size: 24 by 24 inches.

D. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

## 2.5 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (AC-3)

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.; To be determined.

B. Color: White.

C. Modular Size: 24 by 60 inches.

D. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

## 2.6 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

D. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

I. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

1. Available Products: UHDC by Armstrong or L15 by USG.

## 2.7 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong: Suprafine 9/16" Exposed Tee System (7500 series)
2. CBI USA, Inc.: Narrow System
3. Celotex: 9/16" Narrow Stab System
4. USG: Centricitee DXT 24 System; USG Interiors, Inc.

B. Narrow-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 9/16-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.

## 2.8 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.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. 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/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

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 and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
5. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
9. Do not attach hangers to steel deck tabs.
10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Suspension system shall be reinforced to support diffusers, light fixtures and any additional members. Install hanger wires to grid at each corner of light fixtures. Coordinate location with electrical and other trades.

1. Each individual fixture and attachment with combined weight of 56 pounds or less shall have two 12-gage wire hangers attached at diagonal corners of the fixture. These wires shall be slack. Fixtures and attachments with a combined weight of greater than 56 pounds shall be independently supported from the structure at all four corners.

E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. 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 and Fire-Resistive Joint Systems.

## 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 095113

# 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 molding accessories.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

### 1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Nora.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:

a. Style B, Cove: Sanitary cove.

C. Thickness: 0.125 inch.

D. Height: 6 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As selected by Architect from full range of industry colors.

2.2 THERMOPLASTIC-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Johnsonite; A Tarkett Company.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style and Location:

a. Style A, Straight: Provide in areas with carpet.
b. Style B, Cove: Provide in areas with resilient flooring.

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As selected by Architect from full range of industry colors.

## 2.3 VINYL MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
3. Flexco.
4. Johnsonite; A Tarkett Company.
5. Musson Rubber Company.
6. Roppe Corporation, USA.

B. Profile and Dimensions:

1. Transition Strip between VCT and Carpet/Ceramic Tile: CE-XX-A by Johnsonite or approved substitute.
2. Transition Strip between VCT and Carpet: CE-XX-A by Johnsonite or approved substitute.
3. Transition Strip between Sheet Flooring and VCT: CD-XX-C by Johnsonite or approved substitute.
4. Reducer Strip between Concrete and VCT: RRS-XX-C by Johnsonite or approved substitute.
5. Reducer Strip between Concrete and Carpet: EG-XX-L by Johnsonite or approved substitute.
6. Reducer Strip between Quarry Tile and VCT: CTA-XX-P by Johnsonite or approved substitute.

C. 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 resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

## 3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

## 3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Miter or cope corners to minimize open joints.

## 3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

## 3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

# SECTION 096516 - RESILIENT SHEET 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. Vinyl sheet floor covering.
2. Rubber sheet floor covering.
3. Rubber stair treads

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of resilient sheet flooring required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

E. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

## 1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring 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 rolls upright.

## 1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

### 2.2 VINYL SHEET FLOORING WITH BACKING (RF-1)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Johnsonite; Acczent Wood.

B. Product Standard: ASTM F 1303.

1. Type (Binder Content): Type I, minimum binder content of 90 percent.
2. Wear-Layer Thickness: Grade 1.
3. Overall Thickness: 0.080 inches.
4. Backing Class: Class B (nonfoamed plastic).

C. Wearing Surface: Smooth.

D. Sheet Width: 6.6 feet.

E. Seamless-Installation Method: Heat welded.

F. Colors and Patterns: As selected by Architect from full range of industry colors.

### 2.3 UNBACKED RUBBER SHEET FLOORING (RF-5)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Nora Systems, Inc.; Noraplan Sentica nTx.

B. Product Standard: ASTM F 1859.

1. Type: Type I (homogeneous rubber sheet).
2. Thickness: 3 mm.
3. Hardness: Manufacturer's standard hardness, measured using Shore, Type A durometer per ASTM D 2240.

C. Wearing Surface: Smooth.

D. Sheet Width: 4.0 feet.

E. Seamless-Installation Method: Heat welded.

F. Colors and Patterns: As indicated in the Interior Materials Legend.

2.4 RUBBER STAIR TREADS (RF-6)

A. VIBMTR (Visually Impaired) - Bamboo Surface Texture Rubber Stair Tread with Integrated Riser, 2" (5.08 cm) hinged, square nose configuration, .210" (5.33 mm) to .113" (3.89 mm) tapered 13" (33 cm) tread depth with 7" (17.8 cm) integral riser

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated, including high relative humidity adhesives if required.

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Color: Match flooring.

D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring 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.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. 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. 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 resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

## 3.4 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

H. Adhere resilient sheet flooring to 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.

I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

## 3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring 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, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.

1. Apply one coats to sheet vinyl product only.

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

# 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. Solid vinyl floor tile.
2. Rubber floor tile.
3. Vinyl composition floor tile.
4. Resilient quartz floor tile.
5. Linoleum composition floor tile.

### 1.3 PREINSTALLATION MEETINGS

A. 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.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of floor tile indicated.

C. Samples for Verification: Full-size units of each color and pattern of floor tile required.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

## 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

## 1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID VINYL FLOOR TILE (RF-2)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mohawk: Hot and Heavy, Bolder.

B. Tile Standard: ASTM F 1700.

1. Class: Class III, printed film vinyl tile.
2. Type: A, smooth surface.

C. Wear Layer Thickness: .20 inches (5 mm).

D. Size: 36 by 36 inches.

E. Colors and Patterns: As indicated in the Interior Materials Legend.

2.3 SOLID VINYL FLOOR TILE (RF-3)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mannington: Dissolve.

B. Tile Standard: ASTM F 1700.

1. Class: Class III, printed film vinyl tile.
2. Type: A, smooth surface.

C. Wear Layer Thickness: .20 inches (5 mm).

D. Size: 18 by 36 inches.

E. Colors and Patterns: As indicated in the Interior Materials Legend.

2.4 SOLID VINYL FLOOR TILE (RF-4)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Procedo: Loom+.

B. Tile Standard: ASTM F 1700.

1. Class: Class III, printed film vinyl tile.
2. Type: A, smooth surface.

C. Wear Layer Thickness: .125 inches (3 mm).

D. Size: 19.67 by 19.67 inches (500 mm x 500 mm).

E. Colors and Patterns: As indicated in the Interior Materials Legend.

## 2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated, including high relative humidity adhesives if required.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile 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.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 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.

## 3.3 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

## 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.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

## 3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply one coats.

E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

# SECTION 096813 - TILE CARPETING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes modular carpet tile.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Samples for Verification: 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 Tile: Full-size Sample.

C. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

D. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

### 1.4 IINFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, 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 tile.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

## 1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI's "CRI Carpet Installation Standard."

## 1.9 FIELD CONDITIONS

A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

## 1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.
b. Dimensional instability.

c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Loss of face fiber.
f. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CARPET TILE (CPTT-1)

A. Manufacturer: Subject to compliance with requirements, provide product by the following:

1. Lees Mohawk; Tranquil Beauty.

B. Color: As indicated in the Interior Materials Legend.

### 2.2 CARPET TILE (CPTT-2)

A. Manufacturer: Subject to compliance with requirements, provide product by the following:

1. J&J Invision; Mache Trace.

B. Color: As indicated in the Interior Materials Legend.

### 2.3 CARPET TILE (CPTT-3 & 4)

A. Manufacturer: Subject to compliance with requirements, provide product by the following:

1. J&J Invision; Pulp.

B. Color: As indicated in the Interior Materials Legend.

### 2.4 CARPET TILE (CPTT-5)

A. Manufacturer: Subject to compliance with requirements, provide product by the following:

1. Mannington; Traverse.

B. Color: As indicated in the Interior Materials Legend.

### 2.5 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

C. Edge/Transition Strips: Refer to Section 096513 “Resilient Base and Accessories.”

## 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 tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

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. Concrete Substrates: 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 adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

## 3.3 INSTALLATION

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns As indicated in the Interior Materials Legend.

E. Cut and fit carpet tile 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 tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

## 3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."

C. Protect carpet tile 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 tile manufacturer.

END OF SECTION 096813

# SECTION 097200 - WALL COVERINGS

## 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. Vinyl wall covering.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Samples for Verification: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36-inch- long in size.

C. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

### 1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

## 1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.

2. Fire-Growth Contribution: No flashover and heat and smoke release according to NFPA 265.

## 2.2 VINYL WALL COVERING (WC-1)

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. MDC; Esquire, Rapson Villa.

B. Description: Provide mildew-resistant products in rolls from same production run and complying with the following:

1. CFFA-W-101-D for Type II, Medium-Duty products.

C. Total Weight: 13.33 oz/sqyd.

D. Width: 54 inches.

E. Backing: Osnaburg fabric.

F. Repeat: 24" Vertical, 53" Horizontal.

G. Colors, Textures, and Patterns: As indicated in the Interior Materials Legend.

## 2.3 VINYL WALL COVERING (WC-2)

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Innovations: Matalessence Glaze.

B. Description: Provide mildew-resistant products in rolls from same production run and complying with the following:

1. CFFA-W-101-D for Type II, Medium-Duty products.

C. Width: 46/47 inches.

D. Backing: Nonwoven fabric.

1. Fiber Content: Polyester cellulose.

E. Repeat: Non-match.

A. Colors, Textures, and Patterns: As indicated in the Interior Materials Legend.

## 2.4 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

B. Primer/Sealer: Mildew resistant, complying with requirements in Section 099123 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

C. Seam Tape: As recommended in writing by wall-covering manufacturer.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

## 3.3 WALL-COVERING INSTALLATION

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Match pattern 72 inches above the finish floor.

F. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

## 3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

# 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. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Steel and galvanized metal.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

### 1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams “Custodian Project Color and Product Information” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

## 1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

## 1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints 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.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. California Paints.
3. PPG Architectural Finishes, Inc. (Pittsburgh Paints, Glidden Professional, Flood Stains)
4. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior Painting Schedule for the paint category indicated.

## 2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

1. Allow for up to 5 different color selections.

## 2.3 METAL PRIMERS

A. Ferrous and Galvanized Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04.
2. California: Rust Stop DTM 100% Acrylic Latex Metal Primer.
3. Devoe Coatings: 4020-1000 Devflex 4020PF DTM Primer & Flat Finish. (91 g/L)
4. Pittsburgh Paints: 90-712 Pitt-Tech One Pack Interior/Exterior Primer Finish DTM Industrial Enamel. (123 g/L)
5. 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. California Paints: Rust Stop DTM 100% Acrylic Semi-Gloss, 10XX.
3. Devoe Coatings; 4216-XXXX, High Performance Waterborne Acrylic Semi-Gloss Enamel.
4. Pittsburgh Paints: 6-900XI Speedhide Exterior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.5 mils.
5. 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 the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

## 3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal 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 and recommendations in "MPI Architectural Painting Specification Manual."

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. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tinting: Tint primer of colors such as reds, yellows, and oranges with a gray basecoat system designed to help provide color coverage.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces. When using colors such as red, yellow or orange, an extra coat of finish may be necessary. Notify Architect when additional coats do not fix the problem.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:

a. Equipment, including panelboards and switch gear.
b. Uninsulated metal piping.
c. Pipe hangers and supports.
d. Metal conduit.

## 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. Steel and Galvanized Metal Substrates: Exterior hollow metal doors and frames, metal fence framing, exposed metal piping.

1. Acrylic Enamel Coating System:

a. Prime Coat: Primer, rust inhibitive, water based. Apply over shop primer.
b. Intermediate Coat: Acrylic enamel, matching topcoat.
c. Topcoat: Acrylic enamel, semi-gloss (MPI Gloss Level 5).

END OF SECTION 099113

# SECTION 099123 - INTERIOR PAINTING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Steel and galvanized metal.
2. Wood.
3. Gypsum board.
4. Cotton or canvas insulation covering.
5. ASJ insulation covering.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

### 1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams “Custodian Project Color and Product Information” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish

was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

## 1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

## 1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. California Paints.
3. PPG Architectural Finishes, Inc. (Pittsburgh Paints, Glidden Professional, Flood Stains)
4. Samuel Cabot, Inc. (Cabot).
5. Sherwin-Williams Company (The).
6. Tnemec Company, Inc. (Tnemec).

B. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

## 2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

1. Allow for up to 15 different color selections.

## 2.3 PRIMERS/SEALERS

A. Low-VOC Latex Primer/Sealer:

1. Cal: Envirotech Zero VOC Interior Latex Primer/Sealer, 64600.
2. Moore: Pristine Eco Spec Interior Latex Primer Sealer, No. 231
3. Glidden Professional: 9116-1200 LifeMaster No VOC Interior Primer. (0 g/L)
4. PPG: Pure Performance Interior Latex Primer, 9-900 Series. (0 g/L)
5. SW: ProMar 200 Zero VOC Interior Latex Primer B28W02600 Series. (0 g/L)]

B. High-Build Primer/Sealer:

1. Cal: Hide-A-Spray, 91-20. (VOC 76 g/L)
2. Glidden Professional: 1040-1200, High Build Surfacer Interior Primer Sealer. (100g/L)
3. PPG: 6-1 Speedhide Interior MaxBuild High Build Surfacer. (<50 g/L)
4. SW: PrepRite High Build Interior Latex Primer/Surfacer B28W601 (VOC 74 g/L).
5. Moore: Super Spec Satin-Fil 172 (VOC 31g/L)

## 2.4 METAL PRIMERS

A. Rust-Inhibitive Primer (Water Based):

1. Cal: Rust Stop DTM 100% Acrylic Semi-Gloss, 10XX.
2. Devoe Coatings: 4020-1000 Devflex 4020PF DTM Primer & Flat Finish. (91 g/L)
3. Moore: IMC Acrylic Metal Primer M04. (51 g/L)
4. Pittsburgh Paints; 90-712 Pitt-Tech One Pack Interior/Exterior Primer Finish DTM Industrial Enamel. (123 g/L)
5. S-W: IMC Pro-Cryl Universal Primer, B66-310 Series. (100 g/L)

## 2.5 WOOD PRIMERS

A. Latex-Based Wood Primer:

1. Cal: ASAP “30” 50300.

2. Glidden Professional: 3210-1200 Gripper Interior/Exterior Primer Sealer. (100 g/L)
3. Moore: Super Spec Latex Enamel Undercoater & Primer Sealer #253.
4. PPG: Seal Grip Interior Primer/Finish, 17-951. (45 g/L)
5. S-W: PrepRite Classic Latex Primer B28W101 Series.

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.6 LATEX PAINTS

A. Low-VOC Latex (Flat):

1. California Paints: Envirotech Zero VOC 100% Acrylic Flat, 633XX.
2. Glidden Professional: 1209-XXXXN Ultra-hide No VOC Interior Flat Paint (0 g/L)
3. Moore: Eco Spec Interior Latex Flat, No. 219.
4. PPG: 6-4110XI Series, Speedhide zero Interior Zero VOC Interior Flat Latex. (0 g/L)
5. SW: ProMar 200 Zero VOC Interior Latex Flat B30-2600 Series. (0 g/L)]

B. Low-VOC Latex (Low Luster):

1. California Paints: Envirotech Zero VOC 100% Acrylic Eggshell, 631XX.
2. Glidden Professional: 1411-XXXX Ultra-hide No VOC Interior Eggshell Paint (0 g/L)
3. Moore: Pristine Eco Spec Interior Latex Eggshell, No. 223
4. PPG: 6-4310XI Series, Speedhide zero Interior Zero VOC Latex Eggshell Interior. (0 g/L)
5. SW: ProMar 200 Zero VOC Interior Latex Eg-Shell B20-2600 Series. (0 g/L)]

C. Low-VOC Latex (Semi-gloss):

1. California Paints: Envirotech Zero VOC 100% Acrylic Semi-Gloss, 663XX.
2. Glidden Professional: 1415-XXXXN Ultra-hide No VOC Interior Semi-Gloss Paint (0 g/L)
3. Moore: Pristine Acrylic Semi-Gloss, No. 214
4. PPG: 6-4510XI Series, Speedhide zero Interior Zero VOC Latex Semi-Gloss. (0 g/L)
5. SW: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series. (0 g/L)]

2.7 HIGH PERFORMANCE EPOXY PAINTS

A. Waterborne Epoxy Finish:

1. Moore: Moorcraft Super Spec Acrylic Epoxy Coating No. 256.
2. PPG: 98-1 Aquapon WB Water Base Epoxy (250 g/L)
3. S-W: IMC Water Based Catalyzed Epoxy Gloss, B70 Series. (200 g/L)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal 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.

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. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

I. Existing Painted Surfaces: Remove any loose paint by scraping or sanding. Sand any rough or “orange peel” or crazing areas.

## 3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tinting: Tint primer of colors such as reds, yellows, and oranges with a gray basecoat system designed to help provide color coverage.

1. Do not tint prime or base coat for multi-colored finishes.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces. When using colors such as red, yellow or orange, an extra coat of finish may be necessary. Notify Architect when additional coats do not fix the problem.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms: Not applicable.
2. Paint the following work where exposed in occupied spaces:

    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

## 3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## 3.5 INTERIOR PAINTING SCHEDULE

A. Steel and Galvanized Metal Substrates:

1. Low-Odor/VOC Latex System:

    a. Prime Coat: Primer, rust inhibitive, water based.
    b. Intermediate Coat: Latex, interior, low odor/VOC, matching topcoat.
    c. Topcoat: Latex, interior, low odor/VOC, semi-gloss (MPI Gloss Level 5).

B. Wood Substrates: Wood trim.

1. Low-Odor/VOC Latex System:

    a. Prime Coat: Primer, latex, for interior wood.
    b. Intermediate Coat: Latex, interior, low odor/VOC, matching topcoat.
    c. Topcoat: Latex, interior, low odor/VOC, semi-gloss (MPI Gloss Level 5).

C. Gypsum Board Substrates:

1. Low-Odor/VOC Latex System:

a. Prime Coat: Primer sealer, interior, low odor/VOC.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1) for ceilings and interior soffits.
d. Topcoat: Latex, interior, institutional low odor/VOC eggshell (MPI Gloss Level 3) for walls.

2. High-Performance Epoxy System:

a. Prime Coat: Primer sealer, interior, low odor/VOC.
b. Intermediate Coat: Interior, high performance epoxy, matching topcoat.
c. Topcoat: Interior, high performance epoxy, semi-gloss (MPI Gloss Level 5).

D. Fiberglass-Faced Gypsum Board Substrates:

1. Low-Odor/VOC Latex System:

a. Prime Coat: High-Build Primer/Sealer.
a. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
b. Topcoat: Latex, interior, institutional low odor/VOC eggshell (MPI Gloss Level 3).

E. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings.

1. Low-Odor/VOC Latex System:

a. Prime Coat: Primer sealer, interior, low odor/VOC.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1).

END OF SECTION 099123

# 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.
2. Dimensional letters and numbers.

### 1.3 ACTION 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. Shop Drawings: Show fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components.

1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
3. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.

C. Samples for Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available.

### 1.4 INFORMATION SUBMITTALS

A. Warranty: Special warranty specified in this Section.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

## 1.6 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.

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.

## 1.7 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.

## 1.8 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

## 1.9 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metal and polymer finishes beyond normal weathering.
b. Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: Five years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

B. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the sign manufacturer for the casting process used and for the use and finish indicated.

C. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

D. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

## 2.2 PANEL SIGNS

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. Mohawk Sign Systems.
2. Welch Architectural Signage.

B. 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.

C. Copy: Complying with ADA Accessibility Guidelines.

D. 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.

E. Braille: Use engrave process for all Braille areas. Engrave Braille dots into surface of clear material.

F. Symbols of Accessibility:

1. Accessible elements: Provide international symbol of accessibility.

a. Provide male and female symbols as required for toilets.

G. Provide characters complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille.

## 2.3 DIMENSIONAL LETTERS AND NUMBERS

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. A.R.K. Ramos Manufacturing Company, Inc.
2. ASI Sign Systems, Inc.
3. Gemini, Inc.
4. Metal Arts.
5. Spanjer Brothers, Inc.
6. Vomar Products, Inc.

B. Cast Letters and Numbers: Form individual letters and numbers by casting. Produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, or other defects. Cast lugs into the back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.

1. Metal: Aluminum.
2. Plastic Sheet: Not less than 0.125 inch thick.
3. Letter Height: 12 inches.
4. Letter Thickness: 2 inches.
5. Letter Style: As selected by the Architect.

## 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.

B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.

C. Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Class II Clear Anodized Fine Satin Finish: AA-M31C21A31 (Mechanical Finish: Fine satin directional textured; Chemical Finish: Fine matte etched finish; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).
2. Class II Clear Anodized Medium Satin Finish: AA-M31C22A31 (Mechanical Finish: Fine satin directional textured; Chemical Finish: Medium matte etched finish; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).
3. Baked-Enamel Finish: AA-M4xC12C42R1x (Mechanical Finish: Manufacturer's standard, other nondirectional textured; Chemical Finish: Chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting.

a. Organic Coating: Thermosetting-modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils, medium gloss.
   1) Color: As indicated by reference to the manufacturer's standard color designations.
   2) Color: Match the Architect's sample.
   3) Color: As selected by the Architect from the manufacturer's standard colors.

## 2.5 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. 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. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

C. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.

1. Projected Mounting: Mount aluminum letters and numbers at the projection distance from the wall surface indicated.
2. Flush Mounting: Mount letters with backs in contact with the wall surface.
3. Adhered Mounting: Mount plastic numbers flush with the wall surface.

## 3.3 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.

## 3.4 PANEL SIGN SCHEDULE

A.

| Types: | Sizes: | Quantity: |
|---|---|---|
| Men’s Restrooms | Provide 8" x 6" | one for each room |
| Women’s Restrooms | Provide 8" x 6" | one for each room |
| Toilet | Provide 8" x 6" | one for each room |
| Stairs | Provide 6" x 6" | one for each door to stair |
| Landings | Provide 18" x 18" (per Life Safety Code) | one for each landing |
| Exit | Provide 6" x 6" | one for each exit |

B. Rooms with more than one entrance door shall have a sign at each door.

C. Final room names and numbers will be verified during the submittal.

D. Allow for 40 informational signs, 6 by 6 inch, with minimum of 15 characters each and room number.

E. Provide cast aluminum numbers for selected exterior entrances around the building. Provide numeral indicated in schedule, 12 inches high.

1. On the interior wall above each exit scheduled, provide matching numeral of plastic located above the exit door.

F. Provide cast aluminum letter for sign at Main Entrance to the building. Provide letters as indicated on the drawings, 12 inches high.

END OF SECTION 101400

# SECTION 102123 – CUBICLE CURTAINS AND TRACKS

## 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. Cubicle curtains.
2. Cubicle tracks.

### 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. Shop Drawings: For cubicle curtains and tracks. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For each type of curtain indicated.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Curtain Fabric: 12-inch- square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.

### 1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with shower and dressing compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221.

2.2 CUBICLE CURTAINS

A. Arc-Com Cubicle Curtain: 100 percent Trevira CS, flame resistant cloth, NFPA 701. 1-1/2 inch hems top and bottom; rustproof grommets 6 inches on center; number 40 open mesh with 1 -1/4 inch cotton tape hem at top. Color as indicated in the Interior Materials Legend.

2.3 CUBICLE CURTAIN TRACKS

A. Inpro Optitrac® Cubical Track with Optitrac Carrier – Ball & Chain roller carriers. Provide one hook for each 6 inches of track length. Configuration as shown on the plans.

B. Anchorages and Fasteners: Manufacturer's standard, exposed fasteners of stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions.

B. Install track rigid and level. Secure tracks in position with manufacturer's recommended anchoring devices.

C. Curtains: Install curtains to specified length and verify that they hang vertically without stress points or diagonal folds.

3.2 ADJUSTING

A. Curtain Adjustment: After hanging curtains, test and adjust each track or rod to produce unencumbered, smooth operation. Steam and dress down curtains as required to produce crease- and wrinkle-free installation. Remove and replace curtains that are stained or soiled or that have stress points or diagonal folds.

END OF SECTION 102123

# SECTION 102600 - WALL AND DOOR PROTECTION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Wall guards.
2. Corner guards.
3. Abuse-resistant wall coverings.
4. Door-hardware protection.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Wall Guards: 12 inches long. Include examples of joinery, corners, end caps, and field splices.
2. Corner and End-Wall Guards: 12 inches long. Include example top caps.
3. Abuse-Resistant Wall Covering: 6 by 6 inches square.
4. Door-Surface Protection: 6 by 6 inches square.

### 1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of handrail.

B. Material Certificates: For each type of exposed plastic material.

C. Sample Warranty: For special warranty.

## 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.
b. Store wall-guard covers in a horizontal position.

## 1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

## 2.3 WALL BUMPER (WB)

A. Crash Rail: Snap-on-type plastic cover installed over a continuous aluminum retainer mounted at height indicated.

1. Product: C/S Group Acrovyn, SCR-50N Crash Rail.
2. Cover: Extruded, rigid plastic, minimum 0.078 inch thick, in dimensions and profiles indicated.

a. Profile: Convex.

1) Dimensions: Nominal 5 inches high by 1 inch deep.
2) Surface: Uniform.

3. Retainer: Continuous, one-piece, extruded-aluminum retainer; minimum 0.072 inch thick.

a. Mounting Type: Surface mounted.

4. Accessories: Provide prefabricated, injection-molded end caps and inside and outside corners with concealed splices, cushions, mounting hardware, and other accessories as required.

a. End caps and inside and outside corners shall match plastic cover color and shall be field adjustable for close alignment with snap-on plastic covers.

## 2.4 CORNER GUARDS

A. Surface-Mounted, Resilient, Plastic Corner Guards (CG-1): Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90-degree turn to match wall condition.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Construction Specialties, Inc.: SM-20.

2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; as follows:

a. Profile: Nominal 3-inch- long leg and 1/4-inch corner radius.
b. Height: Full height.
c. Color and Texture: As indicated in the Interior Materials Legend.

3. Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

## 2.5 ABUSE-RESISTANT WALL COVERINGS

A. Wall Protection (WP-1 and 2): Fabricated from plastic sheet wall-covering material.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acrovyn; 4000 Series.

2. Sheet Thickness: 0.060 inch.
3. Color and Texture: As indicated in the Interior Materials Legend.
4. Height: As indicated in the Interior Materials Legend.
5. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
6. Mounting: Adhesive.

B. Wall Protection (WP-3): Fabricated from plastic sheet wall-covering material.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Korogard; Koroseal.

2. Sheet Thickness: 0.060 inch.
3. Color and Texture: As indicated in the Interior Materials Legend.
4. Height: As indicated in the Interior Materials Legend.
5. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
6. Mounting: Adhesive.

## 2.6 PLASTIC DOOR-PROTECTION PLATES

A. General: Manufacturer's standard plastic products of thicknesses and sizes indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acrovyn; 4000 Series.

2. Fire-Rated Doors: Where the tops of door-protection plates indicated for field installation on fire-rated doors are more than 16 inches above the door bottoms, provide door-

protection plates complying with NFPA 80 that are listed and labeled by a qualified testing and inspection agency acceptable to authorities having jurisdiction.

B. Kick Plates: Minimum 0.060-inch wall thickness; beveled four sides.

1. Size: 10 inches high by door width, with allowance for frame stops.
2. Color and Texture: As indicated in the Interior Materials Legend.
3. Mounting: Adhesive.

C. Armor Plates: Minimum 0.060-inch wall thickness; beveled four sides.

1. Size: 40" high by 1-1/2" less than door width for single doors and 1" less than door width for pairs of doors.
2. Color and Texture: As indicated in the Interior Materials Legend.
3. Mounting: Adhesive.

## 2.7 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

C. Adhesive: As recommended by protection product manufacturer.

## 2.8 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

## 2.9 FINISHES

A. Protect 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 wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

### 3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
3. Adjust end caps as required to ensure tight seams.

D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

E. Door-Frame Protectors: Install on both door jams.

### 3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

# SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Custodial accessories.

### 1.3 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.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: Full size, for each exposed product and for each finish specified.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: The following accessories will be furnished by the Owner and installed by the Contractor:

1. Toilet Tissue Dispenser.
2. Paper Towel Dispenser.
3. Soap Dispenser.
4. Sharps Container.
5. Glove Dispenser.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in this section or substitute product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.
4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Grab Bar:

1. Basis-of-Design Product: Bobrick No. B-5806 Series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings.

C. Sanitary-Napkin Disposal Unit:

1. Basis-of-Design Product: Bobrick No. B-254.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

D. Mirror Unit:

1. Basis-of-Design Product: Bobrick No. B-165.
2. Frame: Stainless-steel channel.

    a. Corners: Welded and ground smooth.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
    b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: 24 by 36 inches.

E. Seat-Cover Dispenser:

1. Basis-of-Design Product: Bobrick No. B-3013.
2. Mounting: Recessed.
3. Minimum Capacity: 500 seat covers.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.

## 2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in this section or substitute product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.
4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Shower Curtain Rod:

1. Basis-of-Design Product: Bobrick No. B-6047.
2. Description: 1-1/4-inch OD; fabricated from nominal 0.05-inch- thick stainless steel.

3. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
4. Finish: No. 4 (satin).

C. Shower Curtain:

1. Basis-of-Design Product: Bobrick No. 204-2.
2. Size: Minimum 6 inches wider than opening by 72 inches high.
3. Material: Vinyl, minimum 0.006 inch thick, opaque, matte.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

D. Folding Shower Seat:

1. Basis-of-Design Product: Bobrick No. B-518.
2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: White vinyl padded seat.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).

E. Soap Dish:

1. Basis-of-Design Product: Bobrick B-7680.
2. Description: Without washcloth bar.
3. Mounting: Surface mounted.
4. Material and Finish: Bright polished stainless steel.

F. Robe Hook:

1. Basis-of-Design Product: Bobrick B-7671.
2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Towel Pin:

1. Basis-of-Design Product: Bobrick B-7677.
2. Description: Projecting minimum of 4-3/8 inches from wall surface.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

## 2.4 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in this section or substitute product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.
4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Mop and Broom Holder:

1. Basis-of-Design Product: Bobrick No. B-223 x 36.
2. Description: 0.0375-inch thick, stainless-steel hat channel with four spring-loaded, rubber, cam-type, mop/broom holders.
3. Length: 36 inches.
4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Utility Shelf:

1. Basis-of-Design Product: Bobrick No. B-295.
2. Description: With exposed edges turned down not less than 1/2 inch and supported by two triangular brackets welded to shelf underside.
3. Size: 16 inches long by 6 inches deep, unless otherwise indicated.
4. Material and Finish: Not less than nominal 0.05-inch thick stainless steel, No. 4 finish (satin).

## 2.5 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

## 2.6 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 instructions.

END OF SECTION 102800

# SECTION 104413 - FIRE PROTECTION 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 Requirements:

1. Section 104416 "Fire Extinguishers."

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches square.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

### 1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

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.

### 2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. JL Industries, Inc.; a division of the Activar Construction Products Group.
    b. Larsens Manufacturing Company.
    c. Potter Roemer LLC.

2. Available Products: Subject to compliance with requirements, provide one of the following.

    a. J.L. Industries: Cosmopolitan Series 8137F17.
    b. Larsen's: Architectural Series SS 2409-6R.
    c. Potter-Roemer: Alta Series 7062-A-4.

B. Cabinet Construction: Nonrated and fire-rated to meet wall construction.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Stainless-steel sheet.

F. Door Material: Stainless-steel sheet.

G. Door Style: Fully glazed panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. 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 continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel or powder coat.
b. Color: White.

2. Stainless Steel: ASTM A 666, Type 304.

a. Finish: No. 4 directional satin finish.

3. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

## 2.3 IDENTIFICATION

A. Identification: Projecting sign with lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

1. Available Products:

a. PTD-182 by Larsen.
b. PTD109 by J.L. Industries.

2. Location: Applied to wall above extinguisher.
3. Application Process: Pressure-sensitive tape or screw fasteners.
4. Lettering Color: White on red background with graphic of fire extinguisher and arrow pointing down.

## 2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

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.

## 2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "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.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed or semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Prepare recesses for recessed or 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 inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.

2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification: Install identification above fire extinguisher cabinet.

## 3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

# SECTION 104416 - FIRE EXTINGUISHERS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Section 104413 "Fire Protection Cabinets."

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

### 1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

### 1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

## 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

## 2.2 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, provide products by one of the following:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International.
c. Badger Fire Protection.
d. Buckeye Fire Equipment Company.
e. JL Industries, Inc.; a division of the Activar Construction Products Group.
f. Kidde Residential and Commercial Division.
g. Larsens 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:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

## 2.3 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 black baked-enamel finish.

# 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. Install a fire extinguisher in each fire extinguisher cabinet.

END OF SECTION 104416

# SECTION 105113 - METAL LOCKERS

## 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. Knocked-down corridor lockers.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of metal locker.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Show locker trim and accessories.
3. Include locker identification system and numbering sequence.

C. Samples: For each color specified, in manufacturer's standard size.

D. Product Schedule: For lockers. Use same designations indicated on Drawings.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

## 1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

## 1.8 COORDINATION

A. Coordinate sizes and locations of recessed opening for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

## 1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures.
    b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

## 2.3 KNOCKED-DOWN CORRIDOR LOCKERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. List Industries Inc.; Standard Quiet KD Lockers.
2. Penco Products, Inc., Subsidiary of Vesper Corporation; Guardian Lockers.
3. Republic Storage Systems Company; Quiet Lockers.

B. Doors: One piece; fabricated from 0.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Doors less than 12 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.
2. Doors for box lockers less than 15 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.
3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch nominal-thickness steel sheet; welded to inner face of doors.
5. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
1. Door Style: Vented panel as follows:

    a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier; three louver openings at top and bottom for double-tier lockers.

C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
2. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.
3. Shelves: 0.024-inchnominal thickness, with double bend at front and single bend at sides and back.

D. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
2. Frame Vents: Fabricate face frames with vents.

E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 42 inches high.

F. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.

a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

G. Locks: Built-in combination locks with master key.

H. Filler Panels: Fabricated from 0.036-inch nominal-thickness steel sheet.

I. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet.

J. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

K. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

L. Finish: Baked enamel or powder coat.

1. Color: As selected by Architect from manufacturer's full range.

## 2.4 LOCKS

A. Built-in Combination Locks: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key.

1. Bolt Operation: Manually locking deadbolt or automatically locking spring bolt.

## 2.5 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.

2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

D. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for preassembly at plant prior to shipping.

E. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

F. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

## 2.6 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.

B. Knocked-Down Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

## 3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

## 3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

## 3.5 METAL LOCKER SCHEDULE

A. Standard Metal Locker: Where metal lockers of this designation are indicated, provide products complying with the following:

1. Locker Arrangement: Single tier.
2. Size: 12 inches wide by 12 inches deep by 60 inches high; single-tier.
3. Backs: Solid.
4. Sides: Solid.
5. Door Style: Expanded metal.
6. Shelves: Solid.

7. Hinges: Heavy-duty hinge.
8. Handles/Latches: Recessed
9. Locks: Combination.
10. Accessories:

    a. Hooks.
    b. Number Plates.
    c. Filler panels.

11. Colors: Allow for one color selected by Architect from manufacturer's full range.

B. Standard Metal Locker: Where metal lockers of this designation are indicated, provide products complying with the following:

1. Locker Arrangement: Double tier.
2. Size: 12 inches wide by 12 inches deep by 60 inches high; single-tier.
3. Backs: Solid.
4. Sides: Solid.
5. Door Style: Expanded metal.
6. Shelves: Solid.
7. Hinges: Heavy-duty hinge.
8. Handles/Latches: Recessed
9. Locks: Combination.
10. Accessories:

    a. Hooks.
    b. Number Plates.
    c. Filler panels.

11. Colors: Allow for one color selected by Architect from manufacturer's full range.

END OF SECTION 105113

# SECTION 108000 - OTHER SPECIALTIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Stainless steel wall cabinet/shelves.
2. Sliding pass-thru window.

### 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 STAINLESS STEEL WALL CABINET/SHELVES

A. Where indicated on the drawings, provide wall cabinets by Pearce Stainless or equal. http://pearcestainless.com/item/stainless-steel-cabinets/wall-cabinet-2/

### 2.2 SLIDING PASS-THRU WINDOW

A. Provide Daisy Model Pass-Thru assembly with D6 overhead tracks and jambs by CR Laurence Co., Inc. or equal. Provide satin anodized finish and tempered glass. Size and configuration as indicated on the drawings.

## 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 108000

# 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. Refrigeration appliances.
2. Ice machine.
3. Blanket warmer.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Product Schedule: For appliances. Use same designations indicated on Drawings.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of appliance.

C. Sample Warranties: For manufacturers' special warranties.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

## 1.7 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS AND PRODUCTS

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. BOSCH Home Appliances.
3. Electrolux Home Products (Frigidaire).
4. General Electric Company (GE).
5. KitchenAid; a division of Whirlpool Corporation.
6. LG Appliances.
7. Maytag; a division of Whirlpool Corporation.
8. Sears Brands LLC (Kenmore).
9. Whirlpool Corporation.

## 2.2 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. 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.

## 2.3 REFRIGERATOR/FREEZERS

A. Refrigerator/Freezer: [**One-door refrigerator with freezer compartment inside**] [**Two-door, side-by-side refrigerator/freezer**] [**Two-door refrigerator/freezer with freezer on top**] [**Two-door refrigerator/freezer with freezer on bottom**] <**Insert description**> and complying with AHAM HRF-1.

1. Basis-of-Design Product: To be determined.
2. Type: Freestanding.

3. Dimensions:

a. Width: 36 inches.
b. Depth: [**24 inches**] [**27 inches**] [**33-1/4 inches**] [**As indicated on Drawings**] <**Insert dimension**>.
c. Height: [**34-1/2 inches**] [**70 inches**] [**73 inches**] [**84 inches**] [**As indicated on Drawings**] <**Insert dimension**>.

## 2.4 ICE MACHINE

A. Icemaker [**IC #**]:

1. Basis-of-Design Product: To be determined.

## 2.5 BLANKET WARMER

A. Blanket Warmer:

1. Basis-of-Design Product: To be determined.

## 2.6 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, areas, 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

A. Install appliances according to 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.

## 3.3 FIELD QUALITY CONTROL

A. Perform the following 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.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. 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 113100

# SECTION 122413 - ROLLER WINDOW SHADES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.

F. Roller-Shade Schedule: Use same designations indicated on Drawings.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 WARRANTY

A. Roller Shade Hardware and Chain: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Shade Cloth: Standard non-depreciating 10-year limited warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade by MechoShade Systems, Inc. or an approved substitute.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

## 2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Nickel-plated metal.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, sill mounted.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of inside face of shade.
2. Direction of Shadeband Roll: Regular, from back of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

E. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped.
b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.

2. Endcap Covers: To cover exposed endcaps.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

## 2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Shade Cloth: EcoVeil group, 1550 Series, fabricated from TPO for both core yarn and jacket, single thickness, non-raveling 0.030 inch (0.762 mm) thick fabric.

1. Fabric Width: As required for windows.
2. Weave: 1 percent open 2 x 2 basket weave.
3. Colors: As selected by Architect from manufacturer's full range
4. Bottom Hem: Straight.

C. Light-Filtering Shade Cloth: EcoVeil group, 1550 Series, fabricated from TPO for both core yarn and jacket, single thickness, non-raveling 0.030 inch (0.762 mm) thick fabric.

1. Fabric Width: As required for windows.
2. Weave: 5 percent open 2 x 2 basket weave.
3. Colors: As selected by Architect from manufacturer's full range
4. Bottom Hem: Straight.

## 2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances,and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

### 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.

### 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

### 3.6 WINDOW SHADE SCHEDULE

A. Provide shades in all exterior windows unless noted otherwise.

END OF SECTION 122413

# SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Resilient-tile entrance mats.

### 1.3 COORDINATION

A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.

B. Samples: For the following products, in manufacturer's standard sizes:

1. Floor Mat: Assembled sections of floor mat.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Structural Performance: Provide roll-up rail mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:

1. Uniform floor load of 300 lbf/sq. ft..
2. Wheel load of 350 lb per wheel.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

## 2.2 RESILIENT-TILE ENTRANCE MATS (M-1)

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. Tandus/Captiva; Abrasive Action II.

B. Carpet-Type Tiles: Nylon carpet bonded to 1/8- to 1/4-inch-thick, flexible vinyl backing to form mats 3/8 or 7/16 inch thick with nonraveling edges. ER3 RS Modular.

1. Colors, Textures, and Patterns: Asphalt #19102.
2. Tile Size: 24 by 24 inches.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes,and other conditions affecting installation of floor mats and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

## 3.3 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813

## PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Factory-Fabricated Pre-Piped and Pre-Wired Patient Care Headwall System

a. Patient Care Headwall as detailed on the drawings, including related components and accessories required to form an integral unit. Headwall components shown on the drawings but not specified below shall be included as part of the work under this Section, and all applicable portions of the Specification shall apply to these items.

B. Related Documents

1. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

C. Related Sections

1. Section 22 60 00, Gas and Vacuum systems for Laboratory and Healthcare Facilities

2. Section 26 00 00, Electrical

3. Section 27 52 00, Healthcare Communications and Monitoring Systems

1.02 REFERENCES

A. American National Standards Institute (ANSI)

B. National Fire Protection Association (NFPA)

1. NFPA 70, National Electrical Code (NEC)

2. NFPA 99, Healthcare Facilities

C. Underwriters Laboratories (UL)

D. GreenGuard Certification (Components)

1.03 SUBMITTALS

A. Submit sufficient information, clearly presented, to determine compliance with drawings and specifications, including but not limited to the following.

1. Product Data

a. Regulatory Agency Approval Information.

b. Manufacturer’s Product and Utility Information.

c. Manufacturer's Product Specifications.

2. Drawings

a. Elevation of Headwall showing materials, construction, dimensions, ceiling height, piping/electrical termination points, circuit designators, and quantities/locations of utilities and accessories.

b. Wiring diagram showing connections, electrical ratings, and circuit designators for utilities contained within the Headwall.

c. Mounting diagram, wall reinforcement recommendations, rough-in locations/dimensions, and installation details.

3. Request For Information (RFI).

4. Reference to available finishes and colors.

1.04 CLOSE-OUT DATA

A. As directed by Owner, provide complete Operation and Maintenance Manual.

B. As directed by Owner, provide complete Drawings of Record.

C. Warranties: See Section 1.10.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer

a. Has been regularly engaged in design and manufacture of the types of products and scope similar to the requirements of this project for a period of not less than five years.

b. Has sufficient capacity to produce and deliver required materials without causing delays in work.

c. Is capable of providing field service representation.

B. Field Samples (Mock-Ups)

1. As directed by Owner, construct fully functional Mock-Up unit for the purpose of evaluating quality of work, operation of equipment, product application, system integration, and facility preparation.

2. Construct per approved drawings.

3. As directed by Owner, may or may not remain part of finished work.

4. Work may proceed only after written acceptance of Mock-Up is received.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Time deliveries to ensure materials are available on site when required.

B. Materials delivered to site in Manufacturer's clearly identified containers.

C. Receive and store materials in their original containers in a secured space, and in a manner to prevent damage from exposure to harmful weather or conditions.

1.07 PROJECT / SITE CONDITIONS

A. Existing Conditions

1. Ensure that walls scheduled to receive materials are adequately reinforced to accept installation of this work.

2. Report any deficiencies to Owner/Contractor for corrections.

B. Protection

1. Ensure that adjoining work will not be adversely affected by installation of work in this Section.

2. Provide temporary protection as required.

C. Environmental Limitations

1. Do not install materials until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of the construction period.

D. Field Measurements

1. Verify actual dimensions of construction contiguous with Headwall by field measurements before fabrication.

2. Field measurements to be provided by General Contractor.

1.08 SEQUENCING

A. Coordinate work in this Section with work of other trades for proper time and sequence in order to avoid delays.

B. Coordinate this work with other operations taking place in the same area to avoid conflicts.

1.09 WARRANTY

A. All warranties run from date of substantial completion.

B. Written warranty on entire system, signed jointly by Installer, Manufacturer, and Contractor for period of twelve (12) years.

## PART 2 - PRODUCTS

2.01 PATIENT BED SERVICE WALL

A. Products for basis of design – submit for Owner and Architect review.

1. Axiom Patient Care Headwall by Hospital Systems, Inc.; 750 Garcia Avenue, Pittsburg, CA 94565 USA; Telephone (925) 427-7800; Fax (925) 427-0800; Email info@HSIheadwalls.com; Website www.HSIheadwalls.com

2. Basis Headwall system by Hill-Rom **Hill-Rom Batesville, IN**
   1069 State Route 46 East
   Batesville, IN 47006 USA
   (812) 934-7777

3. Regal Series Headwall by Amico Corporation, 71 East Industry Court, Deer Park, NY 11729
   71 East Industry Court
   Deer Park, NY 11729 **Toll Free Tel:** 1.877.462.6426
   **Toll Free Fax:** 1.866.440.4986

B. Manufacturer

1. Single Source Responsibility: Components and materials specified in this section provided by a single Manufacturer.

2. If products of other Manufacturers are used to satisfy this section, all items shall meet the requirements specified herein, and be approved by Owner or Architect prior to bid.

C. Design Criteria

1. High-quality functional Patient Care Headwall with the inherent attributes of durability, aesthetic value, and safety while providing maximum functionality.

2. Effective means to deliver necessary medical gases and other utilities to the patient.

3. Space efficient solution making maximum use of vertical space and maximizing floor space with in-wall mounting.

4. Highly organized and versatile method of storing materials unique to medical requirements.

5. Facilitate ease of Headwall installation and cleaning.

D. Regulatory Requirements

1. Meets or exceeds NFPA 99, 56A, 76B requirements.

2. Complies with NFPA 70 (NEC) requirements.

3. UL listed and labeled.
4. OSHPD approved.
5. Meets or exceeds local codes.

2.02 GENERAL SUMMARY

A. Surface-mounted or in-wall flush-mounted Patient Care Headwall System consisting of vertical Headwall units, extending from the ceiling or fabricated to required height, as specified by the drawings.

2.03 MATERIALS

A. Frame

1. Extruded, heat-treated 6063-T5 aluminum alloy.
2. Clear anodized.

B. Removable Fascias

1. Aluminum sheet.
2. High Pressure Laminate (HPL) finish on outside face.
3. Laminate color as specified by Owner.

C. Removable Spectrum Duracore™ Access Panels

1. Particle board core.
2. High Pressure Laminate (HPL) finish on outside face.
3. Fire-Retardant backing sheet on inside face.
4. Laminate color as specified by Owner.

2.04 COMPONENTS

A. Medical Gas Piping and Medical Gas / Vacuum Outlets

1. Medical Gas Piping

a. Type L copper pipe, cleaned, capped, and properly identified.

b. Factory installed and manifolded for single-point connection to building services in accordance with facility requirements and drawings. Termination points above ceiling (surface-mounted Headwall) or below integrated terminal compartments (flush-mounted Headwall).

c. Factory tested.

2. Medical Gas / Vacuum Outlets

a. Location and quantity to meet the configuration of services detailed on the drawings.

b. Provided per Section 22 62 00 and 22 63 00.

c. Factory installed and tested.

d. Medical gas outlet Manufacturer's standard cover plates.

e. Fixed medical gas outlets are permanently installed in one location, however, solutions to allow for future relocation or addition of outlets without requiring recertification can be incorporated during the design phase.

B. Electrical Wiring and Electrical Receptacles

1. Electrical Wiring

a. Normal (Standard) and Emergency (Critical) Branch Power: #12 THHN stranded copper wire, 600 Volt, with heat resistant thermo-plastic insulation.

b. Ground: #12 THHN stranded copper wire.

c. Factory installed for single-point connection to building power in accordance with facility requirements and drawings. Termination points at integrated terminal compartments.

d. Factory tested.

2. Electrical Receptacles

a. Location and quantity to meet the configuration of services detailed on the drawings.

b. Hospital Grade NEMA 5-15R or NEMA 5-20R.

c. Tamper-Resistant (Safety), Illuminated, or GFCI as directed by Owner.

d. Colors: Ivory for use on normal (standard) circuits and red for use on emergency (critical) circuits, unless otherwise noted.

e. Factory installed and tested.

C. Internal Ground Bus

1. Aluminum, unless otherwise specified.

2. Factory installed and tested.

D. Integrated Terminal Compartments

1. Located at the top of each unit.

2. Normal (standard), emergency (critical), low voltage, and 277V as required.

E. Ceiling Mounting Plate (Surface-Mounted Headwall)

1. Factory punched for conduit termination.

F. Rough-In Bracket (Flush-Mounted Headwall)

1. Factory punched for conduit termination.

G. Integrated Accessory Tracks

1. Vertical accessory tracks integrated into the frame.

H. Provisions

1. Can accommodate provisions for, but not limited to, Nurse Call Equipment, Monitoring Equipment, Data Jacks, Phone Jacks, Lighting, etc. Low Voltage Controller for lighting fixtures (fixture by others) can be provided and factory installed when specified.

2. Required raceways, isolated termination points, and labeled pull cords factory installed.

3. Blank cover plates provided for all provisions with the exception of Nurse Call equipment.

I. Optional Electrical Components – Provided and Factory Installed As Shown On Drawings

1. Switches

a. Industrial Grade, 120/277 Volt, 20 Amp

b. Toggle, Decora, 3-Way, Momentary, etc.

c. Colors: Ivory for use on normal (standard) circuits and red for use on emergency (critical) circuits, unless otherwise specified.

2. REACT Timer

a. Digital time of day and elapsed timer.

b. Allows activation of elapsed time indicator by manual depression of Start switch, or by patient ventricular alarm condition broadcast through bedside physiological monitor and/or Code Blue switch.

c. Manually operated Stop/Start, Reset, and Mode switches pre-wired within the REACT unit.

d. Installing Contractor performs wiring and electrical actuation between the monitor and the REACT unit.

3. Grounding Jacks

a. Solid brass receptacles enclosed in non-conductive housing.

b. Spring loaded with twist-to-lock action.

c. Meets requirements of NEC article 517 and NFPA 99.

4. Secondary Circuit Breakers

a. Includes breaker box and door with concealed hinges for access to circuit breaker handles.

2.05 LIGHTING (OPTIONAL)

A. Aurora™ Overbed Light Fixture

1. 2-Way Multi-Directional Fluorescent: Indirect (up), Direct (down), and High-Intensity Exam.

2. Safety shut-off feature to prevent damage from rising electric beds.

B. Horizon™ 8 Overbed Light Fixture

1. 2-Way Fluorescent: Indirect (up) and Direct (down).

C. Qualux 50GX™ Exam/Reading Light

1. Dual-Intensity Halogen: Exam (spot) and Reading (flood).

2. 38-Inch knuckle-joint arm.

D. Qualux 50SX™ Exam/Reading Light

1. Dual-Intensity Halogen: Exam (spot) and Reading (flood).

2. 31.5-Inch gooseneck arm.

E. Series MLC Exam/Reading Light

1. Fluorescent/Incandescent.

2. 45-Inch adjustable arm.

F. Series ARL Exam/Reading Light

1. Incandescent.

2. 45-Inch or 50-Inch adjustable arm.

2.06 ACCESSORIES (OPTIONAL)

A. Large selection of accessories to be available including Vacuum Bottle Slides, Monitor Mounting Channels and Arms, Bed Bumpers and Docking Stations, Horizontal Eclipse™ Equipment Rails, Diagnostic Equipment, Sharps, Glove Holders, I.V. Poles, Vacuum Bottles and Slides, etc.

B. Accessories to be provided by Manufacturer of Headwall to ensure compatibility.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Ensure structure and/or substrate is adequate to support Headwall.

B. Inspect and verify that walls and areas in which work is to be performed are acceptable for Headwall installation in accordance with Manufacturer's published recommendations and all applicable Sections.

C. Report all discrepancies and unacceptable conditions to Owner/Contractor for corrections.

D. Proceed with installation only after discrepancies and unacceptable conditions have been remedied.

### 3.02 PREPARATION

A. Coordinate Headwall installation with work of other trades for proper sequence to avoid delays.

B. Coordinate service connection work with Electrical, Piping, and Communication Contractors.

C. Ensure that backing material (surface-mounted Headwall) or applicable sill/stud/header (flush-mounted Headwall) installation is complete and acceptable for Headwall installation in accordance with Manufacturer's published recommendations and all applicable Sections.

D. As directed by Owner, Ceiling Mounting Plate (surface-mounted Headwall) or Rough-In Bracket (flush-mounted Headwall) provided in advance of Headwall.

1. Install at location specified on drawings for pre-installation of electrical, communication, and medical gas building service connections.

### 3.03 INSTALLATION

A. Perform installation in strict accordance with Manufacturer's published recommendations and all applicable Sections.

B. Install Headwall securely, square, level, and plumb. Installation hardware supplied by installing Contractor.

C. After installation of Headwall and connection of services are complete, test electrical equipment function and grounding in accordance with NFPA requirements. Purge and test medical gases for system certification in accordance with NFPA 99.

### 3.04 CLEANING

A. Clean all surfaces to remove all marks, soil, and foreign matter immediately after installation and adjustment are complete.

B. Recheck all components and perform any necessary additional cleaning just prior to substantial completion.

C. Remove surplus materials, debris, tools, and equipment upon completion.

D. Manage Packaging Waste

1. Collect and separate packaging waste materials for reuse and/or recycling.

a. Fold and flatten metal and plastic banding.

2. Remove packaging materials from site and dispose of at appropriate recycling facilities.

3.05 PROTECTION

A. Protect installed Headwall from damage during remaining construction work.

**END OF SECTION**

SECTION 21 00 00

FIRE PROTECTION

PART 1 - GENERAL

1.1 REFERENCES

A. Conditions of the Contract and Division 1, General Requirements, apply to work of this Section. Where paragraphs of this Section conflict with similar paragraphs of Division 1, requirements of this Section shall prevail.

B. As used in this Section, "provide" means "furnish and install". "P.O.S." means "provided under other sections". "Furnish" means "to purchase and deliver to the project site complete with every necessary appurtenance and support," and "Install" means "to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project".

C. Before submitting bid, visit and carefully examine site to identify existing conditions and difficulties that will affect work of this Section. No extra payment will be allowed for additional work caused by unfamiliarity with site conditions that are visible or readily construed by experienced observer. Site visit is particularly important because this is renovation work.

D. Before starting work in a particular area of the project, visit site and examine conditions under which work must be performed including preparatory work performed under other Sections or Contracts, or by Owner. Report conditions which might adversely affect work in writing through the Contractor to the Architect. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing conditions and preparatory work.

1.2 QUALIFICATIONS OF INSTALLER

A. Prior to installation, submit data for approval by the Owner or authorized representative showing that the Contractor has successfully installed automatic fire-extinguishing sprinkler systems of the same type and design as specified herein, or that he has a firm contractual agreement with a subcontractor having such required experience. The data shall include the names and locations of at least two installations where the Contractor or the subcontractor referred to above, has installed such systems. The Contractor shall indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

1.3 SCOPE

A. Sections of the existing building presently have a wet pipe sprinkler system. Design, modify and extend existing sprinkler service to accommodate new work in accordance with BOCA and NFPA. Contractor shall visit the work site prior to determine sizes and locations of tie-ins.

B. Perform work and provide material and equipment for systems as shown on Drawings and as specified or indicated in this Section. Completely coordinate work of this Section with work of other Sections and provide a complete and fully functional installation. The project shall be phased in accordance with the contractor's approved phasing plan. The contractor shall obtain approval from the owner for the sequencing and timing of operations prior to commencing work.

C. Give notices, file plans, obtain permits and licenses, pay fees and back charges and obtain necessary approvals from authorities that have jurisdiction, as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.

D. The work includes designing and providing a new automatic wet pipe fire extinguishing sprinkler system for light hazard occupancy (contractor to confirm hazard occupancy) with uniform distribution of water to afford complete fire protection coverage throughout the areas protected. Spaces subject to freezing shall have a separate dry pipe system. Design density shall be increased in those areas with a higher hazard designation. The design, equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of NPFA 1, NFPA 13, NFPA 14, BOCA and other applicable NFPA publications except as modified herein. Design and install each system to give full consideration to blind spaces, piping, electrical equipment, ductwork, and all other construction and equipment to afford complete coverage in accordance with detailed drawings to be submitted for review. Devices and equipment for fire protection service shall be of an approved make and type listed by the Underwriters Laboratories Inc. In the publications referred to herein, the advisory provisions shall be considered to be mandatory as though the word "shall" has been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the Owner or authorized representative.

1.4 RELATED WORK IN OTHER SECTIONS

A. The following work is not included in this Section and shall be performed under other Sections:
   1. Concrete work, including concrete housekeeping pads and other pads and blocks for vibrating and rotating equipment.
   2. Cutting and patching of masonry, concrete, tile and other parts of structure, with the exception of drilling for hangers and providing holes and openings in metal decks.
   3. Flashing of all roof penetrations.
   5. Installation of access panels in ceilings and wall construction.
   6. Painting, except as specified herein.
   7. Electric power wiring for all equipment.
   8. Structural supports necessary to distribute loading from equipment to roof or floor except as specified herein.
   9. Temporary light, power, water, heat, gas and sanitary facilities for use during construction and testing.
   10. Gypsum drywall enclosures of piping.

1.5 CODES, STANDARDS AND AUTHORITIES AND PERMITS

A. Perform work strictly as required by rules, regulations, standards, codes, ordinances, and laws of local, state, and federal governments, and other authorities that have jurisdiction over the site. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:

1. National Fire Protection Association (NFPA) Publications:
   - "13" Sprinkler Systems
   - 24-77 Outside Protection
   - 70-78 National Electrical Code
   - 72B-79 Installation, Maintenance and Use of Auxiliary Protective Signaling Systems
2. Underwriters' Laboratories, Inc. (UL) Publications:
   - 262-73 Gate Valves for Fire Protection
   - & Am 76 Service
   - 789-76 Indicator Posts for Fire Protection Service
   - 1980 Fire Protection Equipment List
3. American Society for Testing and Materials (ASTM) Publications:
   - A 53-79 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
   - A 120-79 Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless for Ordinary Uses
4. American Water Works Association (AWWA) Publications:
   - C500-71 Gate Valves, 3 Inch Through 48 Inch, for Water and Other Liquids
   - C601-68 Disinfecting Water Mains
5. Factory Mutual System (FM) Publications:
   - 1980 Approval Guide

B. Materials and equipment shall be listed by Underwriters' Laboratories (UL), and installed only in strict accordance with its listing.

C. When requirements cited in this Section conflict with each other or with Contract Documents, most stringent requirement shall govern work. Architect may relax this requirement when such relaxation does not violate ruling of authorities that have jurisdiction. Approval for such relaxation shall be obtained in writing.

1.6 GUARANTEE AND 24 HOUR SERVICE

A. Guarantee Work of this Section in writing for one year following the date of initial building occupancy or turning over of the building to the owner, whichever is earlier. Repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly, and to Architect's satisfaction, and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.

B. In addition to guarantee requirements of Division 1 and of Subparagraph A above, obtain written equipment and material warranties offered in manufacturers' published data without exclusion or limitation, in Owner's name.

C. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Architect.

D. Provide 24 hour service beginning on the date the project is first occupied, whether or not fully occupied, and lasting until the termination of the guarantee period. Service shall be at no cost to the owner. Service can be provided by this contractor or a separate service organization. Choice of service organization shall be subject to Architect and Owner approval. Submit name and a phone number that will be answered on a 24 hour basis each day of the week, for the duration of the service.

E. Submit guarantee to Architect before final payment.

F. At end of guarantee period, transfer manufacturers' equipment and material warranties still in force to Owner.

G. This Paragraph shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.

H. Part 2 Paragraphs may specify warranty requirements that exceed those of this Paragraph.

I. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of work or beneficial use by Owner, and shall not institute guarantee period.

J. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to Owner's satisfaction, advise Architect in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Architect will suggest course of action.

1.7 RECORD DRAWINGS

A. As work progresses, and for duration of Contract, maintain complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to the original design. Record valve tags as they are installed.

B. At completion of work prepare a complete set of record drawings on mylar drafting film, showing all systems as actually installed. The design tracings will be made available for the contractor's copying into reproducibles to serve as backgrounds for the record drawings. The quantity of design tracings which are made available shall in no way be interpreted as setting a limit to the number of drawings necessary to show the required as-built information. Contractor's professional draftsperson shall transfer changes to mylars; submit mylars and three sets of prints to Architect for review and approval.

1.8 SHOP DRAWINGS

A. This Paragraph supplements Division 1.

B. Definitions:
   1. Shop Drawings are drawings, diagrams, schedules and other data specially prepared for Work by Contractor, subcontractor, manufacturer, supplier or distributor to illustrate portions of Work.
   2. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other general information furnished to illustrate material, products and systems.
   3. Samples are physical examples that illustrate materials, equipment and workmanship and established standards by which work will be judged.

C. Submittal Requirements:
   1. Coordinate submittal packages, review for compliance with Contract Documents and submit to Architect for review. Submit transparency and three blue- or black-line reproductions of each Shop Drawing. Submit eight sets of each Product Data package. When samples are required, submit one, unless two are required to illustrate potential range of deviations in physical characteristics.
   2. Review submittals for each item and determine compliance with Contract Documents. Transmittal letter or form shall be evidence of submittal review. Submittals without transmittal letter or form will be returned without review.

D. Identification and Information Submitted:
   1. INFORM SUBCONTRACTORS, MANUFACTURERS, SUPPLIERS, ETC. OF SCOPE AND LIMITED NATURE OF REVIEW PROCESS AND ENFORCE COMPLIANCE WITH CONTRACT DOCUMENTS.
   2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:
      a. Title
      b. Name and location of project
      c. Names of Architect, Engineer, Contractor and Subcontractor(s)
      d. Names of manufacturer, supplier, vendor, etc.
      e. Date of submittal
      f. Date of each correction or revision
      g. Section and paragraph number of Specifications and sheet number of Contract Drawings describing work
   3. Submittals Required: Partial submittals will not be acceptable. Annotate descriptive data to show the specific model, type, and size of each item the Contractor proposed to furnish. Prepare working drawings on sheets not smaller than 24 inches by 36 inches in accordance with the requirements for "Working Drawings (Plans)" as specified in NFPA 13, and include data essential to the proper installation of each system. Do not commence work until the design of each system and the various components have been approved. The Owner or authorized representative will review and approve all submittals. Before any work is commenced, submit for approval complete sets of working drawings and calculations for each sprinkler system, hydraulic calculations to show the basis for the design, graphs or tables showing the pressure discharge relationship for the sprinkler heads; and full descriptive data for pipe, fittings, dry pipe and wet pipe alarm valves, gate valves, check valves, water motor alarms, sprinkler heads, hangers, air compressor, pressure switch, control panel, air maintenance device,

low air pressure trouble alarm, electrical wiring diagram, devices, materials, and all associated equipment.

4. Provide product data prepared by manufacturers, suppliers and vendors comprising:
   a. Detailed dimensional drawings.
   b. Accurate and complete description of materials of construction.
   c. Installation details.
   d. Manufacturer's published performance characteristics and capacity ratings (performance data, alone, is not acceptable).
   e. Electrical requirements and wiring diagrams, Drawings shall clearly indicate location (terminal block or wire number), voltage and function for all field terminations.
   f. Other information necessary to demonstrate compliance with all requirements of Contract Documents.
5. Data not included with Product Data submittal, including information required above, must be shown on Shop Drawings.
6. Submittals shall contain information specific to systems, equipment and materials required by Contract Documents for this Project only. Do not submit catalogs that describe products, models, options or accessories other than those required, unless irrelevant information is marked out or unless relevant information is highlighted clearly. Marks on submittals, whether by Contractor, subcontractor, manufacturer, supplier or vendor, shall be made in black, blue, or green ink only. Red and yellow are reserved for review process. Observe special requirements for submittals specified elsewhere in Contract Documents.
7. Submittals for systems, equipment and material specified under different, major paragraphs of this Section shall be submitted separately and shall be identified with applicable Paragraph number and name.
8. Submit samples required by Contract Documents or requested by Architect, with letter or transmittal and complete descriptive Product Data. Certify accuracy of samples.

E. Material and equipment requiring Shop Drawing and Product Data Submittals shall include but not be limited to:
   1. Sprinkler heads.
   2. Valves.
   3. Pipe and fittings.
   4. Fire department connection (if applicable).

F. Substitutions and Deviations:
   1. Deviations from Contract Documents and substitution of materials or equipment for those specified shall be requested individually in writing whether deviations result from conditions, standard shop practice, or other cause. Submit letter before transmittal of Shop Drawings and Product Data; describe present basis of design, proposed deviation or substitution, and reason for change. Describe changes in system shown and physical characteristics (connections to adjacent materials, electrical services, service access requirements, and other characteristics), and differences in operating characteristics or cycles. Assume full responsibility for safety, operation and performance of altered system.

2. Do not request substitute materials or equipment unless identical material or equipment has been operated successfully for at least three consecutive years. Such materials and equipment shall be a regular cataloged item shown in current catalog of the manufacturer. Submittals affected by such proposed deviations and substitution shall be accompanied by copy of Architect's approval of substitution. When deviation or substitution is permitted, coordinate fully with related changes to Architectural, Structural, Plumbing, Fire Protection, Electrical and other work. Ensure that related changes necessary for coordination of substitution item are made within Contract Price.
3. Substitutions of equipment, systems, etc. requiring approval of local authorities must comply with such regulations and be filed at the expense of the Contractor (should filing be necessary).
4. Approval of proposed deviations or substitutions, if any, will be made at discretion of Architect.
5. If equipment proposed for substitution that is not tested and rated according to industry wide standards, the Architect shall have the right to have performance tests completed, at the Contractor's expense, to confirm manufacturer's performance claims.

G. Schedule: Allow at least 10 working days, exclusive of transmittal time, for review each time Submittals package is submitted or resubmitted, unless specified otherwise. Incorporate review period into schedule so that Work is not delayed.

H. List of, Proposed Equipment and Materials:
1. Within four weeks after Award of Contract and before ordering materials or equipment, submit complete list of proposed materials and equipment and indicate manufacturer's names and addresses. No consideration will be given to partial lists submitted out of sequence.

I. Responsibility:
1. Intent of Submittal review is to check for capacity, rating, and features. Contractor meets requirements of regarding information fabrication processes techniques, sequences construction; and for certain construction shall ensure that work Contract Documents that pertains to or means, methods, and procedures of coordination of work of this and other Sections. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the shop drawing errors or deviations from requirements of Contract Documents. The Architect's noting of some errors while overlooking others will not excuse the contractor from proceeding in error. Contract Documents requirements are not limited, waived nor superseded in any way by review.

1.9 BULLETINS, MANUALS AND OPERATING INSTRUCTIONS AND PROTECTION

A. Obtain at time of purchase of equipment, three copies of operation, lubrication and maintenance manuals for all items. Assemble literature in coordinated manuals with additional information describing combined operation of field assembled units, including as-built wiring diagrams. Manual shall contain names and addresses of manufacturers and

local representatives who stock or furnish repair parts for items or equipment. Divide manuals into three sections or books as follows:

1. Directions for and operation of Fire Protection system components. Detail procedure to be followed in case of malfunctions.
2. Detailed maintenance and trouble shooting manuals containing data furnished by manufacturer for complete maintenance.
3. Lubrication instructions detailing type of lubricant, amount, and intervals recommended by manufacturer for each item of equipment. Include additional instructions necessary for implementation of a first class lubrication program. Include approved, where appropriate, summary of lubrication instructions in chart form.

B. Furnish three copies of manuals to Architect for approval and distribution to Owner. Deliver manuals no less than 30 days prior to acceptance of equipment to permit Owner's personnel to become familiar with equipment and operation prior to acceptance.

C. Operating Instructions: Upon completion of installation or when Owner accepts portions of building and equipment for operational use, instruct owner's operating personnel in any or all parts of various systems. Instructions shall be performed by factory-trained personnel. Owner shall determine which systems require additional instructions. Duration of instructions shall take equipment through complete cycle of operation (at least five working days). Make adjustments under operating conditions.

D. Each Contractor shall be responsible for his work and equipment until finally inspected, tested, and accepted. Carefully store materials and equipment which are not immediately installed after delivery to site. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.

E. Each separate Contractor shall protect the work and material of other trades that might be damaged by his work or workmen and make good all damage thus caused.

1.10 MODIFICATIONS IN LAYOUT

A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet architectural requirements.

B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Architect.

C. Maintain sufficient clearance around mechanical equipment to permit routine maintenance and inspection of equipment.

D. Check Contract Drawings as well as Shop Drawings of all subcontractors to verify and coordinate spaces in which work of this section will be installed.

E. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.

F. Make modifications in layout and components needed to coordinate with work of other trades and to coordinate according to A, B, C, D above. Systems shall be run in a rectilinear fashion.

1.11 WORKING PLANS

A. Submit Working Plans signed and stamped by either a NICET Level 3 or Professional Engineer with 5 years experience licensed in the project state to authorities that have jurisdiction, including:
1. Architect
2. Insurance Underwriter
3. State Fire Marshall
4. Local Fire Department

B. Submit Working Plans in one complete package. When it is not possible to submit entire system design in one package due to job conditions, submit plans of entire building indicating area not yet defined.

C. Working Plans shall be at least 1/8 in. = 1 ft. scale on sheets of uniform size. Working Plans shall show all data required by NFPA 13.

D. Working Plans shall be subject to Architect's final approval. Submit to Architect only after review by other authorities. If necessary to submit plans to Architect before review by other authorities, identify authorities that have not reviewed plans and resubmit for final approval when review by all parties is complete.

E. Pipe size shall be based on hydraulic calculations. Ensure that calculations are correct. Hydraulic calculations are required to be submitted if system is hydraulically designed.

1.12 SPECIAL DESIGN CONSIDERATIONS

A. Secure water flow test data taken from fire hydrants nearest site or fire pump. If recent flow test data is not available from city records, make necessary tests as required by NFPA 13 Standards to determine character of water supply. Minimum of 20 psi drop in pressure between static and residual pressure shall be required in order to obtain accurate data.

B. Run piping horizontally and at right angles to walls and ceilings.

C. Provide additional sprinkler heads (over code minimum quantities) if requested by Architect, to obtain symmetrical ceiling layouts.

D. Fire protection system shop drawings shall include complete reflected ceiling plans indicating location of each sprinkler head, as well as piping layouts. Provide additional sprinkler heads (over code minimum quantities) if requested by Architect, to obtain symmetrical ceiling layouts.

E. Where required by the State Fire Marshal, ceiling cavities shall be sprinklered in accordance with NFPA 13 for concealed spaces. This requirement applies to new and existing areas of the building.

F. Sprinkler heads in finished spaces shall be centered in ceiling tiles where suspended ceilings are used.

G. Coordinate sprinkler head locations with electrical and mechanical plans to avoid interferences with lighting fixtures, diffusers, and other equipment.

PART 2 - PRODUCTS

2.1 DESIGN OF SPRINKLER SYSTEMS

A. Design of wet pipe and dry pipe fire extinguishing sprinkler systems shall be by hydraulic calculations for uniform distribution of water over the design area and shall conform to NFPA 13 and to the requirements as specified herein.

1. Sprinkler Heads: Heads shall have nominal 0.50 inch orifice. Provide semi-recessed ceiling plates with white finish and sprinklers for finished areas with suspended or GWB ceilings. Sprinkler heads located in concealed and unfinished areas shall be brass upright or pendent type, as required. Provide corrosion resistant sprinkler heads and sprinkler head guards as required by NFPA 13. Sprinkler heads located in all Behavioral Health patient areas shall be institutional type designed to be unobtrusive to resist attracting unwanted attention and tamper resistant similar to Tyco Raven Institutional Sprinklers.
2. Sprinkler Heads Located in Unheated Areas: Sprinkler heads in unheated areas (e.g. overhangs, attic spaces, porches and roofs) shall be dry pendent or dry sidewall type, or from a Glycol and water loop or separate dry-pipe system.
3. Cabinet: Provide extra sprinkler heads and sprinkler head wrench in a metal cabinet adjacent to the wet-pipe valve. The number and types of extra sprinkler heads shall be as specified in NFPA 13.
4. Alarm Valves (Wet Pipe): Valves shall be of the variable pressure type complete with all accessories and appurtenances necessary for the proper operation of each system and to prevent false alarms due to surges or other conditions in the supply of each system. Multiple sprinkler risers shall be provided in accordance with NFPA 13.
5. Distribution of Water: Distribution shall be essentially uniform throughout the area in which it is assumed the sprinkler heads will open. Variation in discharge from individual heads (in the hydraulically most remote area) shall be between 100 and 120 percent of the specified density.
6. Density of Application of Water: Size pipe to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces below the sprinklers shall be per NFPA 13. The hydraulically most remote area may be determined from a point on the applicable curve.
7. Friction Losses: Calculate losses in pipe in accordance with the Hazen-Williams Formula with C value of 120 wet steel pipe, 100 for dry steel pipe, 150 for copper

tube, and plastic pipe, and 140 for cement lined ductile iron pipe. Calculations shall include all underground piping, elevation changes and hose stream requirements.

8. Location of Sprinkler Heads: Heads in relation to the ceiling and the spacing of sprinkler heads shall not exceed that permitted by NFPA 13 for light hazard occupancy. The spacing of sprinklers on the branch lines shall be essentially uniform.
9. Water Supply: Coordinate with hospital.
10. A UL-listed double-check valve back flow preventer is required at the sprinkler service by the water district.
11. Concealed spaces enclosed wholly or partly by exposed combustible materials, shall be protected by sprinklers. Note that this requirement applies to spaces above suspended adjustable tile and drywall ceilings containing electrical wiring, as interpreted by the State Fire Marshal.
12. Provide appropriate temperature rating for each head. Coordinate with all trades and equipment to be installed.

2.2 ALARMS

A. Water Motor Alarm: Provide alarms of the approved weatherproof and guarded type, to sound locally on the flow of water in each sprinkler system to which it is connected. Mount alarms on the outside of the outer walls of each building, at a location as directed.

B. Local Alarm: Provide electrical alarm bell to sound locally on operation of any detection system, regardless of whether water flows or not. The current for these alarms may be taken from the normal building service provided the connection is made ahead of the other services.

C. Fire Alarm: Provide equipment for the automatic transmittal of an alarm over the building fire alarm system and arrange to actuate by detection system and by the flow of water in each sprinkler system. Provide Class A supervision of detection and actuation circuits.

D. Trouble Alarm: Provide local 4" electric alarm bell to indicate trouble or failure of the detection system.

E. Water Flow Indicators: Vane type water flow detector, rated to 250 psig; designed for horizontal or vertical installation; have 2-SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7 ampere 125 volts AC and .25 ampere 24 volts DC; complete with factory-set, field adjustable retard element to prevent false signals, and tamper-proof cover which sends a signal when cover is removed.

F. Supervisory Switches: SPST, normally closed contacts, designed to signal valve in other than full open position.

2.3 ABOVE GROUND PIPING SYSTEMS

Provide fittings for changes in direction of piping for all connections. Make changes in piping sizes through standard tapered reducing pipe fittings; the use of bushings will not be permitted. Jointing compound for pipe threads shall be polytetrafluorethylene (PTFE) pipe thread tape, pipe

cement and oil, or graphite and oil; apply only on male threads. Pipe nipples 6" long and shorter shall be Schedule 80 steel pipe. Run the piping concealed in areas with suspended ceilings.

A. Sprinkler Pipe and Fittings: NFPA 13, except steel pipe shall be Schedule 40 for sizes smaller than 2", and Schedule 10 or 40 for sizes 2" and larger. Water motor alarm piping shall be zinc-coated steel pipe and fittings. Rubber gasketed grooved-end pipe and fittings per NFPA 13 with mechanical couplings shall only be permitted in pipe sizes 2" and larger. Rubber gaskets shall be UL listed for use in dry pipe sprinkler systems. Use of restriction orifices, reducing flanges, and plain-end fittings with mechanical couplings (which utilize steel gripping devices to bite into the pipe when pressure is applied) will not be permitted.

B. Pipe Hangers (Supports): Provide in accordance NFPA 13.

C. Valves: Provide valves as required by NFPA 13 and of types approved for fire service. Gate valves shall be open by counterclockwise rotation. Check valves shall be flanged clear opening swing check type with flanged inspection and access cover plate for sizes 4 inch and larger. Provide an OS&Y valve beneath each alarm valve in each riser when more than one valve is supplied from the same water supply pipe.

D. Identification Signs: Attach properly lettered approved metal signs conforming to NFPA 13 to each valve and alarm device. Permanently affix design data nameplates to the riser of each system.

E. Inspector's Test Connection: Provide test connections about 6 feet above the floor for each sprinkler system and locate at the hydraulically most remote part of each system. Provide test connection piping to a location where the discharge will be readily visible and where water may be discharged without damage.

F. Main Drains: Provide drain piping to discharge at safe points outside each building or to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure. Provide auxiliary drains as required by NFPA 13.

G. Pipe Sleeves: Provide piping passing through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 0.25" space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and caulk at both ends of the sleeve with plastic fireproof cement.
   1. Sleeves in Masonry Concrete Walls, Floors, Roofs: Provide ASTM A53 or ASTM A120, Schedule 40 or standard weight, zinc coated steel pipe sleeves. Sleeves in floor slabs shall extend 3" above the finished floor.
   2. Sleeves in Partitions, and Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide zinc coated steel sheet having a nominal weight of not less than 0.90 pounds per square inch.

H. Escutcheon Plates: Provide approved one piece or split hinge type plates for piping passing through floors, walls and ceilings, in both exposed and concealed areas. Provide chromium plated metal plates where pipe passes through finished ceiling. Provide other

plates of steel or cast iron with aluminum paint finish. Securely anchor plates in place with set screws or other approved positive means.

2.5 STANDPIPE

A. Provide dry standpipe systems as required by BOCA.

2.6 FIRE ALARM ZONING

A. The sprinkler system shall be zoned as required by the local fire department.

B. Each sprinkler system zone shall consist of a UL-listed isolation valve with supervisory switch, UL-listed flow switch and drain/test valves in accordance with NFPA 13.

2.7 SEISMIC DESIGN

A. Sprinkler system piping and components shall be seismic-rated and braced/restrained in accordance with BOCA and NFPA.

PART 3 - EXECUTION

3.1 COMMISSIONING OF EQUIPMENT AND SYSTEMS

A. The Architect may review the completed installation either sequentially as different parts are completed, or when the entire installation is complete, at the sole option of the Architect.

B. Prior to the Architect's reviewing a part of the installation or the entire installation, the Contractor shall submit a letter signed by an office of this contracting company or an officer of the general contractor stating that:
1. he is an officer of the company,
2 he has personally inspected the installation to be checked,
3. the date of his inspection,
4. the installation is complete and tested and ready to be inspected by the Architect, and that all required test reports have been submitted.

C. This Contractor shall arrange that an office of this contracting company or of the general contractor, as well as the Clerk of the Works, in addition to other test witnesses that may be specified, shall witness the below listed tests. At the conclusion of each such test this contractor shall submit a letter signed by the officer stating that:
1. he is an officer of the company,
2. he has personally witnessed the test (give the name of the test),
3. the date of testing,
4. the results of testing, as compared to specified performance,
5. listing the name, title, and company affiliation of all those witnessing the test.

3.2 SPECIAL RESPONSIBILITIES

A. Coordination: Cooperate and coordinate with work of other Sections in executing work of this Section.
   1. Perform work so that progress of entire project including work of other Sections shall not be interfered with or delayed.
   2. Provide information as requested on items furnished under this Section which shall be installed under other Sections.
   3. Obtain detailed installation information from manufacturers of equipment provided under this Section.
   4. Obtain final roughing dimensions or other information as needed for complete installation of items furnished under other Sections or by Owner.
   5. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other Sections. Give full information so that openings required by work of this Section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information in proper time, provide cutting and patching to full satisfaction of Architect.
   6. Provide information as requested as to sizes, number and locations of concrete housekeeping pads necessary for floor-mounted vibrating and rotating equipment provided under this Section.
   7. Notify Architect of location and extent of existing piping and equipment that interferes with new construction. In coordination with and with approval of Architect, relocate piping and equipment to permit new work to be provided as required by Contract Documents. Remove non-functioning and abandoned piping and equipment as directed by Architect. Dispose of or store materials as directed by Architect.

B. Surveys and Measurements:

   1. Where this contractor is required to install items which it does not purchase, it shall coordinate their delivery and be responsible for their unloading from delivery vehicles and for their safe handling and field storage up to the time of installation. This trade shall be responsible for:
      a. Any necessary field assembly and internal connections, as well as mounting in place of the items, including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.
      b. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building system.
   2. This contractor shall carefully examine such items upon delivery. Claims that any of these items have been received in such condition that their installation will required procedures beyond the reasonable scope of work of this contractor will be considered only if presented in writing within one week of their date of delivery. Unless such claims have been submitted this contractor shall be fully responsible for the complete reconditioning or replacement of the damaged items.

C. Maintenance of Equipment and Systems: Maintain equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation and shutdown, and during delays pending final test of systems and equipment because of seasonal conditions.

D. Use of Premises: Restrict use of premises as directed by Architect and as required below.
1. Remove dirt and debris, and keep premises clean. upon completion of work, remove equipment and unused material. Put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of Architect and as specified under Cleaning paragraph.
2. It shall be this trade's responsibility to store his materials in a manner that will maintain an orderly clean appearance. If stored on-site in open or unprotected areas, all equipment and material shall be kept off the ground by means of pallets or racks, and covered with tarpaulins.

E. Surveys and Measurements:
1. Base measurements, both horizontal and vertical, on reference points established by Contractor and be responsible for correct laying out of work.
2. In event of discrepancy between actual measurements and those indicated, notify Architect in writing and do not proceed with work until written instructions have been issued by Architect.

F. Sprinkler subcontractor shall verify conditions and take field measurements as required to ensure work shall fit actual conditions. Field corrections to fabricated work and adjustments to adjacent work where required for proper installation of work shall be subject to Architect's review. Corrections and adjustments shall be permitted only when not detrimental to appearance and function of work.

3.3 MATERIALS AND WORKMANSHIP

A. Work shall be neat and rectilinear. Piping shall run concealed except in mechanical rooms and areas with no ceilings. Install material and equipment as required by manufacturers. Installation shall operate safely and without leakage, undue wear, noise, vibration, corrosion or water hammer. Work shall be properly and effectively protected, and pipe openings shall be temporarily closed to prevent obstruction and damage before completion.

B. Except as specified otherwise, material and equipment shall be new. Provide supplies, appliances and connections necessary for complete and operational installation. Provide components required or recommended by OSHA and NFPA.

C. References to manufacturers and catalog designations are intended to establish standards of quality for performance and materials but imply no further limitation of competitive bidding.

D. Finish of materials, components and equipment shall be as approved by Architect and shall be resistant to corrosion and weather as necessary.

E. Owner will not be responsible for material and equipment before Final Acceptance.

3.4 CONTINUITY OF SERVICES

A. Do not interrupt existing services without Owner's approval.

B. Schedule interruptions in advance, according to Owner's instructions. Submit request for interruption with methods proposed to minimize length of interruption, in writing.

C. Interruptions shall be scheduled at such times of day and work to minimize impact on owner's operations.

3.5 TESTS

A. Test sprinkler system as required in NFPA Code, Fire Underwriters, Factory Mutual and agencies that have jurisdiction.

B. Test sprinkler system under pressure of 200 psi for two hours. Correct defects and leaks. No caulking will be allowed.

C. Submit written, approval of tests from authorities that have jurisdiction over installation to Owner before Final Acceptance of work.

D. Notify Architect and various departments and bureaus 48 hours before tests are to be made.

E. Operating test of sufficient duration shall be made for equipment, fixtures and accessories to Owner's satisfaction.

F. General:
1. Test sprinkler and standpipe piping and make watertight before painting and before concealment. Make partial tests as required, during progress of work. Tests shall be witnessed by General Contractor, insurance underwriter's representative, the City Inspector, and a representative of the Architect.
2. Sprinkler system shall be tested to hydrostatic test of 250 psi in accordance with NFPA requirements.
3. If inspection or test show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. Repairs to piping shall be made with new material.

3.6 PIPE IDENTIFICATION

A. Provide color-coded pipe identification markers. Pipe markers shall be snap-on laminated plastic with acrylic coating. Pipe markers shall be applied after architectural painting.

B. Provide arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use double-headed arrow marker.

C. Mains shall be labeled at points of entrance and exit from mechanical room, next to valves, on risers, at tee fittings, at points of entrance and exit from building, at least once in each room, and at intervals not longer than 20 ft.

D. In general, 2" high legend shall be used for pipe lines 4" dia. and larger, and 3/4" high legend shall be used for pipe lines 3" dia. and smaller.

E. Markers shall be Seton Setmark or approved equal.

F. Color banding shall meet ANSI A13.1-1975 and OSHA requirements.

G. Markers shall have legend and with black letters:

| Service | Legend | Background Color |
|---|---|---|
| Sprinkler | Sprinkler-water | Red |

3.7 ACCESS AND ACCESS PANELS

A. Provide access to materials and equipment that require inspection, replacement, repair or service and coordinate their delivery with the installing Trade. If proper access cannot be provided, confer with Architect as to best method minimizing effect of reduced access which may result.

B. Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment. Coordinate supply of access panels with Architectural sections. Furnish and install distinctively colored buttons (color as selected by Architect) in finished ceiling to identify all access panels.

C. Lay-in and removable splined tile ceilings do not require access panels and each valve above ceiling shall have location marked with thumb tack finished ceiling panel. Note location on record drawings.

3.8 PENETRATIONS AND SLEEVES

A. General:
1. Provide pipe sleeves as specified and as shown on Drawings at penetrations of walls, slabs (except on-grade), partitions and floors. Sleeves shall meet NFPA-101 requirements and materials requirements of Part 2 of this Section.
2. Coordinate work carefully with architectural and structural work. Set sleeves in forms before concrete is poured. Provide core drilling as necessary to set sleeves if not set before concrete is poured, and to set sleeves in existing construction. Do not penetrate structural members without Architect's approval.

B. Pipe Sleeves:
1. Annular space between pipe or pipe insulation and sleeve shall be at least 1/4-inch.

2. Sleeves through rated fire walls and smoke partitions shall maintain fire rating of construction penetrated. All penetrations through smoke partitions shall be made smoke tight with approved fire stop system.
3. Do not support piping risers on sleeves.

C. Installation Testing, Listings and Approvals:
1. Installation shall meet material manufacture recommendations exactly, particularly as re preparation of surfaces, removal of foreign material safety requirements, ventilation and other installation details. Dam openings as recommended. Remove flammable materials used for damming and forming seals in fire-rated construction.
2. Sleeve penetration methods shall be water- and gas-tight and shall meet requirements of ASTM E-119 Standard Methods of Fire Tests of Building Construction and Materials.
3. Fire-stop penetration seal methods and materials shall be FM-approved and UL-listed as applicable.
4. Inspect foamed sealants to ensure that installations achieve manufacturer's optimum cell structure and color ranges.

## 3.9 ESCUTCHEONS

A. Provide escutcheons around exposed pipe that passes through finished floor, wall, or ceiling. Escutcheons shall be heavy cast brass, chromium-plated, adjustable, and shall be of sufficient outside diameter to cover sleeve opening and shall fit snugly around pipe.

## 3.10 INSTALLATION OF EQUIPMENT

A. Avoid interference with structure and with work of other Sections, to satisfaction of Architect, codes and as necessary to meet manufacturer's installation and maintenance recommendations. Installation shall permit clearance for access to equipment for repair, servicing and replacement.

B. Distribute equipment loads properly on building structural members provided for equipment support under other Sections. Install and support roof-mounted equipment on structural steel provided under other Sections.

C. Provide suspended platforms, hangers, supports, inserts, anchors, brackets, shelves, stands, and legs as necessary for floor, wall or ceiling mounting of equipment provided under this Section as shown on Drawings and as specified.

D. Provide steel supports and hardware for proper installation of hangers, anchors, guides and other devices.

## 3.11 PAINTING

A. Fire Protection items such as pumps and alarm valves shall be stenciled with equipment name. Stencil shall be at least 6" high for large equipment, 2" high for small equipment. Finish painting, including painting of various piping systems, will be done under other Sections.

3.12 CLEANING

A. Clean installation thoroughly upon completion to remove grease, metal cuttings, dirt and other foreign materials.

B. Repair stoppages, discoloration and damage that result from failure to clean piping properly within Contract Price.

C. After completion of project, clean the exterior surface of equipment included in this Section, including concrete residue.

END OF SECTION

SECTION 22 00 00

PLUMBING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, as well as 23 05 48 “Mechanical Vibration and Seismic Control” and 23 05 01, "Basic Mechanical Requirements” apply to work of this section.

### 1.2 DESCRIPTION

A. Work Included:

1. All labor, materials, equipment and transportation shall be provided as required to completely install plumbing and water systems with all connections, as shown on drawings and described in these specifications, or as required by state and local codes. Accompanying drawings do not show every detail of pipe, valves, fittings, hangers, equipment and fixtures, which are necessary for complete installation, but are provided to show general arrangement and extent of work to be performed.

2. Plumbing System required for this work includes, but is not limited to:

   Hot and cold water piping within building
   Above slab soil, waste, and vent systems
   Trap primers
   Valves
   Plumbing fixtures and trim
   Pipe insulation
   Pipe hangers and supports
   Piping and equipment identification
   Tests

B. Work Not Included

1. All required masonry, carpenter work, slab cutting and patching and furring as specified.

2. Temporary toilets and temporary water.

3. Electrical work.

4. Heating, air conditioning and ventilating work except for condensate drains.

5. Painting except as specified in this section.

1.3 CODES

A. Work done by this Contractor shall conform to Local and State Plumbing Codes having jurisdiction. State and Local Codes are considered part of these specifications.

B. State Plumbing Code shall be minimum requirements for system. Where drawings show more stringent requirements than the State Code, drawings shall be adhered to.

1.4 CROSS CONNECTIONS

A. No piping shall be installed to permit back-siphonage or flow of any liquid into water service piping under any conditions.

B. Air gaps, funnel type drains and approved vacuum breakers shall be provided as required by the State Plumbing Code. Piping to hose end faucets shall have vacuum breakers.

1.5 CUTTING AND PATCHING

A. Plumbing Contractor shall be responsible for informing various trades of sizes and locations of all chases, hole sleeves and supports required for plumbing work within the building structure.

B. Architect shall be notified and approval must be received for any chases and holes which are needed by this Contractor if they involve cutting away steel, concrete, brickwork, or digging under foundation walls. Plumbing Contractor will be held responsible for any damage resulting from work not approved by Architect.

PART 2 - PRODUCTS

2.1 PIPE

A. Sanitary, Waste, Vent and Condensate.

1. See Specification 22 13 16 Sanitary Waste and Vent Piping.

B. Domestic Water Piping

1. See Specification 22 11 16 Domestic Water Piping.

C. All piping penetrating a fire rated wall or floor shall be cast iron pipe or copper tubing as per NFPA 101, Life Safety Code (1994).

2.2 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.

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. 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. Quality: All valves shall be by one manufacturer and by one of those listed. The following list is provided as a means of identifying quality and type required.

1. Gate valves 2-1/2" in size and larger shall be iron body, bronze trimmed, OS&Y, solid wedge, bolted bonnet, flanged ends and rated for 125# WSP, 200# WOG: Valves shall be:

| | |
|---|---|
| Milwaukee | F-2885 |
| Stockham | G-623 |
| NIBCO | F-617-0 |

2. Gate valves 2" in size and smaller shall have bronze bodies, rising stem, solid wedge, union bonnet and rated for 150# WSP, 300# WOG:

| | Solder End | Screwed End |
|---|---|---|
| Milwaukee | 1169 | 1151 |
| Stockham | B-124 | B-120 |
| NIBCO | S-134 | T-134 |

3. Globe valves 2-1/2" in size and larger shall have iron bodies, bronze trim, OS&Y, solid disc, bolted bonnet, gland packed, flanged ends and rated for 125# WSP, 200# WOG:

| | |
|---|---|
| Milwaukee | F-2981 |
| Stockham | G-512 |
| NIBCO | F-718-B |

4. Globe valves 2" and smaller shall have bronze bodies, union bonnet, renewable composition disc for the service intended, and rated for 150# WSP, 300# WOG:

| | Solder End | Screwed End |
|---|---|---|
| Milwaukee | 1590-T | 590-T |
| Stockham | B-24-T | B-22-T |
| NIBCO | S-235-Y | T-235-y |

5. Check valves 2-1/2" and larger shall be horizontal swing type with iron body, bronze trim, flanged ends and rated for 125# WSP, 200# WOG:

| | |
|---|---|
| Milwaukee | F-2974 |
| Stockham | G-931 |
| NIBCO | F-918-B |

6. Check valves 2" and smaller shall be horizontal swing type with bronze body, Teflon disc and rated for 125# WSP, 200# WO4G:

| | Solder End | Screwed End |
|---|---|---|
| Milwaukee | 1509-T | 509-T |
| Stockham | B-310-T | B-320-T |
| NIBCO | S-413-Y | T-413-Y |

7. Drain valves shall be Ball valves as described above, except to have standard hose threads on one end with hose cap and chain. Valves shall be:

| | Solder End | Screwed End |
|---|---|---|
| Milwaukee | BA-150-H | BA-100-H |
| Apollo | 78-200 | 78-100 |
| Watts | --- | --- |

8. Butterfly valves 2" and smaller shall be bronze body, stainless steel stem and disc with Viton seal, calibrated memory stop. Valves shall be:

| | Solder End | Screwed End |
|---|---|---|
| Milwaukee | BB-2FS-350 | BB-2FS-100 |
| Stockham | --- | --- |
| NIBCO | --- | --- |

9. Ball valves 2" and smaller shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blow-out proof stems and adjustable stem gland and shall be equipped with suitable packing for the service intended. Valves shall be rated for 600# WOG and shall be:

| | Solder End | Screwed End |
|---|---|---|
| Milwaukee | BA-150-S | BA-100-S |
| Apollo | 70-240 | 70-140 |
| Watts | B-6001-SS | B-6000-SS |

## 2.3 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 which 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. Sleeve through foundation walls shall be Link Seal modular mechanical type as manufactured by Thunderline Corporation.

B. Escutcheons: Where piping passes through finish walls, floors, ceilings and partitions, provide and set two piece nickel plated steel floor and ceiling plates.

2.4 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 location of use.

2. Piping specified 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 copper tubing equal to Carpenter & Paterson Inc., Fig. 100 (Fig. 100CT copper plated).

5. Hangers shall go outside of insulation for all piping.

6. Exposed vertical risers 3/4 inch and smaller shall be supported at 6 foot intervals between floor and ceiling with split ring type hangers; copper plated for copper tubing equal to Carpenter & Paterson Inc., Fig.81 (Fig. 81CT copper plated).

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 cadmium plated all thread rod. Rod size shall be 3/8 inch for piping 2 inch and under; 1/2 inch for 2 1/2" to 6"; 5/8 inch over 6".

2. Provide lag points with rod couplings for fastening to wood, toggle bolts in concrete blocks and compound anchor shields and bolts in poured concrete.

3. Provide toggle bolts with rod couplings for fastening in pre-cast concrete plank decks.

4. 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.

5. Hot and cold water piping at each fixture shall be securely fastened in wall with split ring type hanger fastened to studs within wall.

2.5 EXPANSION LOOPS AND ANCHORS

Provide expansion loops on domestic hot water supply and circulating return lines where required to control expansion. Provide rigid anchors where required. Anchors shall be bolted collars held by angular braces in direction of piping. Provide guides on each side of all expansion joints.

2.6 DRAINAGE SPECIALTIES

A. Carriers

1. Wall hung lavatories shall be supported with floor mounted carriers to fit building conditions and fixtures specified. All carriers shall be secured to floor.

2. All carriers used with no-hub pipe shall be secured with tie down lugs with the addition of a stabilizer assembly.

3. Carriers shall be as manufactured by Zurn, Smith, Josam or Wade.

B. Traps

1. Traps of material and design as approved by the State 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 off-sets 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 under sinks and lavatories, and all piping and fittings shall be chrome-plated.

C. Floor Drains: All floor drains shall be complete and provided with flashing flange and flange device

2.7 TRAP PRIMERS:

Furnish and install self adjusting automatic trap primers equal to Sioux City or as manufactured by Precision Plumbing Products Inc. Provide distribution unit for outlets as required.

2.8 INSULATION:

Insulate plumbing equipment per Section 23 07 01, "Mechanical Insulation”.

2.9 THERMOMETERS:

Units to be equivalent to Trerice No. BX9 series, adjustable angle with $30^{o}$ to $180^{o}$ range.

2.10 PRESSURE GAUGES:

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.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this section, carefully inspect installed work of all other trades and verify that all such work is complete to the point where this installation may commence.

2. Verify that plumbing may be installed in strict accordance with all pertinent codes and regulations and approved Shop Drawings.

B. Discrepancies

1. In event of discrepancy, notify Architect.

2. Do not proceed with installation in areas of discrepancy until such discrepancies have been resolved.

3.2 INSTALLATION OF PIPING AND EQUIPMENT

A. General

1. 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.

2. Provide uniform pitch of at least 1/8 or 1/4 inch per foot for all horizontal waste and soil piping within the building; pitch all vents for proper drainage; install vent piping with each bend 45 degrees minimum from the horizontal, wherever structural conditions will permit.

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. Back vent all fixtures. Increase vents one size before going through roof up to and including 3" size.

6. All risers and off-sets shall be substantially supported.

7. Pipe hangers shall be placed as follows: Bell and spigot pipe, 5'-0" (at hub), steel piping except air piping 10'-0"; copper tubing and air piping; 1/2" at 6'-0", 3/4" and 1" at 8'-0"; 1-1/4" and larger at 10'-0". PVC piping above slabs shall be supported at 4' intervals horizontally and at each floor vertically.

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 1/2" 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. Any such piping necessary shall be installed in an insulated pocket.

13. Furnish and install trap primers for floor drains in the following areas: Elevator equipment rooms, air handling unit equipment rooms and where noted on the plans.

14. Mount all ADA fixtures in accordance with ADA rules for barrier free installations.

15. Locate valves, water hammer arrestors, trap primers or any other equipment or fittings that require inspection or maintenance at access panels in hard ceilings and walls. See architectural ceiling plans. Provide additional access panels as required to maintain access. See Division 8 for access panel materials and installation. Coordinate access panel location with General Contractor.

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 Silvabrite 100 lead-free solder applied in strict accordance with the manufacturer's recommendations.

4. Make all joints in copper gas tube with Silvabrite 100 lead-free applied in strict accordance with the manufacturer's recommendations.

3.3 STERILIZATION OF PIPES

A. General

1. 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.

2. Chlorinate only when the building is unoccupied.

B. Flushing

1. Upon completion of the sterilization, thoroughly flush the entire potable water system.

2. When sterilization and flushing are complete, sample shall be collected from the end of longest main, or at any other location selected by Architect, and water analysis test provided. Test must prove the water acceptable or additional disinfecting of system performed. A copy of test report shall be submitted to Architect.

3.4 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 and after it has been completely inspected and approved, make all repairs and replacements with such materials as necessary to the approval of Architect and at no additional cost to Owner.

3.5 TESTING

Tests shall be applied to plumbing installation as required by codes and where as directed by Architect, and in all cases before work is covered by earth fill or pipe covering.

A. Piping

1. Sanitary systems shall be securely stopped, except at highest point above roof, and the entire system filled with water to point of overflow. All leaks shall be repaired. Cracked pipes and fitting shall be removed and replaced. No doping of soil pipe or fittings will be allowed.

2. New hot water, cold water, and gas piping shall be subjected to a hydrostatic pressure test of 150 psi. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired. Repair leaks and defects with new materials and retest piping or portion thereof satisfactory results are obtained.

3.6 CLEANING

A. Prior to acceptance of buildings, clean all exposed portions of plumbing installation, removing all labels and all traces of foreign substance, using only a cleaning solution

approved by manufacturer of plumbing item, being careful to avoid all damage to finished surfaces.

B. Clean out all strainers and aerators, and adjust or replace washers, cartridges, etc., to prevent leaks at faucets, stops, shower valves, and pop-up drains.

3.7 IDENTIFICATION

See Section 23 05 01, "Basic Mechanical Requirements".

END OF SECTION 22 00 00

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Domestic water piping, above grade.
2. Unions and flanges.
3. Valves.
4. Strainers.
5. Trap primers.
6. Backflow preventers.
7. Water hammer arrestors.
8. Pressure balanced mixing valves.

B. Related Sections:
1. Section 083100 - Access Doors and Panels: Product requirements for access doors for placement by this section.
2. Section 099000 - Paints and Coatings: Product and execution requirements for painting specified by this section.
3. Section 230529 - Hangers and Supports: Product requirements for pipe hangers and supports and firestopping for placement by this section.
4. Section 230548 - Mechanical Sound, Vibration, and Seismic Control: Product requirements for vibration isolators for placement by this section.
5. Section 230553 - Mechanical Identification: Product requirements for pipe identification and valve tags for placement by this section.
6. Section 230701 - Mechanical Insulation: Product and execution requirements for pipe insulation.
7. Section 232113.10 - Piping Specialties: Product requirements for piping specialties for placement by this section.
8. Section 230516 - Piping Expansion Compensation: Execution requirements for pipe expansion devices for placement by this section.
9. Section 260502 – Basic Electrical Materials and Methods: Execution requirements for electric connections to equipment specified by this section.
10. Section 230500 - Motors: Product requirements for motors for placement by this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B31.9 - Building Services Piping.
5. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
6. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. American Society of Sanitary Engineering:
1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
2. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
4. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
5. ASSE 1016 - Individual Thermostatic,Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings.
6. ASSE 1017 – Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
7. ASSE 1019 - Performance Requirements for Wall Hydrants, Freezeless, Automatic Draining, AntiBackflow Types.

D. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
4. ASTM A536 - Standard Specification for Ductile Iron Castings.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
7. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
8. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
9. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
10. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
11. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
12. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

14. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
15. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
16. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
17. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
18. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
19. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.

E. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:
1. AWWA C651 - Disinfecting Water Mains.

G. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
3. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
4. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
5. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. Plumbing and Drainage Institute:
1. PDI WH201 - Water Hammer Arrester Standard.

1.3 SUBMITTALS

A. Section 013300 - Submittals: Submittal procedures.

B. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with all applicable local and state rules and regulations.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Section 017000 – Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for domestic water piping.

1.10 EXTRA MATERIALS

A. Section 017000 – Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two packing kits for each size valve, two loose keys for outside hose bibs.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L or K, hard drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints:
a. Soldered - Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees
b. Pressed – Shall conform to material requirements of ASME B16.18 and performance criteria of IAPMO PS 117. Sealing element shall be EPDM and factory installed. Joints shall be pressed using the tool approved by the manufacturer.

2.2 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Copper Piping: Class 150, bronze unions with [soldered] [brazed joints].
2. PVC Piping: PVC.

B. Flanges for Pipe 2-1/2 inches and Larger:
1. Copper Piping: Class 150, slip-on bronze flanges.
2. PVC Piping: PVC flanges.
3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.3 BALL VALVES

A. 2 inches and Smaller: MSS SP 110, 400 psi CWP, two piece bronze body, chrome plated brass ball, regular port, teflon seats, blow-out proof stem, solder or threaded ends with union, lever handle.

2.4 FLOW CONTROL VALVES

A. Manufacturers:
1. IMI, Model ICSS.
2. Substitutions: Section 016000 - Product Requirements.

B. Construction:

1. Internal Wear surfaces shall be 303 stainless steel.
2. The 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.
3. The internal flow cartridge shall be permanently marked with a code to identify the gpm and spring range.
4. For 1/2" - 2" pipe size: An assembly shall consist of a Dezincification resistant brass (DZR) or bronze or Ametal Y-body, integral chrome plated brass-body ball valve, and "O" ring type union fitting and shall be IMI Flow Design Model AC or equal.

C. Calibration: Control flow within 5 percent of selected rating

D. Each valve shall have two P/T ports, arranged to provide a reading of the differential pressure across the flow limiting mechanism.

E. Testing and Ratings:
1. All valves 1/2" to 2" shall be factory leak tested at 100 psi air under water. Minimum Ratings:
a. 1/2" through 2" pipe size: 400 PSIG at 250°F

2.5 RELIEF VALVES

A. Manufacturers:
1. Conbraco.
2. Substitutions: Section 016000 - Product Requirements.

B. Pressure Relief (17 Series):
1. Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated at maximum 60 psi, UL listed for fuel oil, capacities ASME certified and labeled.

C. Temperature and Pressure Relief (18-500 Series):
1. ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.6 STRAINERS

A. 2 inch and Smaller: Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

B. 2-1/2 inch to 4 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.

C. 5 inch and Larger: Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

2.7 TRAP PRIMERS

A. Manufacturers;
1. PPP Inc., PTS-#
2. Substitutions: Section 016000 - Product Requirements.

B. ASSE Standard 1018 compliant, trap primer valve with built-in vacuum breaker.
1. Construction: NEMA 1 enclosure.
2. Size: ½-inch.
3. Connections: Threaded.
4. Accessories:
a. Optional air gap.

2.8 BACKFLOW PREVENTERS

A. Furnish materials in accordance with town standards.

B. Reduced Pressure Backflow Preventers:
1. Manufacturers:
a. Watts, Series 009.
b. Substitutions: Section 016000 – Product Requirements.
2. Comply with ASSE 1013.
3. Bronze body, with bronze internal parts and stainless steel springs.
4. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

C. Double Check Valve Assemblies:
1. Manufacturers:
a. Watts, Series 007.
b. Substitutions: Section 016000 – Product Requirements.
2. Comply with ASSE 1012.
3. Bronze body with corrosion resistant internal parts and stainless steel springs.
4. Two independently operating check valves with intermediate atmospheric vent.

2.9 WATER HAMMER ARRESTORS

A. ASSE 1010; copper construction, piston type with 60psi charge.

B. Pre-charged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

C. Size and install in accordance with PDI WH-201.

D. Install in accessible location

E. Provide at
1. All solenoid valves

2. All groups of two or more flush valves
3. All quick opening or closing valves
4. All medical washing equipment
5. Locations recommended by PDI WH-201

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION - ABOVE GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange systems to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Provide anchors as necessary. Refer to Section 230516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 230529.

H. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 083100.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 099000.

L. Install domestic water piping in accordance with ASME B31.9.

M. Sleeve pipes passing through partitions, walls and floors. Refer to Section 230529.

N. Install UL listed firestopping at fire and smoke rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 230529.

O. Install unions downstream of valves and at equipment or apparatus connections.

P. Install valves with stems upright or horizontal, not inverted.

Q. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

R. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

S. Install ball valves for throttling, bypass, or manual flow control services.

T. Provide flow controls in water circulating systems as indicated on Drawings.

U. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

V. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

W. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping where required.

3.4 INSTALLATION - SERVICE CONNECTIONS

A. Provide new water service complete with approved reduced pressure back-flow preventer.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements.

B. Test domestic water piping system in accordance with local authority having jurisdiction.

3.6 CLEANING

A. Section 017000 - Execution Requirements: Requirements for cleaning.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

E. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewer piping buried within 5 feet (1500 mm) of building.
2. Sanitary sewer and vent piping above grade.
3. Cleanouts.

B. Phasing: This work scope involves multiple floors, multiple phases and work including installation, testing and shutdowns during hours outside normal working schedules, including weekends. Bids shall include additional time for coordination meetings, overtime work and interruptions/revisions to the schedule.

C. Related Sections:
1. Section 033000 - Cast-in-Place Concrete: Execution requirements for placement of concrete specified by this section.
2. Section 078400 - Firestopping: Product requirements for firestopping for placement by this section.
3. Section 083100 - Access Doors and Panels: Product requirements for access doors for placement by this section.
4. Section 090900 - Paints and Coatings: Product and execution requirements for painting specified by this section.
5. Section 230529 - Hangers and Supports: Product requirements for pipe hangers and supports and firestopping for placement by this section.

1.2 REFERENCES

A. International Plumbing Code

B. American Society of Mechanical Engineers:
1. ASME A112.14.1 - Backwater Valves.
2. ASME A112.21.1 - Floor Drains.
3. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
4. ASME B16.3 - Malleable Iron Threaded Fittings.
5. ASME B16.4 - Gray Iron Threaded Fittings.
6. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
7. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
8. ASME B31.9 - Building Services Piping.

C. ASTM International:
1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

4. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A536 - Standard Specification for Ductile Iron Castings.
6. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
7. ASTM B32 - Standard Specification for Solder Metal.
8. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
9. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
10. ASTM B75 - Standard Specification for Seamless Copper Tube.
11. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
12. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
13. ASTM B302 - Standard Specification for Threadless Copper Pipe.
14. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
15. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
16. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
17. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
18. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
19. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
20. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
21. ASTM F 1412-01, Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems.
22. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
23. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
24. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
25. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
26. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
27. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
28. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
29. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
30. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
31. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
32. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

33. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
34. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
35. ASTM D2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
36. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
37. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
38. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.
39. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
40. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

D. Cast Iron Soil Pipe Institute:
1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
7. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

## 1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State and local standards.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITH BELOW SLAB OF BUILDING

A. Cast Iron Pipe: CISPI 301, hub-less.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. Copper Tube: ASTM B306, DWV
   1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F (220 to 280 degrees C).

2.3 VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, service weight.
1. Fittings: Cast iron, CISPI 301.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. Copper Tube: ASTM B306, DWV
1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F (220 to 280 degrees C).

C. PVC Pipe: Schedule 40
1. Fittings & Joints: Solvent Welded Socket Typ: Use solvent cement, ASTM D2564.

2.4 CLEANOUTS

A. Available Manufacturers:
1. J. R. Smith

B. Furnish materials in accordance with State and local standards.

C. Floor cleanout: Cast iron body with round adjustable nickel bronze top.
1. Optional flange with flashing clamp.

D. Wall cleanout: Cast iron body cleanout tee with counter sunk plug, and stainless steel round cover with screw.

2.5 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A1 as specified in Section 312300.

B. Cover: Fill Type A1 as specified in Section 312300.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type S1, as specified in Section 312300. Subsoil with no rocks over 6 inches (150 mm) in diameter, frozen earth or foreign matter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to existing piping system size, location, and invert is as indicated on Drawings. Slab cutting and replacement of concrete floor by others, see structural drawings.

B. Establish elevations of buried piping with not less than one (1) foot of cover.

C. Establish minimum separation from other services in accordance with governing code.

D. Remove scale and dirt on inside of piping before assembly.

E. Excavate pipe trench in accordance with Section 312300.

F. Install pipe to elevation as indicated on Drawings.

G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.

H. Install pipe on prepared bedding.

I. Route pipe in straight line.

J. Install trace wire continuous over top of pipe of non-metallic pipe above pipe line; coordinate with Section 312300. Refer to Section 230553.

K. Pipe Cover and Backfilling:
1. Backfill trench in accordance with Section 312300.
2. Maintain optimum moisture content of fill material to attain required compaction density.
3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
5. Do not use wheeled or tracked vehicles for tamping.

L. Install Work in accordance with applicable state and local standards.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/4 or 1/8 inch per foot as required. ¼ inch per foot is preferred. Maintain gradients.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

C. Install floor cleanouts at elevation to accommodate finished floor. Do not place cleanouts in sterile corridors or rooms.

D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

F. Install piping to maintain headroom. Do not spread piping, conserve space.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 230516.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 230529.

J. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 083100.

K. Install piping penetrating roofed areas to maintain integrity of roof assembly.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 099000.

N. Install bell and spigot pipe with bell end upstream.

O. Sleeve pipes passing through partitions, walls and floors.

P. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 230529.

Q. Support cast iron drainage piping at every joint.

R. Install Work in accordance with State and local standards.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirement: Field inspecting, testing, adjusting, and balancing.

B. Test sanitary waste and vent piping system in accordance with applicable code and local authority having jurisdiction.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Water closets
2. Lavatories
3. Sinks
4. Flushing rim sinks
5. Showers
6. Mop sink
7. Water Coolers

B. Related Sections:
1. Section 22 11 16 - Domestic Water Piping: Supply connections to plumbing fixtures.
2. Section 22 13 16 - Sanitary Waste and Vent Piping: Waste connections to plumbing fixtures.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI Z124.1 - Plastic Bathtub Units.
3. ANSI Z124.2 - Plastic Shower Units.
4. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.

B. Air-Conditioning and Refrigeration Institute:
1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

C. American Society of Mechanical Engineers:
1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
2. ASME A112.18.1 - Plumbing Fixture Fittings.
3. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
6. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
7. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS

A. Section 01330 - Submittals: Submittal procedures.

B. Product Data: Submit catalog illustrations of fixtures, sizes, [rough-in dimensions,] utility sizes, trim, and finishes.

C. Samples: Submit color chips for each standard color.

D. Manufacturer's Installation Instructions: Submit installation methods and procedures.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State and local standards.

B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

C. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for plumbing fixtures.

PART 2 PRODUCTS

2.1 Refer to Fixture Schedule on the Drawings. Any proposed substitutions shall be equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install Work in accordance with State and local standards.

B. Install each fixture with trap, easily removable for servicing and cleaning.

C. Provide chrome plated rigid or flexible supplies to fixtures with loose keystops, reducers, and escutcheons.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall supports, wall carriers and bolts.

F. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07900, color to match fixture.

G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

H. For ADA accessible water closets, install flush valve with handle to wide side of stall.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

A. Section 010000 - Execution Requirements: Testing, adjusting, and balancing.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Section 010000 - Execution Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 010000 - Execution Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

END OF SECTION

SECTION 22 63 00

MEDICAL GAS PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Medical gas piping
2. Medical vacuum piping
3. Waste Anestesia Gas Disposal (WAGD)
4. Unions and flanges.
5. Medical gas valves.
6. Medical gas piping accessories.
7. Medical gas outlets.
8. Alarm system.

B. Related Sections:

1. Section 23 05 29 - Hangers and Supports: Product requirements for pipe hangers and supports for placement by this section.
2. Section 23 05 53 - Mechanical Identification: Product requirements for pipe and valve identification for placement by this section.
3. Section 26 05 02 - Wiring Connections: Execution requirements for electric connections specified by this section.
4. Section 12 35 70 - Medical Case Work: for outlets requiring medical gas service.

C. Owner Furnished Materials for Installation Under this Section
1. Supply of gases in cylinders or containers as appropriate for manifolds.
2. Initial supply of liquid (oxygen, nitrogen)

1.2 COORDINATION

A. Medical Gas contractor shall coordinate with other trades to ensure timely installations and avoid conflicts and interference.

B. Work with general contractor and subcontractors to ensure anchors, sleeves and similar items are provided in sufficient time to avoid delays. Ensure chases and openings are properly sized and prepared.

C. Medical gas contractor shall supply and install the master alarm system, including all manufacturer recommended signal wiring. The electrical contractor shall be hired by the medical gas contractor to provide power wiring to each alarm panel. The medical gas contractor is responsible for proper termination, testing and marking of alarm panels. Termination shall be done by or under supervision of the manufacturer of the alarm panels.

D. Coordinate with the owner to ensure medical gas outlets, whether owner supplied or contractor supplied, in walls, ceiling and all equipment is provided by the same manufacturer.

E. Work with owner and architect during head wall design to determine optimal method of installing outlets detailed as required on drawings.

F. Coordinate with Medical Gas Verifier to deliver a complete, tested medical gas installation ready for owner's use.

1.3 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.

B. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

C. FM Global:
   1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

D. Military Standardization Documents:
   1. MIL STD 105 - Regulator, Pressure, Medical Gas Administration Apparatus.

E. National Fire Protection Association:
   1. NFPA 99 - Health Care Facilities.

1.4 SUBMITTALS

A. Section 01330 - Submittals: Submittal procedures.

B. Shop Drawings: Indicate piping system schematic with electrical and connection requirements general assembly of components, mounting and installation details, and general layout of control and alarm panels. Indicate detailed medical wall assembly drawings.

C. Medical Gas Equipment Manufacturer (MGEM) Submittals shall include;
   1. Complete specifications for the product intended to be installed, dimensional drawings, and wiring schematics.
   2. Complete installation instructions for the use of the installer.
   3. Statement of specific compliance with paragraphs of NFPA 99 most recent edition as relevant to the equipment and as listed in those sections.
   4. Complete maintenance schedules.
   5. Warranty statement which must encompass all system components. Warranties

covering only specific components for containing exclusions are not acceptable.
6. Name and contact information for warranty and service.
7. Description of available Preventative Maintenance programs for Owners review.
8. Information on training programs available to maintenance personnel for Owners review.
9. Name, contact information, MGPHO Credential Number and reference list provided by the intended third party verifier. Reference list to include not fewer than three references on projects of similar size and complexity.
10. A list of certifications currently maintained by the manufacturing facility(ies). Specifically, certificates for ISO 13485 compliance and UL or equivalent shall be included.

D. Test Reports: Furnish independent testing agency report showing medical gas systems are complete, zone valves installed, alarm systems functional, and pressure and cross connections tests performed.

E. Manufacturer's Field Reports: Indicate systems are complete, zone valves installed, and alarm systems functional.

F. For Medical Air and Instrument Air plants include:
1. Package drawing indicating package style, dimensions when complete, method of disassembly and sizes of subsections for rigging and installation.
2. Compressor and package capacity expressed in inlet SCFM.
3. Lubrication method (if any).
4. Drive detail including adjustment method.
5. Motor including manufacturer, frame type, service factor, horsepower, current draw, and RPM.
6. Air filters including type and replacement element.
7. Pressure regulators including type and manufacturer.
8. Dew point monitor including technology employed, calibration interval, and annual drift in degrees.
9. Carbon monoxide monitor including technology employed, calibration interval, and annual drift in ppm.
10. Air dryers, type; manufacturer; and design dew point at 50 psig.
11. Sound pressure in dBa when operated at NFPA capacity.
12. BTU output for the equipment.
13. PICS sheet for BACnet implementation including vendor code demonstrating the MGEM is also the BACnet vendor.
14. OSP numbers for all medical air and medical vacuum plant to a minimum Sds of 2.2.

G. For medical gas manifolds include:
1. Third party certification of ISO 10524-2 adiabatic ignition testing.
2. Third party certification of Mil Std 810F environmental testing.

H. For other medical gas products include:
1. Outlet keying system.
2. Alarms networking instructions.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 – Contract Closeout: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment piping, valves, outlets and components.

C. Operation and Maintenance Data: Submit assembly views, lubrication instructions, replacement part numbers and availability.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience, and with service facilities within 100 miles of Project. One Medical Gas Equipment Manufacturer (MGEM) shall supply the medical gas, support gas, medical vacuum and WAGD source and pipeline system(s) and equipment to include outlets, valves and gauges, valve boxes, alarm panels, manifolds, medical air, and instrument air, vacuum and WAGD sources.

B. Medical Gas Testing Agency: Company specializing in performing Work of this section. Retain a qualified third party verifier acceptable to the engineer and owner to Perform and attest to final verification of the systems. Make corrections as required, including additional testing if necessary to attain full and unqualified certification.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 - Product Requirements: Product storage and handling requirements.

B. Accept equipment on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

C. Protect piping and equipment from weather and construction traffic. Maintain factory packaging and caps in place until installation.

D. Deliver each length of piping with manufacturer’s plugged or capped ends and keep sealed until installation.

E. Deliver fittings, valves, and other components in sealed containers and keep sealed until installation.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Electrical Control systems and Medical Gas Alarms are to be UL listed as assemblies with label affixed.
   2. Medical air, instrument air, medical vacuum and WAGD controls are to be wired in accordance with NEC.
   3. MGEM will include with submittals affidavit attesting to compliance with all relevant paragraphs of NFPA 99 most recent edition including (d)

below.

4. MGEM personnel assembling medical air, instrument air, vacuum and WAGD plant shall meet NFPA 99 5.1.10.11.10 Qualification of Installers and hold medical gas endorsements as under ASSE 6010.
5. The installer shall furnish documentation attesting that all installed piping materials were purchased cleaned and complied with the requirements of NFPA 99 5.1.10.1 and 5.1.10.2.

B. Installation and Start-up.
   1. The manufacturer will provide factory authorized representatives to review installation and perform initial start up of system.

C. Warranty
   1. All Medical Air, Instrument Air, Medical Vacuum and WAGD source equipment will be warranted by the MGEM of record:
      a. For 24 months or longer from start-up.
      b. Warranty will be expressly complete, include all components of the system and be the responsibility of the MGEM of record only. Warranties limiting the responsibility of the MGEM for any system component or which pass through the MGEM to another manufacturer are not acceptable.
      c. Warranties shall include on site repairs including travel, labor and parts. Warranties requiring return of equipment for adjustment are not acceptable.

D. Maintenance

   1. MGEM shall demonstrate a national service capability able to perform major overhauls.
   2. MGEM shall offer preventative maintenance contract for the owner's consideration.
   3. MGEM shall offer formal maintenance training courses for owners review.

E. Certification
   1. Medical Gas Contractor shall deliver to the owner a complete system certification without qualifications.

PART 2 PRODUCTS

2.1 MEDICAL GAS, MEDICAL VACUUM, AND WAGD PIPING

A. Factory Preparation and Cleanliness: Piping shall be thoroughly washed and disinfected at the factory. Piping shall be shipped, loaded, stored, and installed with end covers in place.

B. All Pressurized Gases, Aboveground:
   1. Seamless ASTM B-819, type K or L hard drawn seamless medical gas copper tubing, identified by the markings "OXY" "MED" "OXY/MED" "OXY/ACR" , or "ACR/MED" in green (Type K) or blue (Type L).
   2. Fittings shall be wrought copper, brass or bronze designed expressly for brazed connection, compliant with ANSI B16.22.
   3. Pipe (Tube), fittings, valves, and other components shall be specially cleaned for oxygen service in a facility equipped to clean, rinse, and purge the material in accordance with the requirements of NFPA 99 5.1.10.1.1 and received on job site cleaned and capped. On site cleaning of the interior surfaces of tubes, valves, fittings, and other components is not allowed.
   4. Brazing alloy shall be BCuP-5 Brazing alloy or equivalent alloy with at least 1000 degree F melting point.

C. Vacuum and WAGD piping, Aboveground:
   1. Type 'L' , 'M', or ASTM B-280 ACR copper.
   2. Brazed with BCuP-5 Brazing alloy or equivalent alloy with at least 1000 degree F melting point.
   3. Comply with NFPA 99 5.1.10.2

D. Isolation of copper tubing from dissimilar metal shall be accomplished either through use of copper or copper plated hangers or hangers with plastic isolators.

2.2 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Copper Piping: Class 150, bronze unions with brazed joints.

2.3 MEDICAL GAS VALVES

A. Acceptable Manufacturers:
   1. BeaconMedaes Products.
   2. Chemetron.

B. All Medical Gas Valves shall be specially prepared for oxygen service and shall conform to NFPA 99 5.1.4 and 5.1.10. Valves shall be ball-type, with teflon seats and adjusting stem packing gland with teflon stem seal.

C. Valves are three piece construction with swing out center.

D. Valve ends where copper to brass joint is made are forged, complying with 5.1.10.3.1. Cast valves are not acceptable (5.1.10.3.2)

E. Seals between center section and outer flanges are silicone capable of withstanding 500°F (260°C) during the brazing process.

F. Ball valves shall be rated 600 WOG, actuate from full "ON" to full "OFF" by 90 degree turn of vinyl gripped valve handle.

G. Furnish and install only valves with factory installed type K copper tubing extensions.

H. Valves not in valve boxes shall be provided with locking handles, BeaconMedaes series 4255 (locks to be provided by contractor to owner).

I. All valves shall be cleaned for oxygen, capped and sealed in a polyethylene bag for shipping and storage.

J. Valve boxes shall be constructed of 18 gauge steel with white enamel finish. The valve box shall have a sliding, opaque door with pull ring and clear gauge window. The removable window cannot be replaced when any valve is closed. The frame assembly shall be capable of adjusting for variances in wall thickness up to 1". The window shall conceal exposed piping and mounting screws. Window shall be labeled "Caution-Medical Gas Shut - Off Valves -Close Only in Emergency." Clear viewing space shall be provided in the window to display the gas service and the area pressure gauges and label for areas controlled by the valve.

K. Provide color coded self-adhesive gas labels for compliance with NFPA 99 labeling requirements. Apply labels to each valve in the assembly for gas service identification according to manufactures recommendations.

L. Zone valves shall include a 1 1/2 inch pressure gauge reading 0 to 100 psig for oxygen, air, nitrous oxide and carbon dioxide; 0 to 300 psig for nitrogen and instrument air; and 0 to 30 HG for vacuum and WAGD. The gauge port shall be equipped with removable plug for pressure testing before final assembly of gauge.

M. All zone valve boxes assemblies shall read pressure downstream and vacuum upstream of the valve per NFPA 99. Valves shall be piped left to right with right being on patient side.

N. All main line, riser, service, and futures valves as scheduled on the drawings shall include plugged 1/8” NPTF ports on inlet and outlet.

O. All zone valve assemblies shall have a total of three 1/8” NPT ports with pie plugs. One port to be used as a provision for connection of a gauge and shall be located on the terminal outlet side of the valve to register pipeline pressure or vacuum. The second port to be used as a provision for a DISS connection of a gas sensor. The third port to be used for purging during the brazing process and is located upstream of the valve.

P. All zone valve assembly designs allow for the configuration of up to 7 valves within the rough-in box assembly.

Q. All zone valve box assemblies to include Nylon 6/6 insulated grommets to allow for ease of valve replacement and reorientation within the rough-in box.

R. All zone valve box doors to be treated with InstaCure Guardian to reduce/prevent bacterial and mold growth.

2.4 MEDICAL GAS OUTLETS

A. Available Manufacturers:
1. BeaconMedaes Products.
2. Chemetron.

B. Medical gas outlet stations shall be modular, quick-disconnect recessed type, or DISS screw thread recessed type equal to BeaconMedaes Series B. Provide keying systems compatible with existing keying system in existing equipment or owner preference. Threaded DISS connector shall be per CGA standards.

C. Outlets shall be field assembled with sequences and services indicated. Centerline spacing of multiple outlets shall be 5 inches minimum. Contractor to verify proper headwall design and configuration. Required numbers of outlets appears on plan.

D. Outlet stations shall have a die cast light gray epoxy powder coated cover plate. The hook plate shall have a retractable arm and provide the trim for each outlet. The hook plate shall specifically fill the space between adjacent outlets. The finish of the hook plate shall be treated with Biomaster, an additive that has been shown to reduce bacteria and mold growth. Furnish indexing pins for safety keying and gas specific cover plate to the appropriate rough in box, with color coded gas service identification. The safety keying index pins shall be permanently captured between the cover plate and latch assembly and not removable without destroying the outlet. Designs with index pins molded in plastic are not acceptable.

E. The latch mechanisms shall be designed for one handed, single thrust mounting and one handed fingertip release of secondary equipment.

F. The complete outlet shall be made, cleaned and packaged to NFPA 99 Standards, UL Listed and CSA certified. Medical gas outlets shall be cleaned for oxygen service in accordance with CGA Pamphlet G-4.1. The assembly shall be capped and the finish assembly poly bagged for shipment.

G. The rough in assembly shall be of modular design and include a gas specific 16 gauge steel mounting plate designed to permit on-site ganging of multiple outlets, on 5"centerline spacing. A machined brass outlet block shall be permanently attached to the mounting bracket to permit the 1/2" OD, type-K copper inlet to swivel 360 degrees for attachment to the piping system. The rough in assembly shall contain a double seal to prevent gas leakage between the rough in and latch-valve assemblies after the wall is finished. A single o-ring seal shall not be acceptable.

H. The latch-valve assembly shall telescope up to 3/4" to allow for variation in finished wall thickness from 1/2" to 1-1/4".

I. DISS Outlets shall be used for all ceiling mount applications.

J. Furnish hose assemblies for all ceiling outlets for the finished ceiling height as indicated on drawings. Provide each hose with a heavy-duty chain type dual retractor for pressure

gases and triple for vacuum. Retractors made of stainless cable are not acceptable. Allow an extra 18" of hose length for retractors.

K. Provide outlets in individual rooms as indicated on Detail sheet.

2.5 MEDICAL GAS ALARM SYSTEMS

A. Available Manufacturers:
1. BeaconMedaes Products.
2. Chemetron.

B. General Requirements
1. All Medical Gas Alarm panels shall be ETL listed to UL 1069 for Hospital Signaling Equipment as an assembly and shall include factory wiring, transformers, and circuitry. Panels shall require only 115 or 230 volt primary power.
2. Alarm panels shall meet the FCC Part 15, Subpart B and ICES-003 to reduct possibility of magnetic radiation interference with other equipment.
3. The alarm shall arrive on the job site pre-configured as shown on the drawings and schedules or shall be configured by MGEM personnel at no additional charge.
4. Alarm shall supervise its wiring to sensors and switches, indicating at the relevant panel(s) if any wire is cut, disconnected or open.
5. Each signal will include an indicator light to signify the condition monitored. Activation of any switch will change the display, and actuate the audio alarm.
6. Each panel shall include a power on indicator and test function for testing all modules electrically.
7. Each alarm panel shall incorporate a 10.2” touch screen LCD display.
8. Alarm shall have a LCD touch screen display to allow for all alarm programming and set up on site without the use of tools.
9. Alarm shall have a green NORMAL condition on the home screen which shows that there are no alarms active.
10. The alarm home page includes a location/area served badge for the alarm panel, customizable with the keyboard feature of the touch screen during the set up process.
11. The alarm LCD display shall contain an adjustable background with many color/brightness options.
12. The alarm LCD display backlight includes a "sleep mode" option via motion sensor to preserve screen life, adjustable from 5 minutes to 60 minutes. By default, the alarm sleep mode option is not active and the backlight remains on all of the time. If option is active and an alarm occurs during "sleep mode", the backlight turns on and remains on during the alarm condition.
13. The alarm shall be able to provide a full diagnostic self-test testing the alarm signals (green and red), the LED indicators on the front panel, the audible horn, and displays all of the alarm set points. The test to be initiated with the touchscreen controls.
14. Green POWER ON LED indicator illuminates when the alarm panel is powered.
15. WARNING LED alerts the user to unused signals and communication issues which are not alarm causing conditions.

16. Audible HORN produces a minimum sound pressure level of 80 dBA measured at a distance of 3 ft. (.92m), adjustable to 90 dBA at 3 ft. (.92m).
17. MUTE button indicator LED flashes red during an alarm condition and remains illuminated as a constant red after silencing until the fault is corrected.
18. Medical Gas contractor to include as separate price all labor, materials, specialist subcontractors, programming and other costs required for full advertised functionality of alarm network. Contractor shall coordinate with owners Information Technology (I.T.) personnel as required, but is not permitted to use owner's I.T. personnel for system installation.
19. Aarms shall be compatible with BACNet for building information system integration.
20. Alarm shall be factory capable of connection to the facility's Ethernet network for remote monitoring. Alarms shall require no special programming or software to allow remote interrogation through any computer or device on the same intranet. MGEM personnel shall be responsible for alarm configuration at no additional charge if required.
21. Provide owner with any software and manuals required for interface at time of commissioning at no additional charge.

C. Master Alarms
   1. Furnish exact duplicate Master Alarm Panels at locations designated by owner.
   2. Wire master alarm panel directly to individual sensors/switches, furnishing duplicate sensors/switches as required for compliance with NFPA 99 5.1.9.2.4. Low voltage shielded wire shall be provided and installed by contractor installing the alarm panels.
   3. Provide alarm points as indicated in NFPA 99 A.5.1.9.2.
   4. Alarms shall be tested, labeled and fully operational for owner. Where alarm configuration in software is necessary, it shall be provided by MGEM representative at no additional charge.

D. Area Alarms
1. 1. Each area alarm shall include a rough in including power supply. Box must accommodate sensors for piped installation or allow for conduit connection for wired installations. Include sensor for each specific gas and gas specific DISS Demand check for each Sensor.
   2. The power supply shall be of the universal switching type (100-250VAC, 50/60/440Hz, 120-300VDC). Power supply shall be fused to protect the system from voltage and amperage surges. Alarm shall clearly indicate when power is on.
   3. The area alarm shall provide an audible and visual signal when an advisory or a fault signal is received. Signal limits shall be factory set, with the ability to be field adjusted without the use of tools.
   4. Each panel shall allow continuous digital display of the vacuum or pressure, indicators for high pressure, and low pressure (or vacuum) and a Normal indicator.

5. The Sensor shall contain a transducer to drive the pressure display. Sensors shall include conduit mounting connector for wiring conduit.
6. The sensor shall include an indicator on the sensor housing allowing visual confirmation of sensor operation from floor level when the sensor is in the ceiling on the piping.
7. Furnish and install the alarm. Coordinate the power wiring with Division 16. Low voltage shielded signal wiring will be provided and installed by this contractor.
8. Termination of signal wiring at alarm location will be done by or under supervision of manufacturer of alarm.
9. Gas specific digital gas sensor contains a transducer capable of providing factory calibrated signals to the alarm panel.
10. Gas sensors may be located inside the alarm rough-in (local) or outside the alarm rough-in (remote).
11. When installed remotely, sensors may be located up to 1524 m (5,000 feet) from the alarm panel.
12. Pipeline connections are 3/8" nominal (1/2" OD) type K copper tube and include a DISS check fitting.
13. Digital gas sensors include a "heartbeat" flashing green LED light to designate that sensor is functioning correctly.
14. Termination of signal wiring at alarm location will be done by or under supervision of manufacturer of alarm.
15. Provide area alarm panels, MGAP, with medical gases as required.

## 2.6 GAS CYLINDER MANIFOLDS

A. Manifolds shall meet the requirements of NFPA 99 5.1.3.5. and be tested according to ISO 10524-2 for adiabatic compression and flow.

B. The manifold control(s) shall be fully automatic, including shifting to secondary bank when the service bank is exhausted, with automatic reset of replaced bank to primary status. Semi-automatic manifolds are not acceptable.

C. Manifolds shall be easily installed including provision for pre-mounting manifold bracket and zero clearance unions at outlet, vent and reserve header (if equipped).

D. The manifold control(s) shall incorporate:
1. Pressure switches or transducers to actuate designated signals when service bank is exhausted.
2. Visible display on control unit to determine when primary bank is exhausted and the secondary bank is in operation.
3. A continuously lit green indicator to indicate header in use.
4. Gauges to indicate contents of each header.
5. A green indicator of header ready for the secondary header.
6. A red indicator of header empty for each header.
7. A pressure gauge for line pressure.
8. Service vent valve piped to vent line for manifold testing.

E. Manifold design shall ensure that the failure of any one component does not prevent continued supply of gas to patients.

F. Bank regulators shall be:
1. dome biased and shall not require heaters for any gas.
2. balanced design for minimum opening pressure.
3. piston design for positive reassembly at service.

G. Manifolds shall utilize a forged flow path design with integral connections, regulators, and control valves to minimize potential gas loss and shall be provided with an emergency reserve tap appropriate for connection of a reserve header.

H. Manifold power supply shall be integral, prewired unit for ease of installation. Wiring between manifold and power supply shall be factory supplied. Manifolds requiring electrical work inside the manifold cabinet during installation are not acceptable.

I. Power supply box shall include terminals for all NFPA mandated alarm signals per Table A-5.1.9.2.

J. Manifolds shall be designed and constructed to prevent adiabatic ignition and have the following:
1. For Oxygen, oxygen mixtures, and helium, furnish Copper pigtails. Flexible leads with polymeric linings are not acceptable.
2. For all other gases, Flexible leads with polymeric linings are acceptable.
3. Cylinder check valves shall contain no Teflon or Kel-F.
4. Header valves shall be furnished with copper seats.
5. Include no NPT or other connections requiring tape or dope sealants.
6. Use only HBNR for primary regulator.

K. Manifolds shall be designed and constructed for either indoor or outdoor use and be rated IP 66 / NEMA 4.

L. Manifolds shall be designed to permit cylinders to be placed under the manifold controls.

M. Contractor shall furnish and install or field fabricate cylinder storage racks adequate to restrain the anticipated number of cylinders while attached to the manifolds.

N. Contractor shall furnish and install or field fabricate cylinder storage racks adequate to restrain the number of cylinders indicated on the plans while in storage.

O. Manifolds using gauges which require electrical power are not acceptable.

P. Manifolds which cannot perform switching operations as per NFPA 99 5.1.3.5.10.5 without electrical power are not acceptable.

Q. Manifolds shall be Ethernet capable for remote monitoring using any web-enabled device.

R. Manifolds shall be BeaconMedæs LifeLine series with sizes as scheduled on the plans.

PART 3 EXECUTION

3.1 PREPARATION

A. Pre-Installation Cleaning: Disassemble positive pressure gas systems pipe, fittings, valves, and components, except those supplied cleaned and prepared for intended service, and thoroughly wash in hot solution of sodium carbonate or trisodium phosphate mixed 1 pound to 3 gallon of water. After washing, rinse with water, dry and cap until installation.

B. Ream pipe and tube ends. Remove burrs.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment with flanges or unions.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION

A. All installation shall be performed in strict accordance with NFPA 99 5.1.10. Brazing procedures shall be as detailed in NFPA 99 5.1.10.5. Brazing shall be performed only by brazers qualified under NFPA 99 5.1.10.11.11.

B. Where piping runs underground, install in accordance with NFPA 99 5.1.10.10.5.

C. Copper, tubing, valves and fittings shall be pre cleaned and prepared for oxygen service by the manufacturer and received sealed on the job. Certificates of origin and of proper preparation shall be maintained on the job site attesting the above.

D. The use of flux is prohibited when making of joints between copper to copper pipes and fittings.

E. During any brazing operation, the interior of the pipe shall be purged continuously with oil free, dry nitrogen following the procedure in NFPA 99 5.1.10.5.5. At the completion of any section, all open pipe ends shall be capped using an EXTERNAL cap.

F. Threaded joints in piping systems shall be avoided whenever possible. Where unavoidable, make up the male threads with polytetrafluorethylene (such as teflon) tape. Do not use liquid sealants.

G. Piping shall be supported with pipe stays or hangers at intervals as defined in NFPA 99 Table 5.1.10.10.4.5. Piping shall not be supported by other piping. Isolation of copper piping from dissimilar metals shall be of a firm, positive nature. Duct tape is not acceptable as isolation material.

H. After installation of the piping, but before installation of the outlet valves, blow lines clear using oil-free air or nitrogen.

I. Piping exposed to physical damage shall be protected.

J. Label piping with name of gas service, identification color and direction of flow. Where non-standard pressures are piped, label for pressure. Labels shall be placed at least once every 20 feet of linear run or once in each story (whichever is more frequent). A label shall additionally be placed immediately on each side of each wall or floor penetration. Pipe labels shall be self adhesive vinyl or other water resistant material with permanent adhesive colored in accordance with NFPA 99 Table 5.1.11 and shall be visible on all sides of the pipe. Pipe labels shall be BeaconMedaes Series 6-435 or equal.

K. Alarms and valves shall be labeled for gas service and areas monitored or controlled. Coordinate with owner for final room or area designations. Label valves with name and identification color of the gas and direction of flow.

L. Piping penetrating an electromagnetic shield shall have an isolation device on each side of shield.

3.3 Labeling

A. Label the medical gas pipelines per NFPA 99 5.1.11 and as follows:
1. Label each master alarm signal for function after ring out.
2. Label each zone valve and area alarm for the area of control or surveillance after test.

B. Labels shall be permanent and of a type approved by the owner.

3.4 INSTALLER TESTING

A. Prior to declaring the lines ready for final verification, the installing contractor shall follow strictly the procedures for verification as described in NFPA 99 5.1.12.2 and attest in writing over the notarized signature of an officer of their company to the following;
1. That all brazing was conducted by brazers qualified to ASSE 6010 and holding current medical gas endorsements.
2. That all brazing was conducted with nitrogen purging. (Procedure per NFPA 99 5.1.10.4.5).
3. That the lines have been blown clear of any construction debris using oil free dry nitrogen or air and are clean and ready for use. (Procedure per NFPA 99 5.1.12.2.2).
4. That the assembled piping, prior to the installation of any devices, maintained a test pressure 1 1/2 times the standard pressures listed in NFPA 99 Table 5.1.11 without leaks. (Procedure per NFPA 99 5.1.12.2.3).
5. That after installation of all devices, the pipeline was proven leak free for 24 hours at a pressure 20% above the standard pressures listed in NFPA 99 Table 5.1.11. (Procedure per NFPA 99 5.1.12.2.2.6)
6. That the systems have been checked for cross connections and none were found. (Procedure per NFPA 99 5.1.12.2.4)

7. That the manufacturer has started up all medical air compressors, medical vacuum pumps WAGD producers, liquid oxygen system(s) and manifolds, and that they are in operating order.
8. Provide four originals of the affidavit, distributed; (1) to the engineer, (1) to the owners representative, (1) to the general contractor and (1) to the verifier.

3.5 VERIFIER TESTING

A. Prior to handing over the systems to the owner, contractor shall retain a Verifier acceptable to the engineer who shall follow strictly the procedures for verification as described in NFPA 99 5.1.12.3 and provide a written report and certificate bearing the notarized signature of an officer of the verification company which contains the following:
   1. A current ACORD insurance certificate indicating professional liability coverage in the minimum amount of $1 Million per occurrence, and general aggregate liability in the minimum amount of $1 Million, valid and in force when the project is to be verified. General liability insurance is not alone acceptable.
   2. A listing of all tests performed, and listing each source, outlet, valve and alarm included in the testing.
   3. An assertion that all tests were performed by a MGPHO Certified Medical Gas Verifier (CMGV) or by individuals qualified to perform the work and holding valid qualifications to ASSE 6030 and under the immediate supervision a CMGV Verifier. Include the names, credential numbers and expiration dates for all individuals working on the project.
   4. A statement that equipment used was calibrated at least within the last six months by a method traceable to a National Bureau of Standard Reference and enclosing certificates or other evidence of such calibrations(s). Where outside laboratories are used in lieu of on site equipment, those laboratories shall be named and their original reports enclosed.
   5. A statement that where and when needed, equipment was recalibrated during the verification process and describing the method(s) used.
   6. A statement that the systems were tested and found to be free of debris to a procedure per NFPA 99 5.1.12.3.7.
   7. The flow from each outlet when tested to a procedure per NFPA 99 5.1.12.3.10.
   8. A statement that the systems were tested and found to have no cross-connections to a procedure per NFPA 99 5.1.12.3.3.
   9. A statement that the systems were tested and found to be free of contaminants to a procedure per NFPA 99 5.1.12.3.8 except that the purity standard shall be 2 ppm difference for halogenated hydrocarbons and 1 ppm total hydrocarbons (as methane).
   10. A statement that all local signals function as required under NFPA 99 5.1.12.3.4.7 and as per the relevant NFPA 99 sections relating to the sources.
   11. A listing of local alarms, their function and activation per NFPA 99 5.1.12.3.14.
   12. A listing of master alarms, their function and activation, including pressures for high and low alarms per NFPA 99 5.1.12.3.5.2.
   13. A listing of area alarms, their function and activation pressures per NFPA 99 5.1.12.3.5.3.
   14. A statement that the sources include all alarms required by NFPA 99 5.1.9.5.

15. The concentration of each component of NFPA 99 Table 5.1.12.3.12 in the medical air after 24 hours of operation of the medical air source.
16. The concentration of each gas at each outlet as specified in NFPA 99 5.1.12.3.11.
17. A statement that all valves and alarms are accurately labeled as to zone of control.

B. Provide four originals of this affidavit, distributed; (1) to the engineer, (1) to the owner's representative, (1) to the general contractor and (1) to the installing contractor.

END OF SECTION

# SECTION 23 05 01 - BASIC MECHANICAL REQUIREMENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. General Provisions of Contract, including general and supplementary conditions and general requirements (if any) apply to work specified in this Section.

### 1.2 SUMMARY

A. This section includes the following general administrative and procedural requirements for mechanical installations, and shall supplement the requirements of Division 1.
   1. Alternates.
   2. Description of work.
   3. Contractor's detailed phasing plan.
   4. Quality assurance.
   5. Materials.
   6. Plans and specifications.
   7. Shop drawings including Coordination Drawings.
   8. Product handling.
   9. Record documents.
   10. Maintenance manuals.
   11. Objectionable noise and vibration.
   12. Warrantees and guarantees.
   13. Minor deviations and discrepancies.
   14. Workplace safety.
   15. Rough-ins.
   16. Mechanical installations.
   17. Cutting and patching.
   18. Delivery, storage, and handling.

### 1.3 ALTERNATES

A. See Architectural drawings.

### 1.4 DESCRIPTION OF WORK

A. The project involves demolition, reuse of existing and installation of new HVAC, plumbing and fire protection equipment associated with the renovation of the of the existing 4-story building located at 161 Marginal Way, Portland, Maine. The renovated areas include the 1st and 2nd floors, vertical mechanical chases extending to the roof, the penthouse mechanical room and roof mounted equipment HVAC unit.

B. The mechanical contractor will be responsible for all mechanical, plumbing and fire protection work required in this project as indicated in these specifications and the project drawings.

C. Mechanical scope of work shall include, but is not limited to:

1. Disconnection, removal/relocation of existing plumbing fixtures as indicated on the drawings.
2. Installation of new plumbing fixtures.
3. Installation of below slab sanitary piping and vents serving the Instrument Processing room sterilizer equipment and sinks.
4. Installation of packaged above slab sewage ejector pumps. New plumbing fixtures located above the 1st floor will tie into existing above slab sanitary piping.
5. New vent piping and tie-ins into existing piping.
6. The existing roof drains and storm drain piping will remain in place and be reused.
7. The existing 6" fire main and 2" domestic water service to the building will remain in place and be reused. A new 3" water meter will be installed.
8. New domestic cold water, hot water and return piping will be installed within the building.
9. New sprinkler systems will be installed. To the extent possible existing piping will be reused. New and existing sprinkler piping and systems will be fully coordinated with new mechanical and electrical systems.
10. The existing gas fired domestic water heater will be inspected, tested and commissioned for reuse. A 2nd new gas fired water heater will be installed and piped to operate in parallel with the existing water heater. New hot water return pumps will be installed.
11. Installation of new medical gas piping including manifold piping at gas storage cylinders.
12. Installation of new medical vacuum pump and vent piping extending through the roof.
13. Demolition of existing HVAC systems including supply/exhaust ductwork, duct risers located within mechanical chases, air terminal devices, exhaust fans, piping and controls. HVAC-E2 supply ductwork down to existing humidifier manifold and return ductwork located above the roof to remain.
14. Installation of new VAV terminals with hot water reheat, radiant ceiling panels located over the patient beds, wall mounted panel radiators beneath the 1st floor Practice area windows and cabinet unit heaters at entrance vestibules.
15. Installation of new supply, return and exhaust ductwork
16. Installation of new hot water piping systems.
17. Existing packaged rooftop unit HVAC E2 will be inspected, tested and commissioned for reuse.
18. Existing stair tower pressurization system/fans (typical of 2) will be inspected, tested and commissioned for reuse.
19. The existing gas fired boiler will be inspected, tested and commissioned for reuse.
20. The existing gas fired humidifier HU-E2 serving existing HVAC-E2 will be inspected, tested and commissioned for reuse. Existing steam manifold located at HVAC-E2 supply duct will be reused.
21. New custom air handling unit and packaged chiller will be installed to serve the Ambulatory Care area. The air handling unit and chiller will be mounted on grade.

22. Installation of new chilled water piping.
23. Installation of new split ductless air conditioning units and refrigerant piping.
24. Installation of new roof mounted exhaust fans and associated ductwork.
25. Installation of new wall exhaust fan intake louver/damper and electric unit heater in new electrical building.
26. Installation of new chilled water piping
27. Installation of new hot water cabinet unit heater and commissioning existing cabinet units heaters for reuse
28. Perforated laminar flow panels will be located over the operating room tables with a surrounding four sided linear slot diffuser air curtain.
29. New DDC controls will be installed to serve all new equipment and existing equipment to be reused.
30. Testing and balancing of all new systems. TESTING, ADJUSTING, AND BALANCING WILL BE REQUIRED AT EACH AND EVERY PHASE OF CONSTRUCTION. SCOPE OF WORK FOR EACH PHASE IS SHOWN ON DRAWINGS.
31. Flow/BTU meters will be provided at each floor at heating hot water piping and domestic hot and cold water piping to assist in tenant billing.
32. The mechanical contractor will be responsible for providing all fire stopping of all penetrations for the mechanical installation. Refer to other sections of the project specification for materials allowed.
33. The mechanical contractor will be responsible for all cost associated with the repair and re-application of the existing spray-on fire proofing where mechanical work has been disturbed or removed the existing fire proofing. The repaired spray-on fire proofing material and application shall restore the affected surfaces original fire rating.

D. Work Included
1. Furnish all labor, materials, equipment, transportation, and perform all operations required including demolition, commissioning of existing equipment and installation of new equipment to achieve a complete heating, ventilating, and air conditioning system in the building, in accordance with these specifications and applicable drawings.
2. 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.
3. 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.
4. Mechanical contractor shall be responsible for rigging to hoist his own (and his sub-contractors) materials and equipment into place.
5. Mechanical contractor and his sub-contractors shall be responsible for start-up of all equipment provided under Division 23 sections.

E. Related Work Described Elsewhere
1. Excavation and backfill
2. Cutting and patching

3. Fire stopping between building construction and pipe sleeves and between building construction and ductwork.
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. All finish work

F. Mechanical-Electrical Work

1. Provide and erect all motors, temperature controls, limit switches as specified.
2. Switches, fused switches, outlets, power supply 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 26, "ELECTRICAL" (electrical contractor) unless noted otherwise. Motor starters shall be furnished, installed and wired under Division 26 unless noted otherwise. Division 26 shall not mount disconnect switches to indoor mechanical equipment. Coordinate all wiring between mechanical and electrical trades to provide a complete and operating system.
3. All wiring provided under this section shall be in accordance with the latest rules and regulations of the National Fire Underwriters, National Electric Code, State and Local Codes. Install all wiring under the supervision of the electrical contractor. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 26 in type, quality and appearance shall be corrected by Division 26 at the expense of this section.
4. Variable frequency drives shall be furnished by the mechanical contractor; shall be installed by the electrical contractor and shall be programmed by the controls contractor.
5. Temperature Control Systems
   Control wiring shall be furnished and installed by controls contractor under supervision of electrical contractor. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 26 in type, quality and appearance shall be corrected by Division 26 at the expense of this section.
6. Fans:
   a. Single-phase, 120-volt units: Electrical contractor to wire to unit mounted disconnect switch with overload protection provided with unit.
   b. Three-phase units: Electrical contractor shall provide combination disconnect switches with magnetic starters unless specifically indicated otherwise, and wire power to supply through to line terminals on unit motor. Starters shall have auxiliary contactors for Automatic Temperature Control interlocks. Controls contractor SHALL COORDINATE his requirements with electrical contractor as soon as possible after award of contract. Fans shall operate as indicated in "Sequence of Operation" section of this specification.
   c. Motor operated dampers associated with exhaust fans: Electrical contractor to provide 120 or 208 volt power from exhaust fans to damper.
7. Temperature Control Panels

a. Electrical contractor shall provide branch circuit breakers for circuits to temperature control panels. Wiring from circuit breaker to temperature control panels will be provided and installed by the controls contractor.

8. Circulating Pumps
   a. Electrical contractor shall provide and wire magnetic starters, each with Hand-Off-Automatic switch, unless variable frequency drives are called out in the schedules or specifications. Starters shall have automatic re-start feature in event of power failure.
   b. Electrical contractor shall install variable frequency drive for each unit indicated. Wire power supply through to line terminals. Controls contractor shall provide interlock wiring with other equipment.
9. Duct Smoke Detectors
   a. Duct smoke detectors shall be furnished and wired by electrical contractor. Wiring shall include connection to air handling unit starting circuit to stop unit on smoke alarm. Mechanical contractor shall install detectors in ductwork.
10. 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, 3 phase, 60 hz, unless specifically shown otherwise. Minimum guaranteed motor efficiencies shall be as follows:

| HP | 1200 RPM | 1800 RPM | 3600 RPM |
|---|---|---|---|
| 1 | 81.5 | 82.5 | -- |
| 1½ | 85.5 | 84.0 | 82.5 |
| 2 | 86.5 | 85.5 | 84.0 |
| 3 | 88.5 | 87.5 | 85.5 |
| 5 | 87.4 | 87.4 | 86.3 |
| 7½ | 89.4 | 89.8 | 87.7 |
| 10 | 89.7 | 90.3 | 89.0 |
| 15 | 90.5 | 91.4 | 89.3 |
| 20 | 90.8 | 91.6 | 90.4 |
| 25 | 92.0 | 92.6 | 91.1 |
| 30 | 92.3 | 92.6 | 91.4 |
| 40 | 93.2 | 93.3 | 91.9 |
| 50 | 93.0 | 93.6 | 92.4 |
| 60 | 93.6 | 93.9 | 92.5 |
| 75 | 94.1 | 94.4 | 92.9 |

## 1.5 CONTRACTOR'S DETAILED PHASING PLAN

A. In conjunction with the construction schedule as stipulated in Division 1, the contractor shall prepare and submit a logical demolition and construction phasing plan to the architect for review and comment. The preliminary phasing plan shall be submitted for review and comment prior to the start of new work.

B. The contractor's phasing plan shall be based on the contract documents and contractor confirmation of existing conditions and coordination of occupancy of adjacent areas of

the building.

C. The phasing plan shall include a logical sequence for demolition/removal and new construction which minimizes interruption of services, utilities and operations to occupied portions of the building. Include detailed sequence for shutoff of utility services to the occupied portions of the building to accommodate demolition and removal work, tie-ins of new piping/ductwork to existing systems, and temporary removal of ductwork or piping systems.

D. All costs associated with the phasing activities including the design and installation of temporary ductwork and piping are to be base bid of this contract.

1.6 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 |
| AMCA | American Moving & Conditioning 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.

C. The mechanical 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.

D. The mechanical contractor shall frame under glass 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.

1.7 QUALITY ASSURANCE

A. Qualification of Workmen

Use sufficient qualified workmen and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of system throughout.

B. Radon mitigation work to be performed by a certified and licensed mitigating contractor registered with the state Department of Health and Human Services.

C. 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.).

D. Piping design shall conform to ANSI, ASME B31.9 and AWS D10.9 codes.

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

1.8 MATERIALS

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. Proposed substitution of Mechanical equipment shall be made in writing PRIOR OF OPENING OF BIDS, see Section 01 60 00, - Product Requirements. Submit full details for consideration and obtain written approval of the Architect. The phrase "or approved equal" used in this section 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 with his submittals that any equipment to be considered as an "approved equal" 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'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. Any additional cost resulting from the substitution of equipment shall be paid by this Contractor.

E. All materials not specified otherwise shall be manufactured within the United States and supplied locally (within the state) when available.

1.9 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 flows, air handling unit air volumes, etc. Failure to do so may result in the Architect providing the required materials at the Contractor's expense.

1.10 SHOP DRAWINGS

A. As soon as possible after award of Contract, before any material or equipment is purchased, Mechanical Contractor shall submit to the Architect no less than six (6) copies of shop drawings for approval. 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. NOTE: ALL SUBMITTAL PAGES SHALL BE NUMBERED; i.e. 1 of 8, 2 of 8, etc.

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 "F" below.

D. 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.

E. Coordination drawings: Submit complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and

maintenance. Provide detailed layout drawings of all piping and duct systems. Do not install equipment foundations, equipment or piping until layout drawings have been approved. In addition, for HVAC systems, provide details of mechanical equipment rooms, interstitial spaces, chases, hangers, inserts, supports, bracing, pipe sleeves and duct and equipment penetrations of floors, walls, ceilings or roofs.

F. Review must be obtained on the following items:
   1. Ductwork and Accessories
      a. Registers, diffusers, and grilles
      b. Duct access doors
      c. Volume control dampers (manual and automatic)
      d. Duct sealant
      e. Fire dampers and sleeves
      f. Smoke dampers and sleeves
      g. Combination fire and smoke dampers and sleeves
      h. Turning vanes
      i. Side takeoff fittings
      j. Flexible duct
      k. Duct silencers
      l. Backdraft dampers
      m. Relief and intake hoods
      n. Gravity ventilators
      o. Louvers and brick vents - provide color chips (photocopies not acceptable) - provide samples if substituting
      p. Duct lining
      q. Filters
   2. Mechanical Equipment
      a. AC units and accessories - provide computer selection printouts.
      b. Equipment identification tags
   3. Piping and Accessories
      a. Pipe, valves, unions and flanges
      b. Balancing valves with read-out gauge and pressure tappings. Provide a schedule clearly indicating each valve and its location, flow, size and pressure drop.
      c. Air vents (automatic and manual)
      d. Pipe hangers and insulated pipe supports
      e. Pressure gauges and thermometers
      f. Pipe flexible connectors
      g. Pipe and valve markers
      h. Flow control valves
      i. Pipe sleeve wall closure devices
   4. Terminal Units
      a. Hot water heating coils - provide computer selection printouts.
      b. Variable air volume boxs.
      c. Radiant panels.
   5. Insulation
      a. Pipe
      b. Duct

c. Pipe fittings
d. Hydronic specialties

6. Temperature Controls
7. Inspection, testing and commissioning report at all mechanical equipment designated to be re-used.

1.11 PRODUCT HANDLING

A. Use all means necessary to protect heating, ventilating and air conditioning materials before, during and after installation and to protect the installed work and materials of all other trades.

B. 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.

1.12 RECORD DOCUMENTS

A. 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. If the Mechanical Contractor does not make a complete record of changes, the Engineers shall make a record, and this Mechanical Contractor shall pay for the cost of the record. If the contractor prefers, copies of the mechanical drawings can be provided in electronic format for CAD application should he care to document the as-built conditions in this manner. Drawings shall be dated accordingly and clearly identified as “RECORD DOCUMENTS”. Specify required CAD format when requesting the files. Files will be zipped and will require “WinZip” for extraction.

1.13 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 and each building shall have its own manual with the equipment and systems unique to that building in the manual. 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 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.)

1.14 OBJECTIONABLE NOISE AND VIBRATION

A. 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.

1.15 GUARANTEE

A. 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.

1.16 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.

1.17 WORKPLACE SAFETY

A. Mechanical contractor shall be responsible for the safety of his workmen.

PART 2 – PRODUCTS

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and requirements of actual equipment to be installed.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate mechanical systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots and openings in other building components during progress of construction to allow for mechanical installations.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
   7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Refer conflicts between coordination requirements and individual system requirements to the Architect.
   9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed in finished spaces.
   10. Install mechanical equipment to facilitate servicing maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum interferences with other installations. Extend grease fittings to an accessible location.
   11. Install access panels or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section “Access Doors.”
   12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance in Division 1 Section “Cutting and Patching.” In addition to the requirements specified in Division 1, the following requirements apply:
   1. During cutting and patching protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
   1. Uncover work to provide for installation of ill-timed work.
   2. Remove and replace defective work.
   3. Remove and replace Work not conforming to requirements of Contract Documents.
   4. Remove samples of installed Work as specified for testing.
   5. Install equipment and materials in existing structures.
   6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials as indicated including, but not limited to, removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Patch existing finished surfaces and building components using new materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with name, model number, type, grade, compliance label, and other information needed for identification.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes single- and three-phase motors for application on equipment provided under other sections and for motors furnished loose to Project.

B. Related Sections:
1. Section 26 05 26 - Grounding and Bonding.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. National Electrical Manufacturers Association:
1. NEMA MG 1 - Motors and Generators.

C. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Product Data: Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.

B. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.

D. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

A. Motors 1/2 hp and Larger: Three-phase motor as specified below.

B. Motors Smaller Than 1/2 hp: Single-phase motor as specified INSECTION 15010, except motors less than 250 watts or 1/4 hp may be equipment manufacturer's standard.

C. Three-Phase Motors: NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.
1. Voltage: As indicated on Drawings.
2. Service Factor: 1.15.
3. Enclosure: Meet conditions of installation unless specific enclosure is indicated on Drawings.
4. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
5. Insulation System: NEMA Class F.
6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
7. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
8. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
9. Sound Power Levels: Conform to NEMA MG 1.

D. Single Phase Motors:
1. Permanent split-capacitor type where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
2. Voltage: As indicated on Drawings.

E. In VFD application, motors shall be "Inverter Rated" designed to NEMA MG1, Part 31, paragraph 31.40.4.2, rated for 1600 volts peak. Manufacturer shall have been in production of "Inverter Rated" motors for a minimum of 5 years.

F. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.2 THREE-PHASE MOTORS FURNISHED LOOSE

A. Product Description: NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds indicated.

B. Voltage: As indicated on Drawings.

C. Service Factor: 1.15.

D. Enclosure: Meet conditions of installation unless specific enclosure is specified or indicated.

E. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

F. Insulation System: NEMA Class F.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: Conform to NEMA MG 1.

K. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

L. In VFD application, motors shall be “Inverter Rated” designed to NEMA MG1, Part 31, paragraph 31.40.4.2, rated for 1600 volts peak. Manufacturer shall have been in production of “Inverter Rated” motors for a minimum of 5 years.

2.3 SOURCE QUALITY CONTROL

A. Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

B. Ground and bond motors in accordance with electrical specification section 26 05 26..

END OF SECTION

SECTION 23 05 23

VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes Following Heating and Cooling System Valves:
1. Gate valves.
2. Globe valves.
3. Ball valves.
4. Plug valves.
5. Butterfly valves.
6. Check valves.

B. Related Sections:
1. Section 23 05 29 - Hangers and Supports: Product and installation requirements for pipe hangers and supports.
2. Section 23 07 01 - Mechanical Insulation: Product and installation requirements for insulation for valves.
3. Section 23 21 13.10 - Piping Specialties: Product and installation requirements for piping specialties used in hydronic, steam and steam condensate, piping systems.
4. Section 23 21 13 – Hydronic Piping: Product and installation requirements for piping used in hydronic piping systems.

1.2 REFERENCES

A. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 67 - Butterfly Valves.
2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
4. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
5. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittals Procedures: Requirements for submittals.

B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves.

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.7 WARRANTY

A. Section 01 70 00 – Execution Requirements: Requirements for warranties.

B. Furnish five year manufacturer warranty for valves excluding packing.

PART 2 PRODUCTS

2.1 GATE VALVES

A. Available Manufacturers:
1. Crane Valve.

B. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, non-rising stem, hand-wheel, inside screw, solid wedge disc, alloy seat rings, threaded ends.

C. 2-1/2 inches and Larger: MSS SP 70, Class 125, cast iron body, bronze trim, bolted bonnet, non-rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.2 GLOBE VALVES

A. Available Manufacturers:
1. NIBCO.

B. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, hand wheel, Buna-N composition disc, threaded ends.
1. Use Teflon disc for steam service.

C. 2-1/2 inches and Larger: MSS SP 85, Class 125, cast iron body, bronze trim, hand wheel, outside screw and yoke, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.
1. Use Teflon disc for steam service.

2.3 BALL VALVES

A. Available Manufacturers:
1. NIBCO, Inc.

B. 2 inches and Smaller: MSS SP 110, 600 psi WOG, two piece bronze body, chrome plated brass ball, regular port, teflon seats, blow-out proof stem, threaded ends, lever handle.

2.4 BUTTERFLY VALVES

A. Available Manufacturers:
1. Milwaukee Valve.

B. 2-1/2 inches and Larger: MSS SP 67, Class 150.
1. Body: Cast or ductile iron, lug ends, stainless steel stem, extended neck.
2. Disc: Aluminum bronze or stainless steel.
3. Seat: Resilient replaceable EPDM.
4. Handle and Operator: 10 position lever handle.

2.5 CHECK VALVES

A. Horizontal Swing Check Valves:
1. Manufacturers:
a. NIBCO.
2. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.
a. Use teflon disc in steam applications.
3. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, flanged ends.
a. Use teflon disc in steam applications.
4. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bronze swing disc, flanged ends, outside lever and spring.

B. Spring Loaded Check Valves:
   1. Manufacturers:
      a. NIBCO.
   2. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.
   3. 2-1/2 inches and Larger: MSS SP 71, Class 125, wafer style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping system is ready for valve installation.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 8.

F. Refer to Section 23 07 01 for insulation requirements for valves.

3.3 VALVE APPLICATIONS

A. Install shutoff and drain valves low points in mains, risers, branch lines, and elsewhere as required for system draining.

B. Install ball, butterfly, or gate valves for shutoff duty at each branch connection to supply main at each riser, at supply connection to each piece of equipment, and elsewhere as required.

C. Install globe valves for throttling, bypass, or manual flow control services.

D. Install spring loaded check valves on discharge of water pumps.

E. Install lever and spring check valves on discharge of pumps in pumped sanitary piping.

F. Install lug end butterfly valves adjacent to equipment when functioning to isolate equipment.

G. Install ball, butterfly, and gate valves in heating, chilled and condenser water systems for shut-off service.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR MECHANICAL PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to mechanical work.
9. Firestopping accessories.
10. Equipment bases and supports.

B. Related Sections:
1. Section 22 00 00 - Plumbing: Execution requirements for placement of hangers and supports specified by this section.
2. Section 23 22 13 – Steam, Condensate, Compressed Air and Chilled Water Piping: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.5 - Refrigeration Piping.
2. ASME B31.9 - Building Services Piping.

B. American Society for Testing and Materials:
1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. Factory Mutual System:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittals: Submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Firestopping: Submit preparation and installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials

1.9 WARRANTY

A. Furnish manufacturer’s standard warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Available Manufacturers:
1. Carpenter & Paterson Inc.

B. Plumbing Piping - DWV:
1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:
1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches and Larger: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
7. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
8. Vertical Support: Steel riser clamp.
9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Copper Pipe Support: Copper-plated, Carbon-steel ring.

D. Heating Hot Water Piping:
1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
4. Hangers for Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
5. Multiple or Trapeze Hangers for Pipe Sizes 4 inches and Smaller: Steel channels with welded spacers and hanger rods.
6. Multiple or Trapeze Hangers for Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods; cast-iron roll and stand.
7. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
8. Wall Support for Pipe Sizes 4 to 5 inches: Welded steel bracket and wrought steel clamp.
9. Wall Support for Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll.
10. Vertical Support: Steel riser clamp.
11. Floor Support for Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
12. Floor Support for Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand steel screws, and concrete pier or steel support.
13. Copper Pipe Support: Copper-plated carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 thick galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft sheet lead
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. Thunderline Link-Seal, Inc.
2. NMP Corporation.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Available Manufacturers:
1. Carpenter and Patterson.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-7/8 inches on center.

2.8 FIRESTOPPING

A. Manufacturers:
1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.

4. International Protective Coating Corp.
5. 3M fire Protection Products.
6. Specified Technology, Inc.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
   1. Silicone Firestopping Elastomeric Firestopping: Single or multiple component silicone elastomeric compound and compatible silicone sealant.
   2. Foam Firestopping Compounds: Single or multiple component foam compound.
   3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
   5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
   6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
   7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected by Architect.

2.9 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:
   1. Mineral fiberboard.
   2. Mineral fiber matting.
   3. Sheet metal.
   4. Plywood or particle board.
   5. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
   1. Furnish UL listed products [or products tested by independent testing laboratory].
   2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
   2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut slab.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping and sealing of smoke walls and partitions. Refer to architectural drawings for locations of fire/smoke rated partitions.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Fire Rated Surface:
   1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

F. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition, floor, ceiling, and roof opening as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
      c. Install type of firestopping material recommended by manufacturer.
   2. Install escutcheons where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
   3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
   4. Interior partitions: Seal pipe penetrations at [clean rooms,] [laboratories,] computer rooms, telecommunication rooms, and data rooms . Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME 31.9.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide copper plated hangers and supports for copper piping.

K. Design hangers for pipe movement without disengagement of supported pipe.

L. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 23 07 01.

3.6 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 23 05 48.

3.7 INSTALLATION – FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor, shower, and mop sink drains watertight to adjacent materials.

E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

F. Flash and counter-flash mechanical equipment roof curbs with sheet metal; seal watertight. Attach Counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

G. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.8 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.9 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.10 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.11 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

3.12 SCHEDULES

PIPE HANGER SPACING

| PIPE SIZE | MAX. HANGER SPACING | HANGER ROD DIAMETER |
|---|---|---|
| Inches | Feet | Inches |
| 1/2 | 7 | 3/8 |
| 3/4 | 7 | 3/8 |

| | | |
|---|---|---|
| 1 | 7 | 3/8 |
| 1-1/4 | 7 | 3/8 |
| 1-1/2 | 9 | 3/8 |
| 2 | 10 | 3/8 |
| 2-1/2 | 11 | 1/2 |
| 3 | 12 | 1/2 |
| 4 | 14 | 5/8 |
| 5 | 16 | 5/8 |
| 6 | 17 | 3/4 |
| C.I. Bell and Spigot (or No-Hub) And at Joints | 5 | 5/8 |
| PVC (all sizes) | As Recommended by Manufacturer, or required by Code. | |

END OF SECTION

SECTION 23 05 48

MECHANICAL VIBRATION AND SEISMIC CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. General
1. This section provides for vibration isolation as well as seismic control (when required) for the "equipment" as listed below. Seismic analysis of nonstructural components is not required for this project. This specification is part of the general conditions for the HVAC, plumbing, fire protection and electrical contracts.

B. Intent
1. It is the intent of the seismic restraint portion of this specification to provide restraint of non-structural building components. Restraint systems are intended to withstand the stipulated seismic accelerations applied through the component center of gravity.

C. The work in this section includes the following:
1. Vibration isolation elements for equipment.
2. Equipment isolation bases.
3. Piping flexible connectors.
4. Seismic restraints for isolated equipment.
5. Seismic restraints for non-isolated equipment.
6. Certification of seismic restraint designs and installation supervision.
7. Certification of seismic attachment of housekeeping pads.

| **Table C**<br>**Vibration Isolation and Seismic Restraint Requirements for Electrical Equipment** | | | **EQUIPMENT INSTALLATION ATTACHMENT POINT** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **On Grade** | | | | **Above Grade** | | | |
| **Equipment** | **Size** | **Mounting** | **ISOL** | **DEFL** | **BASE** | **RESTR** | **ISOL** | **DEFL** | **BASE** | **RESTR** |
| Transformers - dry type | All | Floor | - - | - - | - - | - - | D | 0.30 | - - | V |
| | | Ceiling | - - | - - | - - | - - | E | 0.20 | - - | III |
| Generators | All | Floor | G | 0.10 | - - | V | B | 1.50 | - - | V |

D. Definitions
1. The term EQUIPMENT will be used throughout this specification and it includes ALL non-structural components within the facility and/or serving this facility, such as equipment located in outbuildings or outside of the main structure on grade within five feet of the foundation wall. Equipment buried underground is excluded but entry of services through the foundation wall is included.

Equipment referred to in Table C is a partial list; (equipment not listed is still included in this specification)

2. Life Safety Systems Defined
   a. All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
   b. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all circuits to fire protection, smoke evacuation and/or emergency lighting systems.
   c. All medical and life support systems.
   d. Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.
3. Positive Attachment:
   a. Positive attachment is defined as a support location with a cast-in or wedge type expansion anchor, a double sided beam clamp, a welded or through bolted connection to the structure.
4. Transverse Bracing:
   a. Restraint(s) applied to limit motion perpendicular or angular to the centerline of the pipe, duct, or conduit.
5. Longitudinal Bracing:
   a. Restraint(s) applied to limit motion along the centerline of the pipe, duct, conduit, etc.

1.2 OEM EQUIPMENT ISOLATION PACKAGES

A. Internal and/or External Systems
   1. Substitution of internally or externally isolated and restrained equipment in lieu of the isolation and restraints specified in this section is acceptable provided all conditions of this section are met. The equipment manufacturer shall provide a letter of guarantee from their Engineering Department stamped and certified per the section on Seismic Restraints and Analysis stating that the seismic restraints are in full compliance with these specifications. A copy of an in force Errors and Omissions Insurance Certificate must accompany the submittal. Letters from field offices or representatives are unacceptable.
   2. All costs for converting to the specified vibration isolation and/or restraints shall be borne by the equipment manufacturer in the event of non compliance with the preceding.
   3. In the event that the equipment is internally isolated and restrained, the entire unit assembly must be seismically attached to the structure. This attachment and certification thereof shall be by this section.

1.3 SUBMITTAL DATA REQUIREMENTS

A. Submittals
   1. Catalog cuts or data sheets on specific vibration isolators and restraints to be utilized detailing compliance with the specification including specification reference "Type" as per "Products" section of this specification.

2. An itemized list of all isolated and non-isolated equipment. Detailed schedules showing isolator and seismic restraints proposed for each piece of equipment, referencing material and seismic calculation drawing numbers.

B. Shop Drawings
1. Show base construction for equipment; include dimensions, structural member sizes and support point locations.
2. When walls and slabs are used as seismic restraint locations, details of acceptable methods for ducts, conduit and pipe must be included, with supporting certified calculations.
3. Indicate isolation devices selected with complete dimensional and deflection data before condition is accepted for installation.
4. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
5. Coordinated or contract drawings shall be marked-up with the specific locations and types of restraints shown for all pipe, duct, conduit and cable tray. Rod bracing and assigned load at each restraint location shall be clearly delineated.
6. For ceiling suspended equipment provide minimum/maximum installation angle allowed for restraint system as well as braced and unbraced rod lengths at each allowable installation condition.
7. Calculate thrust for fan heads, axial and centrifugal fans to determine whether thrust restraints are required (see Equipment Installation).

C. Seismic Certification and Analysis
1. Seismic restraint calculations must be provided for all connections of equipment to the structure. All performance of products (such as; strut, cable, anchors, clips, etc.) associated with restraints must be supported with manufacturer's data sheets or certified calculations.
2. Seismic restraint calculations must be based on the acceleration criteria shown in the following Tables. Note: For roof mounted equipment both the seismic acceleration and wind loads shall be calculated, the highest load shall be utilized for the design of the restraints and isolators.
3. Calculations to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience.
4. Table elevations refer to the structural point of attachment of the equipment support system. (i.e. Use floor slab for floor supported equipment and the elevation of the slab above for suspended equipment.)
5. Analysis must indicate calculated dead loads, derived loads and materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or weld length.
6. A seismic design Errors and Omissions insurance certificate must accompany submittals.

| DESIGN LEVEL OF ACCELERATION AT EQUIPMENT CENTER OF GRAVITY | | | | |
|---|---|---|---|---|
| **Seismic Zone 1 $A_V$ 0.05 to 0.09** | | | | |
| **Elevation** (Expressed in feet relative to grade level) | **Rigid* Mounted Equipment** | **Flexible* Mounted Equipment** | **Pipe, Duct, Cable Trays, Conduit, Etc.** | **Life Safety Equipment** |
| Below Grade up to 20 feet above grade | 0.100 "g" | 0.400 "g" | 0.250 "g" | |
| 21 ft. - 300 ft. | 0.200 "g" | 0.450 "g" | 0.400 "g" | |
| 301 ft. - 600 ft. | 0.350 "g" | 0.500 "g" | 0.500 "g" | 1.000 "g" |
| **Seismic Zone 2 $A_V$ 0.10 to 0.19** | | | | |
| Below Grade up to 20 feet above grade | 0.125 "g" | 0.500 "g" | 0.350 "g" | 1.000 "g" |
| 21 ft. - 300 ft. | 0.500 "g" | 0.750 "g" | 0.650 "g" | |
| 301 ft. - 600 ft. | 0.750 "g" | 1.000 "g" | 1.000 "g" | |
| **Seismic Zone 3 $A_V$ 0.2 to 0.3** | | | | |
| Below Grade up to 20 feet above grade | 0.225 "g" | 0.750 "g" | 0.530 "g" | 1.000 "g" |
| 21 ft. - 300 ft. | 0.500 "g" | 0.830 "g" | 0.710 "g" | 1.100 "g" |
| 301 ft. - 600 ft. | 0.750 "g" | 1.250 "g" | 1.000 "g" | 1.500 "g" |
| **Seismic Zone 4 $A_V$ > 0.3** | | | | |
| Below Grade up to 20 feet above grade | 0.300 "g" | 1.000 "g" | 0.700 "g" | 1.000 "g" |
| 21 ft. - 300 ft. | 0.600 "g" | 1.250 "g" | 1.000 "g" | 1.250 "g" |
| 301 ft. - 600 ft. | 0.850 "g" | 1.350 "g" | 1.100 "g" | 1.500 "g" |

* Rigid mounted equipment is any equipment mounted directly to structure. Flexible mounted equipment is any equipment mounted on resilient supports, ceiling suspended, roof supported or mounted on an independent frame with any primary natural frequency below 16 Hz.

1.4 MANUFACTURER'S RESPONSIBILITY

A. Manufacturer of vibration and seismic control equipment shall have the following responsibilities:
   1. Determine vibration isolation and seismic restraint sizes and locations.
   2. Provide equipment vibration isolation and seismic restraints as specified.
   3. Guarantee specified isolation system deflections.
   4. Provide installation instructions, drawings and field supervision to insure proper installation and performance of systems.
   5. Certify correctness of installation upon completion.

1.5 RELATED WORK

A. Housekeeping Pads

1. Housekeeping pad design shall be by the project structural engineer. Attachment shall be designed and certified according to this section by the seismic/isolation supplier. Material and labor required for attachment and construction shall be by the concrete section contractor.
2. Housekeeping pads shall be sized to accommodate a minimum of six (6) inches of clearance all around the equipment and its mounting package.

B. Supplementary Support Steel
1. Structural support and connections for all equipment, including roof mounted equipment, specified in other sections shall comply with the seismic requirements of this section.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Devices
1. All vibration isolation and seismic devices described in this section shall be the product of a single manufacturer. AVNEC, Inc. is the base manufacturer of these specifications; products of other manufacturers are acceptable provided their systems strictly comply with intent, structural design, performance and deflections of the Base Manufacturer.

B. Attachments
1. Hardware and devices such as beam clamps, anchor bolts, cables, cast-in-place plates must be by this section's supplier to ensure seismic compliance and certification.

C. Isolators
1. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than $\pm$10% and shall be out of resonance with equipment forcing frequencies or support structure natural frequency.

2.2 SEISMIC RESTRAINTS AND VIBRATION ISOLATION TYPES

A. General
1. All isolation and seismic restraint devices shall be capable of accepting, without failure, the "G" forces as determined by the seismic certification and calculations as described in the "submittal data requirements" section of these specifications.
2. All seismic restraint devices:
   a. Shall maintain the equipment in a captive position and not short circuit isolation devices during normal operating conditions.
   b. Shall have provisions for bolting and/or welding to the structure.

B. Seismic Restraint Types
1. TYPE I: Same as Type B. Cast or aluminum housings, (except ductile iron) are not acceptable.

a. Available Manufacturers: Avnec, Inc. TYPE RS.

2. TYPE II: Each corner or side of equipment base shall incorporate a seismic restraint snubber having an all directional resilient pad limit stop. Restraints shall be fabricated of plate, structural members or square metal tubing. Angle bumpers are not acceptable.
   a. Available Manufacturers: Avnec, Inc. Type SSN.
3. TYPE III: Restraints for suspended systems.
   a. Available Manufacturers: Avnec, Inc. Type SCA & SRA.
   b. Isolated systems braced with multiple steel cable type with approved fastening devices to equipment and structure.
   c. Non-isolated systems braced with structural steel strut type with approved fastening devices to equipment and structure.
4. TYPE IV: Double deflection neoprene isolator encased in ductile iron or steel casing.
   a. Available Manufacturers: Avnec, Inc. Type SNCM.
5. TYPE V: Rigid attachment to structure utilizing wedge type expansion anchors for bolting or cast-in plates or wedge type expansion bolt anchored plates for welding. Powder shots are not acceptable.

C. Vibration Isolator Types
1. TYPE A: Spring Isolator
   a. Available Manufacturers: Avnec, Inc., Type FSS.
   b. Spring shall have a minimum outside diameter to overall height ratio at rated deflection of 0.8 : 1.0.
   c. Corrosion resistance for outdoor applications shall be as follows:
      1) Springs cadmium plated, electro-galvanized, neoprene coated or powder coated.
      2) Hardware cadmium plated.
      3) All other metal parts hot spray or hot dip galvanized.
   d. Reserve deflection (from published load ratings to solid height) of 50% of the rated deflection.
   e. Minimum 1/4" thick neoprene acoustical base pad or cup on underside, unless designated otherwise.
   f. Designed and installed so that ends of springs remain parallel.
2. TYPE B: Spring Isolator - restrained
   a. Available Manufacturers: Avnec, Inc., Type RS.
   b. Shall be the same as TYPE A with the following additional features.
      1) Capable of increasing vertical height by a minimum of 3/4". The integrity of restraint hardware shall not be compromised by these leveling features.
      2) Integral restraining bolts with elastomeric cushions preventing metal-to-metal contact.
      3) Internal spring adjusting nut or bolt with leveling capability.
      4) Capable of supporting equipment at fixed elevation during equipment installation. Installed and operating heights shall be identical, unless additional increased vertical height adjustment becomes necessary.
      5) Built-in all directional limit stops with minimum 1/4" clearance under normal operation.

6) Concrete anchor bolt spacing shall be in accordance with ICBO National standards for seismic anchorage.

3. TYPE C: Spring Hanger Isolator
   a. Available Manufacturers: Avnec, Inc., Type SASH.
   b. Spring element (same as Type A) with steel upper spring retainer and a lower elastomer retainer cup with an integral bushing to insulate lower support rod from the hanger box.
   c. Steel hanger box shall be hinged to allow for a minimum of 30 degree misalignment between the rod attachment to structure and the connection to the supported equipment. The hanger box shall withstand three times the rated load without failure.
   d. When used on ductwork, provide eyebolts for attachment to duct straps.
   e. All metal box parts shall be hot spray or hot dip galvanized. All hardware shall be electroplated.
4. TYPE D: Double deflection neoprene isolator encased in ductile iron or steel casing.
   a. Available Manufacturers: Avnec, Inc. Type SNCM.
5. TYPE E: Elastomer Hanger Isolator
   a. Available Manufacturers: Avnec, Inc., Type SANH.
   b. Molded neoprene element with an integral bushing to insulate lower support rod from the hanger box.
   c. Steel hanger box shall be hinged to allow for a minimum of 30 degree misalignment between the rod attachment to structure and the connection to the supported equipment. Hanger boxes shall be designed and constructed to support loads over three times the rated load without failure.
   d. When used on ductwork, provide eyebolts for attachment to duct straps.
   e. All metal box parts shall be hot spray or hot dip galvanized. All hardware shall be electroplated.
6. TYPE F: Combination Spring/Elastomer Hanger Isolator.
   a. Available Manufacturers: Avnec, Inc., SANSH.
   b. Spring and neoprene elements in a hinged steel hanger box with the features as described for TYPE C and E isolators.
7. TYPE G: Pad type elastomer isolator
   a. Available Manufacturers: Avnec, Inc., Type NP Pad.
   b. Neoprene pad shall have 0.75" minimum thickness and shall have opposed cylindrical supports spaced on one inch centers to provide uniform deflection of 0.1 inch under rated load. Supports shall be connected in the center by an 1/8" tear strip to facilitate trimming to desired size in one inch increments. Supports will also have thru holes to accept up to 3/8" bolts without special drilling or coring.
   c. 1/16" galvanized steel plate between multiple pad layers.
   d. Load distribution plate where attachment to equipment bearing surface is less than 75% of the pad area.
   e. When bolting is required for seismic compliance, neoprene and duck washers and bushings shall be provided to prevent short circuiting of bolt.
8. TYPE H: Pad type elastomer isolator
   a. Available Manufacturers: Avnec, Inc., Type NIDP Pad.

b. Laminated canvas duck and neoprene, maximum loading 1000 psi, minimum 1/2" thick.
c. Load distribution plate where attachment to equipment bearing surface is less than 75% of the pad area.
d. When bolting is required for seismic compliance, neoprene and duck washers and bushings shall be provided to prevent short circuiting.

9. TYPE I: Thrust Restraints
   a. Available Manufacturers: Avnec, Inc., Type TR.
   b. A spring element same as TYPE A shall be combined with steel angles, backup plates, threaded rod, washers and nuts to produce a pair of devices capable of limiting movement of air moving equipment to 1/4".
   c. Restraints shall be easily converted in the field from a compression thrust type to tension type.
   d. Unit shall be factory precompressed.
   e. All metal parts shall be hot spray or hot dip galvanized. All hardware shall be electroplated.
10. TYPE J: Telescoping Riser Guide – non-isolated
   a. Available Manufacturers: Avnec, Inc., Type TPG.
   b. Telescoping arrangement of two sizes of steel tubing.
11. TYPE K: Resilient Pipe Anchors and Guides
   a. Available Manufacturers: Avnec, Inc., Type RPA anchors and RaPTG guides.
   b. All directional acoustical pipe anchor, consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" thickness of TYPE H pad.
   c. Vertical restraints shall be provided by a similar material arranged to prevent vertical travel in either direction.
   d. Allowable loads on neoprene pad shall not exceed 500 PSI and the design shall be balanced for equal resistance in any direction.
   e. All metal parts shall be hot spray or hot dip galvanized. All hardware shall be electroplated.
12. TYPE L: Isolated Pipe Hanger System
   a. Available Manufacturers: Avnec, Inc., Type CIH, CIR, TIH, TIR and PIH.
   b. Precompressed spring and elastomer isolation hanger combined with pipe support into one assembly. Replaces standard clevis, single or double rod roller, or double rod fixed support.
   c. Spring element (same as Type A) with steel lower spring retainer and an upper elastomer retainer cup with an integral bushing to insulate support rod from the isolation hanger.
   d. The neoprene element under the lower steel spring retainer shall have an integral bushing to insulate the support rod from the steel spring retainer.
   e. Hanger shall be hinged to allow for a normal misalignment between the rod attachment to structure and the connection to the isolation hanger. Hangers shall withstand loads of three times the rated load without failure.
   f. System shall be precompressed to allow for rod insertion and standard leveling.

g. All metal box parts shall be hot spray or hot dip galvanized. All hardware shall be electroplated.

13. TYPE M: Flashable restrained isolator
    a. Available Manufacturers: Avnec, Inc., Type FRS.
    b. Shall have all features of TYPE B isolator.
    c. Shall have waterproof spring covers for adjustment or removal of springs.
    d. Unit shall have a structural top plate for welding or bolting of supplementary support steel.
    e. Isolator shall accept 2" roofing insulation and be flashed directly into the waterproofing membrane.
    e. To be complete with wood nailer and flashing.
14. TYPE P: Elastomer Isolator
    a. Available Manufacturers: Avnec, Inc., Type NCM.
    b. Double deflection neoprene compression mountings shall have all metal surfaces neoprene coated.
    c. Non-skid top and bottom surfaces.
    d. Threaded bolting sleeves shall be embedded in the isolator.
    e. Drilled tie-down bolt holes shall be provided in the base plate.

2.3 EQUIPMENT BASES

A. General
1. All Curbs and roof rails are to be bolted or welded to the building steel or anchored to the concrete deck to attain specified acceleration criteria and shall also be capable of resisting a minimum 110 MPH wind loads. (non-simultaneous)

B. Base Types
1. TYPE B-1: Integral Structural Steel Base
    a. Available Manufacturers: Avnec, Inc., Type SB.
    b. Constructed of structural members as required to prevent base flexure at equipment startup and misalignment of driver and driven units. Centrifugal fan bases shall be complete with motor slide rails and drilled for driver and driven units.
    c. Height saving brackets shall be used to reduce operating height and maintain 1" operating clearance under base.
    d. Member depth shall be such that the maximum deflection of the longest side to be 1/360 of span, not to exceed 1/2".
2. TYPE B-2: Concrete Inertia Base
    a. Available Manufacturers: Avnec, Inc., Type CB.
    b. Steel or wood concrete forms for floating foundations. Bases for pumps shall be large enough to support elbows and/or suction diffusers. ("T" shaped if indicated on the drawings) The base depth shall be a minimum of 1/12 the longest unsupported span, but not less than 6" or greater than 14". Forms shall include concrete reinforcement consisting of 3/8" bars or angles welded in place on 6" centers both ways. A layer 1-1/2" above the bottom and an additional top layer of reinforcing for all bases exceeding 120" in one direction.
    c. Isolators may be set into pocket housings which are an integral part of the base construction or utilize height saving brackets set at the proper height

to maintain 2" clearance below the base. Base shall be furnished with templates for equipment attachment and anchor bolt sleeves.

3. TYPE B-3: Spring Roof Curb
   a. Available Manufacturers: Avnec, Inc., Type P.
   b. Structural steel spring isolation curbs that bear directly on the roof support structure and are flashed and waterproofed into the roof's membrane waterproofing system. Equipment manufacturer's curb shall not be used.
   c. All spring locations shall have removable waterproof covers to allow for spring adjustment and/or removal. Disassembly of the weather and air seal to gain access to the isolators is not acceptable. Springs shall have all of the features of TYPE B.
   d. Shall be sound attenuating type utilizing standard 2" roof insulation supplied and installed by the roofing contractor to act thermally outside and acoustically inside. Curbs supplied without this feature shall be factory acoustically lined with 2" duct liner.
   e. An air tight neoprene seal shall be incorporated into the curb design to prevent air leakage or infiltration. Air Seal must not be exposed so that it could be damaged or that in the event of the air seal failure, water could leak into the curb's interior.
   f. Wood nailer and flashing shall be provided.
   g. Shall be manufactured to NRCA standards.
   h. Shall include a sound barrier package consisting of two layers of waterproof gypsum board and 2" thick rigid fiberglass insulation. The gypsum wallboard shall have staggered and caulked joints.
   i. Contractor shall have the option of ordering the curb built to the roof pitch or field leveled in accordance with all seismic provisions of this section.
   j. Individual pier supported curbs are not acceptable.
4. TYPE B-4: Flashable Roof Rail System - Isolated
   a. Available Manufacturers: Avnec, Inc., Type R.
   b. Continuous structural support rails that combine equipment support and isolation mounting into one unitized assembly.
   c. Rails shall incorporate TYPE B springs which are adjustable, removable and interchangeable after equipment has been installed.
   d. The system shall maintain the same installed and operating height with or without the equipment load and shall be capable of being utilized as a blocking device.
   e. The entire assembly shall be an integral part of the roof's membrane waterproofing and shall be dry galvanized or plastic coated.
   f. Unit to be supplied with continuous upper and lower galvanized flashing.
5. TYPE B-5: Transformer Base
   a. Available Manufacturers: Avnec, Inc., Type TRAF and TRCF.
   b. Base shall be constructed from structural steel angles or channels sized as required to prevent flexure and misalignment under load.
   c. Each base shall be the full length of the supported equipment and be welded or bolted to a series of TYPE B isolators. Bolt-on cross ties at the ends and center shall form one rigid platform.
6. TYPE B-6: Non-isolated roof curb

a. Available Manufacturers: Avnec, Inc., Type P-6000.
b. Same as B-3 without spring isolation.

7. TYPE B-7: Computer room Unit Base
   a. Available Manufacturers: Avnec, Inc., Type CRTF.
   b. Computer room air conditioning units shall be welded or bolted to welded structural steel stands having a minimum 1/2 "G" certified lateral acceleration capabilities or if greater, the acceleration required per the seismic calculations required by the Submittal Requirements section of these specifications.
   c. Stand shall have +/- 1 -1/2" of leveling adjustment.
8. TYPE B-8: Non-isolated
   a. Available Manufacturers: Avnec, Inc., Type R-7000.
   b. Same as continuous support rails, Type B-4 without the spring isolation.
9. TYPE B-9: Steel Rails
   a. Available Manufacturers: Avnec, Inc., Type SR.
   b. Steel members of sufficient strength to prevent equipment flexure during operation.
   c. Height saving brackets as required to reduce operating height.

## 2.4 FLEXIBLE CONNECTORS

A. All connectors shall be installed on the equipment side of shutoff valves; horizontal and parallel to equipment shafts whenever possible. Piping shall be supported and/or anchored to resist pipe movement beyond the allowable movement of the flexible connector. Installations must include check valves and/or other design and installation precautions to reduce the threat to life safety when subjected to the specified seismic accelerations. The manufacture's submittal package must detail the design precautions included and/or the installation precautions required.

B. TYPE FC-1: Elastomer Connector
   1. Available Manufacturers: Avnec, Inc., Type TSF.
   2. Manufactured of nylon tire cord and neoprene, both molded and cured in hydraulic presses.
   3. Straight connectors to have two (2) spheres.
   4. Rated at 225 psi at 170$^{o}$F, dropping in a straight line to 170 psi at 225$^{o}$F for sizes 1-1/2" to 12".
   5. Sizes 10" and 12" at 200 PSI and greater operating pressure, to employ control rods with neoprene end fittings isolated from anchor plates by means of 1/2" bridge bearing neoprene bushings.
   6. Connectors shall be installed pre-extended per manufacturer's recommendations to prevent elongation under pressure.
   7. Minimum safety factor of 3:1 at maximum pressure ratings.
   8. Connectors bolted to victaulic type coupling or gate, butterfly or check valves to have a minimum 5/8" flange spacer installed between the connector and the coupling flange.

C. TYPE FC-2: Flexible Stainless Steel Hose
   1. Available Manufacturers: Avnec, Inc., Type SS.
   2. Stainless steel hose and braid rated with 3:1 safety factor.

3. 2" diameter and smaller with male nipples, 2-1/2" and larger with fixed steel flanges.

D. TYPE FC-3: Unbraided Exhaust Hose
1. Available Manufacturers: Avnec, Inc., Type SSE.
2. Low pressure Stainless steel annularly corrugated with flanged ends.
3. Maximum temperature of 1500$^{o}$F.

E. TYPE FC-4: Wire Braid Reinforced Flexible Metal Hose
1. Available Manufacturers: Avnec, Inc., Type RC.
2. Metal hose and braid rated with a minimum 3:1 safety factor. (Minimum 150 PSI)
3. Copper tube ends.

PART 3 - EXECUTION

3.1 GENERAL

A. Isolation and seismic restraint systems must be installed in strict accordance with the manufacturer's written instructions and all submittal data.

B. Vibration isolators shall not cause any change of position of equipment resulting in stress on equipment connections.

3.2 EQUIPMENT INSTALLATION

A. Equipment shall be isolated and restrained as indicated in TABLES A, B, C and D at the end of this section.

B. Additional Requirements
1. The minimum operating clearance under concrete inertia bases shall be 2".
2. The minimum operating clearance under all other bases shall be 1".
3. All bases shall be placed in position and supported temporarily by blocks or shims prior to the installation of the equipment, isolators and restraints.
4. Spring isolators shall be installed after all equipment is installed without changing equipment elevations.
5. After the entire installation is complete and under full operational load, the spring isolators shall be adjusted so that the load is transferred from the blocks to the isolators.
6. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolation. The equipment shall be free in all directions.
7. Install equipment with flexibility in wiring.
8. Thrust restraints shall be installed on all cabinet fan heads, axial or centrifugal fans whose thrust exceeds 10% of unit weight.
9. Housekeeping pads for equipment in this section must be properly doweled or wedge type expansion bolted to the structure to meet the acceleration criteria. Anchor equipment or isolators to housekeeping pad.

3.3 PIPING AND DUCTWORK ISOLATION

A. Installation
1. General
   a. Hanger isolators shall be installed with the hanger box hung as close as possible to the structure (without touching).
   b. Hanger rods shall not short circuit the hanger box.
   c. TYPE L hangers may be substituted for all other hangers listed below.
2. Ceiling supported piping outside shafts connected to rotating or reciprocating equipment and pressure reducing stations whether the equipment is isolated or not shall be isolated as follows:
   a. Water and steam piping within 50 feet or 100 pipe diameters (whichever is greater) from equipment connection.
      1) Horizontal suspended water piping 1-1/4" to 2" and all steam piping larger than 1" shall be hung with TYPE E isolators with 0.3" deflection.
      2) Water pipe larger than 2" shall be hung with TYPE F isolators. The first three supports for piping connected to isolated equipment shall have deflection equal to the equipment isolators up to 2" deflection, all supports thereafter shall have 0.75" deflection isolators.
3. Floor supported piping outside shafts connected to isolated rotating or reciprocating equipment and pressure reducing stations shall be isolated as follows:
   a. Horizontal floor or roof mounted water piping 1-1/4" to 2" and all steam piping larger than 1" shall be supported by TYPE P isolators with a minimum 0.3" deflection.
   b. Water pipe larger than 2" shall be supported by TYPE B isolators with a minimum of 0.75" deflection.
4. Control air piping and vacuum piping from compressor discharge to receiver shall be suspended by TYPE E isolators with a minimum 0.3" deflection or supported by TYPE P isolators with a minimum 0.3" deflection.
5. All ductwork over four square feet face area located in the mechanical equipment room(s) shall be supported by TYPE C hangers with a minimum of 0.75" deflection.
6. Emergency generator exhaust shall be isolated with TYPE C isolators with a minimum of 0.75" deflection (all neoprene components shall be omitted).
7. Vertical riser supports for pipe 4" diameter and larger shall be isolated from the structure.
   a. For vertical riser guides use TYPE K.
   b. For vertical riser anchors use TYPE K.
8. Install TYPE FC-1 flexible connectors at all connections of pipe to isolated equipment as shown on drawings. Where not installed on isolated equipment, use spool pieces on equipment side of shutoff valve.
9. Install FC-2 or 4 type connectors only at locations which exceed temperature limitations of FC-1 or service requires stainless steel or bronze construction flex. (Such as gas, fuel oil, steam or freon)

3.4 SEISMIC RESTRAINTS

A. Installation
   1. All equipment shall be isolated and restrained per TABLES A, B, C and D at the end of this section.
   2. All floor mounted equipment whether isolated or not shall be snubbed, anchored, bolted or welded to the structure to comply with the required acceleration. Calculations that determine that isolated equipment movement may be less than the operating clearance of snubbers (restraints) do not preclude the need for snubbers. All equipment must be positively attached to the structure.
   3. All suspended equipment and piping including, but not limited to fans, tanks, stacks, VAV boxes, unit heaters, fan powered boxes, cabinet unit heaters shall be two or four point independently braced with TYPE III restraints, installed taught for non-isolated equipment and slack with 1/2" cable deflection for isolated equipment. VAV Boxes (without fans) attached directly to ductwork on the main supply side shall be considered as ductwork for seismic design purposes. Rod bracing shall be installed as per approved submittals and shop drawings.
   4. All horizontally suspended pipe, duct, cable trays, bus duct and conduit shall use RESTRAINT TYPE III or V. Spacing of seismic bracing shall be as per Table D at the end of this section.
   5. For all trapeze supported piping and conduit, the individual pipes and conduits must be transversely and vertically restrained to the trapeze support at the designated restraint locations.
   6. For overhead supported equipment, overstress of the building structure must not occur. Bracing may occur from:
      a. Flanges of structural beams.
      b. Upper truss chords in bar joists.
      c. Cast in place inserts or drilled and shielded inserts in concrete structures.
   7. Pipe Risers
      a. Where pipes pass through cored holes, core diameters to be a maximum of 2" larger than pipe O.D., including insulation. Cored holes must be packed with resilient material or firestop as specified in other sections of this specification and/or state and local codes. No additional horizontal seismic bracing is required.
      b. Non-isolated, constant temperature pipe risers through cored holes require a riser clamp at each floor level on top of the slab attached in a seismically approved manner for vertical restraint.
      c. Non-isolated, constant temperature pipe risers in pipe shafts require structural steel attached in a seismically approved manner at each floor level and a riser clamp at each floor level on top of, and fastened to the structural steel. The riser clamp and structural steel must be capable of withstanding all thermal, static and seismic loads.
      d. Isolated and/or variable temperature risers through cored holes require Type K riser resilient Guides and Anchors installed to meet both thermal expansion and seismic acceleration criteria. Each floor level must have either a riser clamp that does not interfere with the thermal expansion/contraction of the pipe or a riser clamp/cable assembly (also non-interfering) capable of supporting the weight of the pipe between floors in the event of pipe joint failure. Riser guides and anchors must also be selected to serve as seismic restraints.

e. Isolated and/or variable temperature risers in pipe shafts require Type K resilient riser guides and Anchors installed on structural steel to meet both thermal expansion and seismic acceleration criteria. Each floor level must have a riser clamp/cable assembly that does not interfere with the thermal expansion/contraction of the pipe capable of supporting the weight of the pipe between floors in the event of pipe joint failure. Riser guides and anchors must also be selected to serve as seismic restraints.

8. Chimneys, stacks and boiler breeching passing through floors are to be bolted at each floor level or secured above and below each floor with riser clamps.
9. Lay-in ceilings in compliance with seismic zone requirements may use earthquake clips or other approved means of positive attachment to secure fixtures such as panel light and diffusers to T-bar structure.
10. All non-isolated floor or wall mounted equipment and tanks shall use RESTRAINT TYPE III or V.
11. Where base anchoring of equipment is insufficient to resist seismic forces, restraint TYPE III shall be located above the units center of gravity to suitably resist "G" forces specified.
    a. Vertically mounted tanks and up-blast tubular centrifugal fans, tanks, or similar equipment, may require this additional restraint.

B. Exclusions
1. Exclusions do not apply for Life Safety equipment, as follows:
    a. Electrical
        1) Critical, Standby or Emergency power conduit (1" nominal diameter and larger), cable tray or bus duct.
    b. Piping
        1) Fuel oil, gasoline, natural gas, medical gas, compressed air or any piping containing hazardous or corrosive materials that is 1" nominal diameter and larger.
    c. Duct
        1) Smoke evacuation duct or fresh air make-up connected to emergency system.
2. The following equipment exclusions do apply:
    a. Curb mounted mushroom, exhaust and vent fans with curb area less than nine square feet are excluded unless specifically detailed in the schedules or drawings.
    b. Duct
        1) Rectangular, Square, and Oval air handling ducts less than six square feet in cross sectional area.
        2) Round air handling duct less than 28 inches in diameter.
        3) Duct supported at locations by two rods less than 12 inches in length from the structural support to the structural connection at the ductwork with positive attachment to the structure.
    c. Piping
        1) All piping less than 2-1/2" diameter.
        2) All clevis or trapeze supported piping suspended by hanger rods less than 12 inches in length (6 inches or less for fire sprinkler piping) with positive attachment to structure.

3) PVC or Fiberglass suspended waste or vent pipe 6 inch diameter or smaller.

d. Electrical

1) All conduit less than 2-1/2" diameter suspended by individual hanger rods.
2) All clevis or trapeze supported conduit suspended by hanger rods less than 12 inches in length from the bottom of the support to the top of the conduit with positive attachment to structure.
3) Trapeze supported cable trays and bus duct suspended by hanger rods less than 12 inches in length with positive attachment to structure.

3.5 INSPECTION

A. Upon completion of installation of all vibration isolation and seismic restraint devices, a certification report prepared by the manufacturer shall be submitted in writing to the contractor indicating that all systems are installed properly and in compliance with the specifications. The report must identify those areas that require corrective measures or certify that none exists. Any field coordination type changes to the originally submitted seismic restraint designs must be clearly defined and detailed in this report.

**TABLES A, B & C NOTES:**

GENERAL: **ISOL**= ISOLATOR, **DEFL**. = DEFLECTION, **RESTR** = SEISMIC RESTRAINT, ALL DEFLECTIONS INDICATED ARE IN INCHES.

(1) UNITS MAY NOT BE CAPABLE OF POINT SUPPORT. REFER TO SEPARATE AIR HANDLING OR AIR CONDITIONING UNIT SPECIFICATION SECTION, IF BASE IS NOT PROVIDED BY THAT SECTION AND EXTERNAL ISOLATION IS REQUIRED, PROVIDE TYPE B-1 BASE BY THIS SECTION FOR ENTIRE UNIT.

(2) STATIC DEFLECTION SHALL BE DETERMINED BASED ON THE DEFLECTION GUIDE. DEFLECTIONS INDICATED ARE MINIMUMS AT ACTUAL LOAD AND SHALL BE SELECTED FROM MANUFACTURER'S NOMINAL 4", 3", 2" AND 1" DEFLECTION SPRING SERIES. **R.P.M. IS DEFINED AS THE SLOWEST OPERATING SPEED OF THE EQUIPMENT.**

| DEFLECTION GUIDE | |
|---|---|
| R.P.M. | DEFLECTION |
| LESS THAN 400 | 3.50" |

| | |
|---|---|
| 401 TO 600 | 2.50" |
| 601 TO 900 | 1.50" |
| OVER 900 | 0.75" |

(3) SINGLE STROKE COMPRESSORS MAY REQUIRE INERTIA BASES WITH THICKNESS GREATER THAN 14" MAX. AS DESCRIBED FOR BASE B-2. INERTIA BASE MASS SHALL BE SUFFICIENT TO MAINTAIN DOUBLE AMPLITUDE OF 1/8".

(4) FOR FLOOR MOUNTED FANS SUBSTITUTE BASE TYPE B-2 FOR CLASS 2 OR 3 OR ANY CLASS FAN WITH STATIC PRESSURE OVER 5".

(5) EQUIPMENT WITH LESS THAN ONE H.P. ARE EXCLUDED FROM VIBRATION REQUIREMENTS. (SEISMIC REQUIREMENTS STILL APPLY)

(6) UTILITY SETS WITH WHEEL DIAMETERS LESS THAN 24" NEED NOT HAVE DEFLECTIONS GREATER THAN .75".

(7) CURB MOUNTED FANS WITH CURB AREA LESS THAN NINE (9) SQUARE FEET ARE EXCLUDED.

(8) FOR EQUIPMENT WITH MULTIPLE MOTORS, H.P. CLASSIFICATION APPLIES TO LARGEST SINGLE MOTOR.

**TABLE D**

**SEISMIC BRACING TABLE**

| **EQUIP.** | **ON CENTER SPACING** | | **EACH CHANGE WITHIN OF DIRECTION (LARGER OF ...)** |
|---|---|---|---|
| | **TRANSVERSE** | **LONGITUDINAL** | |
| **DUCT** | 30 FEET | 60 FEET | 15 FEET |
| **PIPE (THREADED, WELDED, SOLDERED or GROOVED)** | | | |
| TO 16" | 40 FEET | 80 FEET | 10 FEET or 15 DIAMETERS |
| 18" - 28" | 30 FEET | 60 FEET | 10 FEET or 15 DIAMETERS |
| 30" - 40" | 20 FEET | 60 FEET | 10 FEET or 15 DIAMETERS |
| 42" & LARGER | 10 FEET | 30 FEET | 10 FEET or 15 DIAMETERS |
| **(NO-HUB BELL & SPIGOT, CAST IRON)** | | | |
| 2.5" & LARGER | 10 FEET | 20 FEET | 4 FEET |
| | | | |

| | | | |
|---|---|---|---|
| **BOILER BREECHING** | 30 FEET | 60 FEET | 10 FEET or 15 DIAMETERS |
| **CHIMNEYS & STACKS** | 30 FEET | 60 FEET | 10 FEET or 15 DIAMETERS |
| **CONDUIT** | 40 FEET | 80 FEET | 10 FEET or 15 DIAMETERS |
| **BUS DUCT** | 20 FEET | 40 FEET | 4 FEET |
| **CABLE TRAY** | 40 FEET | 80 FEET | 10 FEET |

**TABLE A** VIBRATION ISOLATION/SEISMIC RESTRAINT REQUIREMENTS FOR HVAC EQUIPMENT

| EQUIPMENT | | SIZE (5)(8) | MOUNTING | EQUIPMENT INSTALLATION ATTACHMENT POINT | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ON GRADE | | | | ABOVE GRADE | | | |
| | | | | ISOL | DEFL | BASE | RESTR | ISOL | DEFL | BASE | RESTR |
| AIR HANDLING/CONDITIONING UNITS AND CABINET TYPE FANS | | TO 10 HP | FLOOR | D | 0.30 | (1) | V | B | 0.75 | (1) | V |
| | | | CEILING | -- | -- | -- | -- | F | 0.75 | (1) | III |
| | | OVER 10 HP | FLOOR | D | 0.30 | (1) | V | B | (2) | (1) | V |
| | | | CEILING | -- | -- | (1) | III | F | (2) | (1) | III |
| AIR OR REFRIGERANT COMPRESSORS | TANK | TO 10 HP | FLOOR | D | 0.30 | -- | V | B | 0.75 | -- | V |
| | | OVER 10 HP | | B | 0.75 | -- | V | B | 1.50 | B-2 | V |
| | UNITARY | TO 10 HP | | D | 0.30 | -- | V | B | 0.75 | B-2 (3) | V |
| | | OVER 10 HP | | B | 0.75 | -- | V | B | 1.50 | B-2 (3) | V |
| AIR COOLED CONDENSERS | | ALL | ROOF | -- | -- | -- | -- | B | 1.50 | B-4 | V |
| AXIAL FANS | | TO 15 HP | FLOOR(roof) | D | 0.30 | -- | V | B | (2) | (B3 or 4) | V |
| | | | CEILING | -- | -- | -- | -- | F | | -- | III |
| | | OVER 15 HP | FLOOR (Roof) | B | 0.75 | -- | V | B | | (B3 or 4) | V |
| | | | CEILING | -- | -- | -- | -- | F | | -- | III |
| BOILERS & | | ALL | FLOOR | -- | -- | -- | V | B | 0.75 | -- | V |
| | | ELECTRIC | | -- | -- | -- | V | G | 0.10 | -- | V |
| CENTRIFUGAL | ARRG'T | ALL | FLOOR (Roof) | B | 0.75 | B-1 | V | B | (2) | B1(B4) | V |
| | | | CEILING | -- | -- | -- | -- | F | | | III |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FANS | ARRG'T | | FLOOR (Roof) | D | 0.30 | -- | V | B | (6) | (B-4) | V |
| | | | CEILING | -- | -- | -- | -- | F | | -- | V |
| CHILLERS AND CONDENSING UNITS | ABSORB | ALL (8) | FLOOR | G | 0.10 | -- | V | B | 0.75 | -- | V |
| | CENTRIF | | FLOOR | G | 0.10 | -- | V | B | 0.75 | -- | V |
| | RECIPR | | FLOOR (Roof) | B | 0.75 | -- | V | B | 1.50 | (B-4) | V |
| | ROTARY | | FLOOR (Roof) | G | 0.10 | -- | V | B | 0.75 | (B-4) | V |
| COMPUTER ROOM UNITS | | ALL | FLOOR | -- | -- | B-7 | V | -- | -- | B-7 | V |
| | | | CEILING | -- | -- | -- | -- | F | 0.75 | -- | III |
| COOLING TOWERS | | TO 200 TONS | FLOOR OR ROOF | G | 0.10 | -- | V | B | 1.50 | -- | V |
| | | 200+ TONS | | | | -- | | | 2.50 | -- | V |
| CURB MOUNTED FANS | | ALL (7) | ROOF | -- | -- | -- | -- | -- | -- | B-6 | V |
| FAN COIL UNITS<br>FAN POWERED BOXES<br>CABINET UNIT HEATERS<br>UNIT VENTILATORS | | ALL | CEILING | -- | -- | -- | -- | F | 0.75 | -- | III |
| PUMPS | BASE MOUNTED | TO 15 HP | FLOOR | D | 0.30 | B-2 | V | B | 0.75 | B-2 | V |
| | | 15-30 HP | | B | 0.75 | B-2 | V | B | 0.75 | B-2 | V |
| | | OVER 30 HP | | B | 0.75 | B-2 | V | B | 1.50 | B-2 | V |
| | IN LINE | ALL | FLOOR | -- | -- | -- | -- | D | 0.30 | -- | V |
| | | | CEILING | -- | -- | -- | -- | F | 0.75 | -- | III |
| | CONDENSATE | | FLOOR | D | 0.30 | B-9 | V | D | 0.30 | B-9 | V |
| | BOILER FEED | | | D | 0.30 | -- | V | D | 0.30 | -- | V |
| PACKAGED ROOF TOP AIR HANDLING UNITS | | TO 15 TONS | CURB MOUNTED | -- | -- | -- | -- | -- | 0.75 | B-3 | V |
| | | 15+ TONS | | -- | -- | -- | -- | -- | 2.50 | B-3 | V |
| | | TO 15 TONS | POINT SUPPORTED | -- | -- | -- | -- | B | 0.75 | -- | V |
| | | 15+ TONS | | -- | -- | -- | -- | B | 2.50 | -- | V |
| UNIT HEATERS | | ALL | CEILING | -- | -- | -- | -- | E | 0.30 | -- | III |

**Table Note:** Bases shown in ( ) indicate roof mounted system.

SECTION 23 05 53

IDENTIFICATION OF HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Mechanical identification work is required by this section and/or specified in other Division 23 sections.

B. Types of identification devices specified in this section include the following:
1. Painted Identification Materials.
2. Plastic Pipe Markers.
3. Plastic Tape.
4. Plastic Duct Markers.
5. Valve Tags.
6. Valve Schedule Frames.
7. Engraved Plastic-Laminate Signs.
8. Plastic Equipment Markers.
9. Plasticized Tags.
10. Ceiling Tacks (color coded).

C. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division-23 sections.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
2. Maintain one (1) copy of document on site.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8 1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves that are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

C. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:
1. Allen Systems, Inc.
2. Brady (W.H.) Co.; Signmark Div.
3. Industrial Safety Supply Co., Inc.
4. Seton Name Plate Corp.

2.2 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-23 sections. Where more than a single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.3 PAINTED IDENTIFICATION MATERIALS

A. Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/2" high letters for ductwork and not less than 3/4" high letters for access door signs and similar operational instructions.

B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

C. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.

2.4 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1. Provide weather and ultra-violet resistant, pressure sensitive vinyl markers for outdoor locations. Strap around type with nylon ties or stainless steel bands for pipe sizes 6 inches in diameter and larger.

B. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13.1. Provide weather and ultra-violet resistant, pressure sensitive vinyl markers for outdoor locations.

C. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125$^{o}$F (52$^{o}$C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.

D. Taped to Pipe Type - Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
2. Adhesive lap joint in pipe marker overlap.
3. Laminated or bonded application of pipe marker to pipe (or insulation).
4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

E. Taped to Pipe Type - Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
1. Laminated or bonded application of pipe marker to pipe (or insulation).
2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1 1/2" wide: full circle at both ends of pipe marker, tape lapped 3".
3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

F. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect in cases of variance with name as shown or specified.

G. Lettering: Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length.

1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.5 PLASTIC DUCT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color coded duct markers. Conform to the following color code:
1. Green: Cold air.

2. Yellow: Hot air.
3. Yellow/Green: Supply air.
4. Blue: Exhaust, outside, return, and mixed air.

B. Nomenclature: Include the following:
1. Direction of air flow.
2. Duct service (supply, return, exhaust, etc.).
3. Duct origin (from).
4. Duct destination (to).
5. Design cfm.

2.6 PLASTIC TAPE

A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1 1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2 1/2" wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.7 VALVE TAGS

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 3/4" high letters and sequenced valve numbers 3/4" high, and with 5/32" hole for fastener.
1. Provide 1 1/2" diameter tags, except as otherwise indicated.
2. Fill tag engraving with black enamel.

B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.8 ACCESS PANEL MARKERS

A. Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

2.9 VALVE SCHEDULE FRAMES

A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.10 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise

indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.11 PLASTIC EQUIPMENT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color coded equipment markers. Conform to the following color codes:
1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Brown: Energy reclamation equipment and components.
5. Blue: Equipment and components that do not meet any of the above criteria.

B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
1. Name and plan number.
2. Equipment service.
3. Design capacity.
4. Other design parameters such as pressure drop, entering and leaving conditions, rpm, etc.

C. Size: Provide approximate 2" x 4" markers for VAV boxes, control devices, dampers, and valves; and 4" x 6" for equipment.

2.12 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color-coded head.

B. Color code as follows:
1. HVAC equipment: Yellow.
2. Fire dampers/smoke dampers: Red.
3. Plumbing valves: Green.
4. Heating/cooling valves: Blue.

2.13 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 DUCTWORK IDENTIFICATION

A. General: Identify air supply, return, exhaust, intake and relief ductwork with duct markers; or provide stenciled signs and arrows, showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork color).

B. Location: In each unfinished space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 50' spacings along exposed runs.

C. Access Doors: Provide duct markers or stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

D. Concealed Doors: Where access doors are concealed above acoustical ceilings or similar concealment, plasticized tags may be installed for identification in lieu of specified signs, at Installer's option.

3.3 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
   1. All new exposed piping located in mechanical rooms.
      a. plastic pipe markers, snap-on type, semi-rigid and color coded.
   2. All other locations select one of the types listed below.
      a. Plastic pipe marker, snap-on type, semi-rigid and color coded.
      b. Pressure sensitive type.
      c. Taped to pipe type.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
   1. Near each valve and control device.
   2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
   3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
   4. At access doors, manholes and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.4 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
   1. Mount valve schedule frames and schedules in boiler room where indicated or, if not otherwise indicated, where directed by Architect.
   2. Provide ceiling tacks to locate valves above T-bar lay-in ceilings. Locate in corner of panel closest to valve.

3.5 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   1. Main control and operating valves.
   2. Fuel-burning units including boilers.
   4. Pumps and similar motor-driven units.
   5. Heat exchangers, coils, evaporators.
   6. Fans.

B. Optional Sign Types: Where lettering larger than 1" height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

C. Lettering Size: Minimum 2" high lettering for name of unit where viewing distance is less than 2'-0", 4" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

D. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

E. Optional Use of Plasticized Tags: At Installer's option, where equipment to be identified is concealed above acoustical ceiling or similar concealment, plasticized tags may be installed within concealed space to reduce amount of text in exposed sign (outside concealment).
   1. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at Installer's option, be identified by installation of plasticized tags in lieu of engraved plastic signs.

F. Provide color coded ceiling tacks to locate equipment above T-bar lay-in ceilings. Locate in corner of panel closest to valve.

3.6 ADJUSTING AND CLEANING

A. Cleaning: Clean face of identification devices, and glass frames of valve charts.

B. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

3.7 EXTRA STOCK

A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than three) for each piping system, additional piping system identification markers, color coded ceiling tacks, and additional plastic laminate engraving blanks of assorted sizes.
   1. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.
   2. Furnish two (2) containers of spray-on adhesive. And two (2) rolls of pressure-sensitive vinyl tape for each color code and width used.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SUMMARY

A. TESTING, ADJUSTING, AND BALANCING WILL BE REQUIRED AT EACH AND EVERY PHASE OF CONSTRUCTION. SCOPE OF WORK FOR EACH PHASE IS SHOWN ON DRAWINGS.

B. Section Includes:
1. Testing adjusting, and balancing of air systems.
2. Testing adjusting, and balancing of hydronic systems.
3. Measurement of final operating condition of HVAC systems.

C. Related Sections:
1. Section 01 91 00- Commissioning: For requirements related to this section.

1.2 REFERENCES

A. Associated Air Balance Council:
1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. Natural Environmental Balancing Bureau:
1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittals: Submittal procedures.

B. Prior to commencing Work, submit proof of latest calibration date of each instrument.

C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms or NEBB reporting forms.

D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Submit draft copies of report for review prior to final acceptance of Project.

F. Furnish reports in soft cover, letter size, 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. All work performed under this section shall be under the direction of an AABC or NEBB certified supervisor.

C. All instruments used for measurement shall be accurate, and calibration histories for each instrument shall be available for examination. Calibration and maintenance of all instruments shall be in accordance with AABC or NEBB requirements.

1.6 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three experience certified by AABC or Certified by NEBB.

1.7 SEQUENCING

A. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.8 SCHEDULING

A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify systems are complete and operable before commencing work. Verify the following:
   1. Systems are started and operating in safe and normal condition.
   2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire, smoke and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place or in normal position.
15. Service and balancing valves are open.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Section 017000 – Contract Closeout: Testing, adjusting, and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 GENERAL PROCEDURES

A. All systems, including equipment, apparatus and distribution systems, shall be tested in accordance with the AABC National Standards for Total System Balance, Current Edition, or NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by NEBB, Current Edition.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in main ducts by pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure at location indicated.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems, after air balancing, to obtain design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.

C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

3.8 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing includes but is not limited to:
1. Plumbing Pumps.
2. Hot Water Pumps
3. Chilled Water Pumps
4. Chillers
5. Air Handling Units.
6. Fans.
7. Air Terminal Units.
8. Air Inlets and Outlets.
9. Cabinet Unit Heaters
10. Radiant Ceiling Panels
11. Stair Tower Pressurization Fans/Dampers.
12. Space Pressurization Measurements and Adjustments.

B. Report Forms
1. Title Page:
   a. Name of Testing, Adjusting, and Balancing Agency
   b. Address of Testing, Adjusting, and Balancing Agency
   c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
   d. Project name
   e. Project location
   f. Project Architect
   g. Project Engineer

h. Project Contractor
i. Project altitude
j. Report date

2. Summary Comments:
   a. Design versus final performance
   b. Notable characteristics of system
   c. Description of systems operation sequence
   d. Summary of outdoor and exhaust flows to indicate building pressurization
   e. Nomenclature used throughout report
   f. Test conditions
3. Instrument List:
   a. Instrument
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Range
   f. Calibration date
4. Electric Motors:
   a. Manufacturer
   b. Model/Frame
   c. HP/BHP and kW
   d. Phase, voltage, amperage; nameplate, actual, no load
   e. RPM
   f. Service factor
   g. Starter size, rating, heater elements
   h. Sheave Make/Size/Bore
5. V-Belt Drive:
   a. Identification/location
   b. Required driven RPM
   c. Driven sheave, diameter and RPM
   d. Belt, size and quantity
   e. Motor sheave diameter and RPM
6. Pump Data:
   a. Identification/number
   b. Manufacturer
   c. Size/model
   d. Impeller
   e. Service
   f. Design flow rate, pressure drop, BHP and kW
   g. Actual flow rate, pressure drop, BHP and kW
   h. Discharge pressure
   i. Suction pressure
   j. Total operating head pressure
   k. Shut off, discharge and suction pressures
   l. Shut off, total head pressure
7. Cooling Coil Data:
   a. Identification/number

b. Location
c. Service
d. Manufacturer
e. Air flow, design and actual
f. Entering air DB temperature, design and actual
g. Entering air WB temperature, design and actual
h. Leaving air DB temperature, design and actual
i. Leaving air WB temperature, design and actual
j. Water flow, design and actual
k. Water pressure drop, design and actual
l. Entering water temperature, design and actual
m. Leaving water temperature, design and actual
n. Saturated suction temperature, design and actual
o. Air pressure drop, design and actual

8. Chillers:
   a. Identification/number
   b. Manufacturer
   c. Capacity
   d. Model number
   e. Serial number
   f. Evaporator entering water temperature, design and actual
   g. Evaporator leaving water temperature, design and actual
   h. Evaporator pressure drop, design and actual
   i. Evaporator water flow rate, design and actual
   j. Condenser entering water temperature, design and actual
   k. Condenser pressure drop, design and actual
   l. Condenser water flow rate, design and actual
9. Heating Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Water flow, design and actual
   g. Water pressure drop, design and actual
   h. Entering water temperature, design and actual
   i. Leaving water temperature, design and actual
   j. Entering air temperature, design and actual
   k. Leaving air temperature, design and actual
   l. Air pressure drop, design and actual
10. Air Moving Equipment:
    a. Location
    b. Manufacturer
    c. Model number
    d. Serial number
    e. Arrangement/Class/Discharge
    f. Air flow, specified and actual
    g. Return air flow, specified and actual

h. Outside air flow, specified and actual
i. Total static pressure (total external), specified and actual
j. Inlet pressure
k. Discharge pressure
l. Sheave Make/Size/Bore
m. Number of Belts/Make/Size
n. Fan RPM

11. Return Air/Outside Air Data:
    a. Identification/location
    b. Design air flow
    c. Actual air flow
    d. Design return air flow
    e. Actual return air flow
    f. Design outside air flow
    g. Actual outside air flow
    h. Return air temperature
    i. Outside air temperature
    j. Required mixed air temperature
    k. Actual mixed air temperature
    l. Design outside/return air ratio
    m. Actual outside/return air ratio
12. Exhaust Fan Data:
    a. Location
    b. Manufacturer
    c. Model number
    d. Serial number
    e. Air flow, specified and actual
    f. Total static pressure (total external), specified and actual
    g. Inlet pressure
    h. Discharge pressure
    i. Sheave Make/Size/Bore
    j. Number of Belts/Make/Size
    k. Fan RPM
13. Duct Traverse:
    a. System zone/branch
    b. Duct size
    c. Area
    d. Design velocity
    e. Design air flow
    f. Test velocity
    g. Test air flow
    h. Duct static pressure
    i. Air temperature
    j. Air correction factor
14. Duct Leak Test:
    a. Description of ductwork under test
    b. Duct design operating pressure
    c. Duct design test static pressure

d. Duct capacity, air flow
e. Maximum allowable leakage duct capacity times leak factor
f. Test apparatus
    1) Blower
    2) Orifice, tube size
    3) Orifice size
    4) Calibrated
g. Test static pressure
h. Test orifice differential pressure
i. Leakage

15. Terminal Unit Data:
    a. Manufacturer
    b. Type, constant, variable, single, dual duct
    c. Identification/number
    d. Location
    e. Model number
    f. Size
    g. Minimum static pressure
    h. Minimum design air flow
    i. Maximum design air flow
    j. Maximum actual air flow
    k. Inlet static pressure
16. Air Distribution Test Sheet:
    a. Air terminal number
    b. Room number/location
    c. Terminal type
    d. Terminal size
    e. Area factor
    f. Design velocity
    g. Design air flow
    h. Test (final) velocity
    i. Test (final) air flow
    j. Percent of design air flow

END OF SECTION

SECTION 23 07 01

MECHANICAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Ductwork insulation.
2. Insulation jackets.
3. Piping system insulation.
4. Insulation accessories including vapor retarders, jackets, and accessories.

B. Related Sections:
1. Section 23 05 29 - Hangers and Supports: Product and Execution requirements for inserts at hanger locations and firestopping.
2. Section 23 05 23 - Mechanical Identification: Product requirements for mechanical identification.

1.2 REFERENCES

A. ASTM International:
1. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
2. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
3. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
4. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
5. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
6. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
7. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
8. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
9. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. Sheet Metal and Air Conditioning Contractors':
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittals: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

PART 2 PRODUCTS

2.1 GLASS FIBER, RIGID PIPE

A. Available Manufacturers:
1. Johns Mansville, Model Micro-Lok.
2. Approved Equal.

B. Insulation: ASTM C547, Type I.
1. 'K' factor: ASTM C177 or ASTM C518, 0.23 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Retarder Jacket: ASTM C1136 Flexible, Low Permeance Vapor Retarders for Thermal Insulation, Type II.

2.2 GLASS FIBER, BLANKET

A. Available Manufacturers:
1. Johns Mansville, Model Microlite.
2. Approved Equal.

B. Insulation: ASTM C553, Type II.
   1. 'K' factor: ASTM C177 or ASTM C518, 0.27 at 75 degrees F.
   2. Maximum Service Temperature: 250 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Retarder Jacket: ASTM C1136 Flexible, Low Permeance Vapor Retarders for Thermal Insulation, Type II.

2.3 GLASS FIBER, RIGID DUCT

A. Available Manufacturers:
   1. Johns Mansville, Model 813 Spin-glas.
   2. Approved Equal.

B. Insulation: ASTM C612; rigid, noncombustible.
   1. 'K' factor: ASTM C177 or ASTM C518, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 350 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.
   4. Density: 3.0 lb/cu ft.

C. Vapor Retarder Jacket: ASTM C1136 Flexible, Low Permeance Vapor Retarders for Thermal Insulation, Type II.

D. Vapor Retarder Lap Adhesive:
   1. Compatible with insulation.

E. Insulating Cement/Mastic:
   1. ASTM C195; hydraulic setting on mineral wool.

2.4 DUCT LINER

A. Manufacturers:
   1. Armacell, AP Coilflex Acoustic Duct Liner.
   2. Approved Equal.

B. Insulation: ASTM C612; fiber free flexible.
   1. 'K' factor: ASTM C177 or ASTM C518, 0.25 at 75 degrees F.
   2. Maximum Service Temperature: 180 degrees F..
   3. Density: 3.0 – 6.0 lb/cu ft.
   4. Sound Absorption Coefficients: Sound Transmission Class 25, Sound Absorption NRC 0.60.
   5. Flame Spread and Smoke Developed Index: 25/50.
   6. EPA registered Microban antimicrobial.
   7. Formaldehyde free.

2.5 FIRE BARRIER DUCT WRAP

A. Available Manufacturers:
   1. 3M.

2. Approved Equal.

B. Insulation: ASTM C411; foil encapsulated, inorganic blanket, UL listed.
1. Thickness: 2 layers of 1-1/2 inches (3" total).
2. Banding Material: Carbon steel or stainless steel.
3. Flame Spread: 0
4. Smoke Developed: 0
5. Establishes zero clearance to combustible material.

2.6 ELASTOMERIC CELLULAR FOAM

A. Available Manufacturers:
1. Armaflex, Model AP.
2. Approved Equal.

B. Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form: ASTM C534; Type I, Tubular form.
1. Temperature Range: -70 – 200 deg F.
2. Thermal Conductivity: 0.27 btu-in/hr-sf-°F @75°F mean temperature.
3. Water Vapor Permeability: 0.08.

C. Elastomeric Foam Adhesive:
1. Air dried, contact adhesive, compatible with insulation.

2.7 PIPE INSULATION AND EQUIPMENT JACKETS

A. PVC Plastic Pipe Jacket:
1. Product Description: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.
2. Thickness: 10 mil.
3. Connections: Brush on welding adhesive.

B. PVC Plastic Equipment Jacket:
1. Product Description: Sheet material, off-white color.
2. Minimum Service Temperature: -40 degrees F.
3. Maximum Service Temperature: 150 degrees F.
4. Moisture Vapor Transmission: ASTM E96; 0.002 perm-inches.
5. Thickness: 10 mil.
6. Connections: Brush on welding adhesive.

C. PVC Pipe Jacket:
1. Product Description: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.
2. Thickness: 10.
3. Connections: Brush on welding adhesive.

D. Covering Adhesive Mastic:
1. Compatible with insulation.

E. Duct Jacket (Outdoors):
1. Manufacturers
a. MFM Building Products, Corp, Model Flex Clad 400.
2. Pre-fabricated, self-adhering, sheet-type waterproofing membrane.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping, equipment and ductwork has been tested before applying insulation materials.

B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Exposed Piping: Locate insulation and cover seams in least visible locations.

B. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

C. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

D. Inserts and Shields:
1. Application: Piping or Equipment 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under finish jacket.
4. Insert configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
5. Insert material: Compression resistant insulating material suitable for planned temperature range and service.

E. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 23 05 29 for penetrations of assemblies with fire resistance rating greater than one hour.

F. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces less than 3 feet above finished floor: Finish with aluminum jacket.

G. Pipe Exposed in Finished Spaces more than 3 feet above finished floor: Finish with white PVC jacket.

H. Factory Insulated Equipment: Do not insulate.

I. Exposed Equipment: Locate insulation and cover seams in least visible locations.

J. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

K. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

L. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

M. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

N. Finish insulation at supports, protrusions, and interruptions.

O. Include chilled water hydronic equipment (air separator, expansion tank), and chilled water pump bodies.

P. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

Q. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

R. Insulated ductwork conveying air below ambient temperature:
1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

S. Insulated ductwork conveying air above ambient temperature:
1. Provide with or without standard vapor retarder jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

T. Insulated exterior ductwork:
1. Provide with outdoor duct jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
3. Slope exterior duct to exterior wall penetrations to allow water to flow away from building.

APPLICATION AND THICKNESS TABLES

Table 1 - Cold Piping Insulation

| Service | Insulation Type | Pipe Size | Thickness | Run-outs * (up to 2 inches) |
|---|---|---|---|---|
| Domestic Cold Water, Rain Leaders and Condensation Piping | Elastomeric or Glass Fiber | 1/2" to 8" | 1/2" | 1/2" |
| Chilled water, aboveground only | Elastomeric, cellular glass | 1/2" to 8" | 2" | 2" |
| Chilled water, underground | Cellular glass | Up to 1-1/2"<br>2" and above | 2"<br>3" | 2"<br>3" |
| Refrigerant Suction | Elastomeric | 1/2" to 1"<br>1-1/4" and above | 1"<br>1-1/2" | 1" |
| Refrigerant Discharge | Elastomeric | All | 1" | Not permitted |

Table 2 - Hot Piping Insulation

| Service | Insulation Type | Pipe Size | Thickness | Run-outs * (up to 2 inches) |
|---|---|---|---|---|
| Domestic Hot Water Supply and Recirculated Hot Water | Elastomeric or Glass Fiber | 1/2"<br>3/4" to 2" | 1/2"<br>1" | 1/2" |
| Hot Water Heating Water | Glass Fiber | 1/2", 3/4"<br>1" to 1 1/2"<br>2" to 3"<br>4" to 6" | 1/2"<br>1"<br>1-1/2"<br>2" | 1/2" |

* Only run-outs less than 12 feet long.

Table 3 – Air System Insulation

| Service | Insulation Type | Thickness |
|---|---|---|
| Supply Air Ducts (Indoors through conditioned spaces) | Glass Fiber | 1.5" (HVAC-2)<br>2" (HVAC-4) |
| Supply and Return Duct Liner (Where Indicated on Drawings) | Duct Liner | 1" |
| Supply and Return Ducts (Outdoors & Attic) | Glass Fiber | 3" |
| Exhaust Ducts (10ft from Fan Curb) | Glass Fiber | 1" |

END OF SECTION

SECTION 23 09 23

DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes controllers and control equipment to be installed in the new Maine Eye Center facility in Portland, ME.

1.2 SYSTEM DESCRIPTION

A. Provide complete and functioning controls for HVAC work described in Drawings and Specifications. Provide programming, commissioning and operational verification including graphics for the existing proprietary website.

B. Controls for existing to remain, renovated or relocated equipment shall be integrated into the new control system. All new or replaced equipment shall receive new DDC controls.

C. Save removed sensors and controllers and handle as described in paragraph 3.2 below.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the automatic control system manufacturer for both installation and maintenance of units required for this project.

B. Control Systems shall be engineered, programmed and supported completely by representative located within 100 miles of project site.

C. 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.

1.4 COORDINATION

A. Other Trades: The automatic control trades shall coordinate and supervise other trades whose work affects the controls systems.

B. Work Performed by Other Trades: The designated trade under the supervision of the automatic temperature control trade shall perform the following incidental work:

1. Installing control valves, pressure and temperature taps, flow switches, thermal wells, dampers, and access doors.

2. This contractor shall provide all electric power wiring required for the installation of the temperature control system, as herein specified, and shown on the Drawings, unless specifically indicated to be installed by the Electrical Contractor.

C. Coordinate location of thermostats, and other exposed control sensors with room details before installation.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Include dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product installed.

1. Each control device labeled with setting or adjustable range of control.

B. Drawings.

1. The system provider shall submit engineered drawings, control sequences, and bill of materials for approval.

2. Drawings shall be submitted in the following sizes: 11"x17" (ANSI B).

C. System Documentation

1. Written description of sequence of operation.

2. Schedule of dampers including size, leakage, and flow characteristics.

3. Schedule of valves including leakage and flow characteristics.

4. Trunk cable schematic showing programmable control unit and input device.

5. All input/output object listings and an alarm point summary listing.

6. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

7. Manufacturer's instructions and drawings for installation, maintenance, and repair.

1.6 WARRANTY

A. All components, system software, and parts supplied by the BAS contractor shall be guaranteed against defects in material and workmanship for a period of one year from acceptance date. During this warranty period the BAS contractor shall furnish labor to repair, reprogram, or replace components at no charge. All corrective software modifications made during the warranty period shall be updated on all user documentation and on user and manufacturer software archived software disks. The contractor shall provide warranty service within 24 hours of the Owner's request.

PART 2 – PRODUCTS

2.1 CONTROL PANELS

A. Local Control Panels: Unitized cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.

2.2 SENSORS

A. Electronic Sensors:

1. Thermistor Temperature Sensors:
   a. Accuracy: +/- 0.5 deg F at calibration point.
   b. Wire: Twisted, shielded pair cable.
   c. Insertion Elements in Ducts: Single point, 8 inches long, use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
   d. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.
   e. Insertion Elements for Liquids: Brass socket with minimum insertion length or 2-1/2 inches.
   f. Room Sensors: Plain locking cover with no override function and no local setpoint adjustment lever. Override shall be stored in controller and be adjustable on a zone-by-zone basis. Setpoint adjustment range shall be stored in controller EEPROM.
   g. Outside Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
   h. Room Security Sensors: Stainless steel cover plate with insulated back and security screws.

2. Current sensing relays used for proof-of-loading for fans and pumps shall be suitable for 2 to 200 amperes and shall have adjustable trip thresholds of plus or minus two percent of range. Each relay shall be provided with an LED to allow ready observation of the relay status.

B. Electronic Damper Position Indication: Visual scale indicating percent of travel and 2 to 10 VDC feedback signal.

2.3 RELAYS

A. Control relays shall be UL listed, plug-in type. Contact rating and coil voltage shall be suitable for application.

2.4 ACTUATORS

A. Electronic Damper Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Dampers: Size running torque calculated as follows:
   a. Parallel Blade Damper with Edge Seals: 7 inch-pounds/ sq. ft. of damper.
   b. Opposed Blade Damper with Edge Seals: 5 inch-pounds/ sq. ft. of damper.
   c. Dampers with 3 to 4 inches w.c. of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Multiply the minimum full-stroke cycles above by 2.0.

2. Coupling: V-bolt and V-shaped, toothed cradle.

3. Overload Protection: Electronic overload or digital rotation sensing circuitry.

4. Fail-Safe Operation: Mechanical, spring return mechanism. Provide external, manual gear release on non-spring return actuators.

5. Power Requirements (Two-position, Spring Return): 120 VAC.

6. Power Requirements (Modulating): Maximum 10 VA at 120 VAC.

7. Proportional Signal: 2 to 10 VDC or 4 to 20 mA, and 2 to 10 VDC position feedback signal.

8. Temperature Rating: -22 to 122 deg F.

9. Run Time: 60 seconds.

10. Auxiliary Switches: 2 SPDT.

B. Dampers for critical rooms with room pressure control shall use high speed actuators by TSI or approved equal.

2.5 DAMPERS

A. Controls contractor shall furnish all automatic control dampers unless provided with packaged equipment.

B. Sheet metal contractor shall install all dampers.

C. All dampers used for modulating service shall be opposed blade type arranged for normally open or normally closed operation as required.

C. All dampers used for two-position service shall be parallel blade type arranged for normally open or normally closed operation as required.

E. Construction:

1. Frame: 5-inch, 16 gauge, galvanized steel hat channel reinforced with corner braces.
2. Blades: 6-inch wide, 16 gauge, galvanized steel blades spaced approximately 6 inches on center.

3. Seals: Blade edge is PVC coated polyester fabric mechanically locked into blade edge. Jamb is flexible metal, compression type.
4. Bearings: Synthetic.
5. Axles: ½-inch steel.
6. Linkage : Concealed in frame.
7. Finish: Mill.

2.6 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
B. Globe Valves NPS 2 and Smaller: Bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends.

2.7 BUILDING MANAGEMENT AND CONTROL SYSTEM WIRING

A. All wiring shall be properly supported and run in a neat and workmanlike manner. All wiring exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals. All wiring shall be in accordance with all local and national codes. All line voltage wiring, all wiring exposed, and all wiring in equipment rooms shall be installed in conduit in accordance to the electrical specifications.

All electronic wiring shall be #18 AWG minimum THHN and shielded if required, except standard network (Ethernet, LonWorks, etc.) cabling shall be as tested and recommended in lieu of #18 gauge twisted, #22 or #24 gauge is acceptable if used as a part of an engineered structured cabling system.

The control manufacturer must submit technical and application documentation demonstrating that this cabling system has been tested and approved for use by the manufacturer of both the control system and the engineered structured cabling system.

B. Codes and Approvals:

1. The complete BMCS installation shall be in strict compliance to the national, state and local mechanical and electrical codes and the electrical section of these specifications. All devices shall be UL or FM listed and labeled for the specific use, application and environment to which they are applied.

2. The system shall comply with NFPA 90A Air Conditioning and 90B Warm Air Heating, Air conditioning.

3. System shall be designed and manufactured to ISO 9001 quality standard, and all electronic equipment shall conform to the requirements of FCC regulation Part 15, Section 15 governing radio frequency electromagnetic interference and be so labeled and European CE rating for electromagnetic emissions standards.

4. System devices shall have UL864 (UUKL smoke control) and CSA approval and shall be so certified at time of bid.

2.8 ROOM PRESSURIZATION, TEMPERATURE AND HUMIDITY MONITORS AND DISPLAYS

A. Setra Systems Room Condition Monitor Model SRCM or approved equivalent.

B. Setra System Room Monitoring Display Model SRMD, displaying room temperature, humidity and pressure.

B. UL Listed. Lifetime warranty on indicator and factory warranty on electronics.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all components in accordance with manufacturer's recommendations.

B. Install equipment level and plumb.

C. Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operations.

D. Install labels and nameplates to identify control components according to Division 23 Section, "Mechanical Identification."

3.2 DEMOLITION

A. All wall sensors and thermostats removed as part of this work scope shall remain the property of the Owner. Deliver these sensors and thermostats to a location directed by the Owners representative.

3.3 INSTALLATION OF SENSORS

A. Verify locations of sensors and thermostats with plans and room details before installation.

B. Install room sensors so that they are properly supported by wall framing.

C. Locate temperature sensors 4 feet above floor. Comply with ADA requirements.

D. Low-limit sensors used in mixing plenums shall be installed horizontally in a serpentine arrangement. Support each bend with a capillary clip.

E. Pip-mounted sensors shall be installed in wells. Provide thermal wells for heat conducting fluid applications.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLTION

A. Install raceways, boxes, and cabinets according to Division 26.

B. Install building wire and cable according to Division 26.

C. Install signal and communications cable according to Division 26.

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path. Limit bundle to 15 cables.
4. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
5. Number-code or color-code conductors for future identification and service of control system.

3.5 CONNECTIONS

A. Ground Equipment.

1. Tighten electrical connectors and terminals according to manufacturer's torque-tightening values. If values are not indicated use those specified in UL 486A and UL 486B.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized representative to inspect field-assembled components and equipment installation, including electrical connections.

B. Engage a factory authorized service representative to perform startup service.

C. Replace damaged or malfunctioning controls and equipment.
1. Start, test, and adjust control systems.
2. Adjust, calibrate, and tune circuits and equipment to achieve sequence of operation specified.

3.7 TRAINING

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to two Project site visits, when requested by owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

B. Provide a minimum of 1– 4 hour, on-site, operator training session. Session shall cover procedures and schedules for starting/stopping, troubleshooting, servicing, and maintaining equipment, training on data display, executing commands, calibrating and adjusting devices. Resetting default values, and requesting data logs.

3.8 GUARANTEE

A. The control system designated on the Contract Documents and herein specified, shall be guaranteed to be free from original defects in both material and workmanship for a period

of one (1) year of normal use and service, excepting damages from other causes. This guarantee shall become effective starting the date the owner begins to receive beneficial use of the system.

3.9 PROGRAMMED MAINTENANCE

A. Upon completion of the installation, the control contractor shall submit to the Owner for consideration, an agreement, to provide the necessary programmed maintenance to keep the various control systems in proper working condition.

B. This proposed programmed maintenance agreement shall fully describe the maintenance work to be performed and shall advise the cost of this work during the guarantee period as well as for subsequent years thereafter.

END OF SECTION

SECTION 23 11 23

FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Natural gas piping.
2. Unions and flanges.
3. Valves.
4. Strainers.

B. Related Sections:
1. Section 23 05 29 - Hangers and Supports: Product requirements for pipe hangers and supports for placement by this section.
2. Section 23 05 53 - Mechanical Identification: Product requirements for valve and pipe identification for placement by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B31.8 – Gas Transmission and Distribution Piping.
3. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:
1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

3. MSS SP 72 - Ball Valves with Flanged or Butt Welding for General Purpose.
4. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
5. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

F. National Fire Protection Association:
1. NFPA 54 - National Fuel Gas Code.
2. NFPA 56PS - Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems

G. Underwriters Laboratories Inc.:
1. UL 842 - Valves for Flammable Fluids.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.

C. Provide pipe hangers and supports in accordance with ASME B31.9.

D. Use plug or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.4 DEFINITIONS

A. Where designation LPG is used, it is abbreviation for Liquefied Petroleum Gas, most commonly Propane.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:

a. Strainers.

C. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Test Reports: Indicate results of piping system pressure test.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and system components.

C. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, and spare parts lists.

1.7 QUALITY ASSURANCE

A. Perform LPG Work in accordance with NFPA 58.

B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

C. Perform Work in accordance with applicable code for welding hanger and support attachments to building structure.

D. Perform Work in accordance with applicable codes and standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Section 01 31 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate trenching, excavating, bedding and backfilling of buried piping systems with General Contractor.

1.12 WARRANTY

A. One year manufacturer warranty for valves excluding packing.

PART 2 PRODUCTS

2.1 FUEL GAS PIPING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
   2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

B. Exterior piping (from inside face of exterior wall and beyond) shall have factory-applied coating of epoxy, adhesive, and polyethylene.

2.2 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Gaskets: 1/16-inch thick preformed neoprene gaskets.

2.3 BALL VALVES

A. Manufacturers:
1. Conbraco
2. Crane Valve, North America
3. Hammond Valve
4. Milwaukee Valve
5. NIBCO, Inc.
6. Stockham Valves & Fittings
7. Approved equal.

B. 1/4 inch to 1 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids, full port.

C. 1-1/4 inch to 2 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids, conventional port.

2.4 LOCKABLE BALL VALVES

A. Manufacturers:
1. Crane Valve, North America
2. Hammond Valve
3. Milwaukee Valve
4. NIBCO, Inc.
5. Stockham Valves & Fittings
6. Approved equal.

B. 1/4 inch to 1 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle with lockable slide, UL 842 listed for flammable liquids and LPG, full port.

C. 1-1/4 inch to 3 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle with lockable slide, UL 842 listed for flammable liquids and LPG, conventional port.

2.5 CAST IRON, NONLUBRICATED PLUG VALVES

A. Manufacturers:
1. McDonald
2. Mueller
3. Crane
4. Approved equal

B. 2-1/2 inch to 4 inch:

1. Construction: Regular pattern, quarter turn, conforming to MSS SP-78
2. Service: Suitable for natural-gas service with "WOG" indicated on valve body
3. Body: Cast iron, complying with ASTM A 126, Class B
4. Plug: Bronze or nickel-plated cast iron
5. Ends: Flanged, ASME B16.1 and B16.10, or threaded.
6. Pressure class: 200 CWP

2.6 STRAINERS

A. 2 inch and Smaller: Threaded iron body for CWP 125 psig, Y pattern with stainless steel perforated screen.

B. 2-1/2 inch to 4 inch: Flanged iron body for CWP 125 psig, Y pattern with stainless steel perforated screen.

C. 5 inch and Larger: Flanged iron body for CWP 125 psig, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

2.7 Appliance Flexible Connectors:

A. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.

B. Corrugated stainless-steel tubing with polymer coating.

C. Operating-Pressure Rating: 0.5 psig.

D. End Fittings: Zinc-coated steel.

E. Threaded Ends: Comply with ASME B1.20.1.

F. Maximum Length: 72 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.

H. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Sections 23 05 09 and 07 84 00.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Do not install valves in concealed spaces.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.

L. When tubing is installed vertically in stud walls provide 16 gauge steel striker plates to protect tubing. Plates to extend 4” beyond tubing.

M. Provide support for utility meters in accordance with requirements of utility company.

N. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood.

O. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting. Refer to Section 09 91 00.

P. Install valves with stems upright or horizontal, not inverted.

Q. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

R. Install gas pressure regulator vent full size opening on regulator and terminate outdoors.

## 3.4 FIELD QUALITY CONTROL

A. Inspect, pressure test, and purge natural gas piping in accordance with NFPA 54 and NFPA 56PS.

## 3.5 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
   1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
   2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
   3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
   4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
   5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Heating and chilled water piping, aboveground.
2. Equipment drains and over flows.
3. Unions and flanges.

B. Related Sections:
1. Section 23 05 53 - Mechanical Identification: Product requirements for pipe identification for placement by this section.
2. Section 23 07 01 - Mechanical Insulation: Product requirements for Piping Insulation for placement by this section.
3. Section 23 21 13.10 - Piping Specialties: Product and execution requirements for piping specialties used in heating and cooling piping systems.
4. Section 23 21 23 - Pumps: Product and execution requirements for pumps used in heating and cooling piping systems.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
4. ASME B31.9 - Building Services Piping.
5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM B32 - Standard Specification for Solder Metal.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
7. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

8. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

## 1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

B. Provide flanges, union, and couplings at locations requiring servicing. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

C. Provide pipe hangers and supports in accordance with ASME B31.9, MSS SP 58, and MSS SP 69.

D. Use ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Use ball valves for throttling, bypass, or manual flow control services.

F. Use 3/4 ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

## 1.4 SUBMITTALS

A. Shop Drawings: Indicate schematic layout of piping system, including equipment, critical dimensions, and sizes.

B. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

C. Test Reports: Indicate results of piping system pressure test.

D. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves, equipment and accessories.

B. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 HEATING WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53, Schedule 40, black.
1. Fittings: ASME B16.3, malleable iron or ASTM A234/A234M, forged steel welding type fittings.
2. Joints: Threaded, or welded.

B. Copper Tubing: ASTM B88, Type L, hard drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
3. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.2 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tubing: ASTM B88, Type L hard drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.3 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with soldered.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install water piping in accordance with ASME B31.9.

B. Route piping parallel to building structure and maintain gradient.

C. Install piping to conserve building space, and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls and floors.

F. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

G. Install pipe identification in accordance with Section 23 05 53.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

J. Install valves with stems upright or horizontal, not inverted.

K. Located valves in accessible locations. Located valves above ceiling access doors in rooms with hard ceilings. Add ceiling access doors as required. Coordinate with architect.

L. Insulate piping; refer to Section 23 07 01.

3.3 FIELD QUALITY CONTROL

A. Test water piping system in accordance with ASME B31.9 and as follows:

1. Leave joints, including welds, un-insulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from trsting.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on piping:

1. Use ambient temperature water as a testing medium unless there is a risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure, but not less than 100 psi. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical run does not exceed 90 percent of specified minimum yield strength or 1.7 times “SE” value in Appendix A of ASME B31.9,. “Building Services Piping”.

4. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
5. Prepare written report of testing.

C. Check expansion tanks to determine that they are not bound and that system is full of water.

END OF SECTION

SECTION 23 21 13.10

PIPING SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pressure gages.
2. Pressure gage taps.
3. Thermometers.
4. Thermometer supports.
5. Test plugs.
6. Flexible connectors.
7. Air vents.
8. Air separators.
9. Strainers.
10. Balancing valves.
11. Automatic flow control valves.

B. Related Sections:
1. Section 23 21 23 - Pumps: Execution requirements for piping connections to products specified by this section.
2. Section 22 00 00- Plumbing: Execution requirements for piping connections to products specified by this section.
3. Section 23 21 13 - Hydronic Piping: Execution requirements for piping connections to products specified by this section.
4. Section 23 22 13 – Steam, Condensate, and Chilled Water Piping: Execution requirements for piping connections to products specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

B. American Society for Testing and Materials:
1. ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications.
2. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
3. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
4. ASTM E1 - Standard Specification for ASTM Thermometers.
5. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

1.3 SUBMITTALS

A. Section 01330 - Submittals: Submittal procedures.

B. Product Data: Submit for manufactured products and assemblies used in this Project.
1. Manufacturer’s data indicating use, operating range, total range, accuracy, and location for manufactured components.
2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
4. Submit electrical characteristics and connection requirements.
5. Submit balance valve data including size, design flow, minimum and maximum flows, pressure drop.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection, and hookup configuration. Include pipe and accessory elevations.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Contract Closeout: Closeout procedures.

B. Project Record Documents: Record actual locations of components and instrumentation.

C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.7 FIELD MEASUREMENTS

A. Verify field measurements before fabrication.

1.8 WARRANTY

A. Furnish manufacturer's standard warranty for piping specialties.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

A. Available Manufacturers:
1. Weiss, Model 4CTS-1.

B. Gage: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
1. Case: Stainless steel.
2. Bourdon Tube: Phosphor bronze.
3. Dial Size: 4-1/2 inch diameter.
4. Mid-Scale Accuracy: One percent.
5. Scale: Psi.
6. Range: Normal operating pressure shall be mid-range of pressure gage.

2.2 PRESSURE GAGE TAPS

A. Available Manufacturers:
1. H.O. Trerice.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 300 psi.

C. Ball Valve: Brass 1/4 inch NPT for 250 psi.

D. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

E. Siphon: Brass, 1/4 inch NPT angle or straight pattern.

2.3 STEM TYPE THERMOMETERS

A. Available Manufacturers:
1. Weiss, Model 7VU35.

B. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
   1. Size: 7 inch scale.
   2. Window: Clear glass.
   3. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
   4. Accuracy: 2 percent.
   5. Calibration: Both degrees F and degrees C.
   6. Range:
      a. Heating Hot Water: 50 - 300 Deg F.
      b. Chilled Water: -20 - 120 Deg F.
      c. Domestic Hot Water: 0 - 200 Deg F.

2.4 DIAL THERMOMETERS

A. Available Manufacturers:
   1. Weiss, Model 5BM25.

B. Thermometer: ASTM E1, stainless steel case, adjustable angle with front calibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
   1. Size: 5 inch diameter dial.
   2. Lens: Clear glass.
   3. Stem Length: 2-1/2 inches
   4. Accuracy: 1 percent.
   5. Calibration: Both degrees F and degrees C.
   6. Range:
      a. Heating Hot Water: 50 - 300 Deg F.
      b. Chilled Water: -20 - 120 Deg F.
      c. Domestic Hot Water: 0 - 200 Deg F.

2.5 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.6 TEST PLUGS

A. Available Manufacturers:
   1. Weiss, Model BP25-NR.

B. 1/4 inch NPT brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with:
   1. Nordel core for temperatures up to 275 degrees F.

C. Test Kit:
   1. Carrying case, internally padded and fitted containing:

a. One 2-1/2 inch diameter pressure gages.
   1) Scale range: 0 to 60 psi.
b. One gage adapters with 1/8 inch probes.
c. One 1 inch dial thermometers.
   1) Scale range: 0 to 300 degrees F.

2.7 FLEXIBLE CONNECTORS

A. Available Manufacturers:
   1. Flexicraft, Model TTL.

B. Corrugated bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 150 psig at 350 Deg F.

2.8 AIR VENTS

A. Available Manufacturers:
   1. Armstrong.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:
   1. Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.9 STRAINERS

A. Available Manufacturers:
   1. Conbraco.

B. Y-Pattern Strainers: Size 2 inch and Smaller:
   1. Body Construction: Cast bronze.
   2. Working Pressure: 300 psi at 150 Deg F WOG.
   3. Type 304 stainless steel screen – 100 mesh.
   4. Connections: NPT.
   5. Self cleaning blow-off connection.

C. Y-Pattern Strainers: Size 2-1/2 inch and Larger:
   1. Body Construction: Cast iron.
   2. Working Pressure: 200 psi at 150 Deg F WOG.
   3. Type 304 stainless steel screen.
   4. Connections: Flanged.

5. Self cleaning blow-off connection.
6. Pointer and scale.

2.10 BALANCING VALVES

A. Available Manufacturers:
1. Taco, Model ACUF.

B. Balancing Valves
1. Construction:
a. Size ½ to 2 inch: Bronze body.
b. Size 2-1/2 to 4 inch: Cast iron body.
c. Teflon seats.
d. O-ring seal.
2. Connections:
a. Size ½ to 2 inch: threaded.
b. Size 2-1/2 to 4 inch: flanged.
3. Accuracy: 3 percent full scale.
4. Calibrated nameplate with tamper resistant memory stop.
5. Pressure port connections.
6. Drain port.

2.11 AUTOMATIC FLOW CONTROL VALVE

A. Available Manufacturers:
1. Flow Design, Inc Autoflow, Model YR, and AC.
2. Approved equivalent.

B. The gpm for the automatic flow control valves shall be factory set and shall automatically limit the rate of flow to within 5 percent of the specified gpm over at least 95 percent of the control range. The internal wear surfaces of the valve cartridge must be stainless steel.

C. The internal flow cartridge shall be permanently marked with the gpm and spring range.

D. The flow cartridge shall be removable from the housing without use of special tools to provide access for regulator changeout, inspection and cleaning without breaking the main piping.

E. Each valve shall have two pressure/temperature test ports, arranged to provide a reading of differential pressure across the flow limiting mechanism.

F. Minimum 5 year product warranty.

PART 3 EXECUTION

3.1 INSTALLATION - THERMOMETERS AND GAGES

A. Install gage taps in piping

B. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Install siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Allow clearance from insulation.

D. Install thermometers in air duct systems on flanges.

E. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

F. Locate duct-mounted thermometers minimum 10 feet downstream of mixing-dampers, coils, or other devices causing air turbulence.

G. Coil and conceal excess capillary on remote element instruments.

H. Provide instruments with scale ranges selected according to service with largest appropriate scale.

I. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

J. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 INSTALLATION - HYDRONIC PIPING SPECIALTIES

A. Locate test plugs as indicated on Drawings.

B. Where large air quantities accumulate, provide enlarged air collection standpipes.

C. Install manual air vents at system high points.

D. Provide access panels in hard ceiling or walls where required to provide access to hydronic piping specialties.

E. For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.

F. Provide drain and hose connection with valve on strainer blow down connection.

G. Pipe relief valve outlet to nearest floor drain.

H. Automatic Flow Control Valves: the differential pressure across the automatie flow control valve shall be measured for flow verification and to determine the amount of system over heading or under pumping. Install automatic flow control valves on the return lines of coils as indicated on the plans. Install on supply side of coils, a Y-strainer (10 mesh) with brass blowdown valve with ¾" hose end connection with cap.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not install hydronic pressure gauges until after systems are pressure tested.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Refrigerant piping.
2. Unions, flanges, and couplings.
3. Refrigerant moisture and liquid indicators.
4. Valves.
5. Refrigerant filter-driers.
6. Refrigerant solenoid valves.
7. Refrigerant expansion valves.
8. Electronic expansion valves.

B. Related Sections:
1. Section 23 05 29 - Hangers and Supports: Product requirements for pipe hangers and supports, sleeves, and firestopping for placement by this section.
2. Section 23 05 48- Mechanical Sound, Vibration, and Seismic Control: Product requirements for Vibration Isolation for placement by this section.
3. Section 23 05 53 - Mechanical Identification: Product requirements for pipe identification for placement by this section.
4. Section 23 07 01 - Mechanical Insulation: Product requirements for Piping Insulation for placement by this section.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
1. ARI 710 - Liquid-Line Driers.
2. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.
3. ARI 750 - Thermostatic Refrigerant Expansion Valves.
4. ARI 760 - Solenoid Valves for Use with Volatile Refrigerants.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. American Society of Mechanical Engineers:
1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B31.5 - Refrigeration Piping.
4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. ASTM International:

1. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
2. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

E. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. Underwriters Laboratories Inc.:
1. UL 429 - Electrically Operated Valves.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittals: Submittal procedures.

B. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.

C. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Refrigerant Specialties: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes for the following:
   a. Refrigerant moisture and liquid indicators.
   b. Refrigerant filter-driers.
   c. Refrigerant solenoid valves.
   d. Refrigerant expansion valves.
   e. Electronic expansion valves.

D. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of refrigerant leak test.

F. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves, equipment and refrigerant accessories.

C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.5 code for installation of refrigerant piping systems.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.

C. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01 70 00 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for valves excluding packing.

1.11 EXTRA MATERIALS

A. Furnish two refrigerant filter-dryer cartridges of each type.

PART 2 PRODUCTS

2.1 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn [or annealed].
1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B. Copper Tubing to 7/8 inch OD: ASTM B88, Type K, annealed.
1. Fittings: ASME B16.26 cast copper, compression type.
2. Joints: Flared.

2.2 UNIONS, FLANGES, AND COUPLINGS

A. 2 inches and Smaller:
1. Copper Pipe: Bronze, soldered joints.

B. 2-1/2 inches and Larger:
1. Copper Piping: Bronze.
2. Gaskets: 1/16 inch thick preformed neoprene.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 REFRIGERANT MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co. Model AMI.
2. Substitutions: Section 01600 - Product Requirements.

B. Indicators:
1. Port: Single, UL listed.
2. Body: Copper or brass, flared or solder ends.
3. Sight glass: Color-coded paper moisture indicator and plastic cap.
4. Maximum working pressure: 500 psig.
5. Maximum working temperature: 200 degrees F.

2.4 VALVES

A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Substitutions: Section 01600 - Product Requirements.

B. Ball Valves:
1. Hermetic design, forged brass body with RPTFE seals and seats, copper tube extensions, brass seal cap, chrome plated ball, soldered ends.

2. Maximum working pressure: 500 psig and
3. Maximum working temperature: 300 degrees F.

C. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, flared or solder ends.
2. Maximum working pressure: 500 psig.

D. Refrigerant Check Valves:
1. Manufacturers:
   a. Alco Controls Div, Emerson Electric Co. Model ACK.
   b. Substitutions: Section 01600 - Product Requirements.
2. Straight Through Type: Hermetic design
   a. Spring, neoprene seat.
   b. Built-in 30 mesh, stainless steel screen.
   c. Maximum working pressure: 500 psig.
   d. Maximum working temperature: 200 degrees F.

## 2.5 REFRIGERANT FILTER-DRIERS

A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Substitutions: Section 016000 - Product Requirements.

B. Replaceable Cartridge Angle Type:
1. Shell: ARI 710, UL listed, removable cap, for maximum working pressure of 500 psig.
2. Filter/Dryer Cartridge: lined sized pleated media with solid core sieve with activated alumina.
3. Filtration: 40 microns.
4. Finish: Epoxy powder.
5. Line sized connections.

C. Permanent Straight Through Type:
1. ARI 710, UL listed, steel shell with molded desiccant filter core, for maximum working pressure of 500 psig.
2. Finish: Epoxy powder.
3. Line sized connections.

## 2.6 REFRIGERANT SOLENOID VALVES

A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Substitutions: Section 016000 - Product Requirements.

B. Valve: ARI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly, with flared, solder, or threaded ends; for maximum working pressure of 500 psig. Stem designed to allow manual operation in case of coil failure.

C. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box.

2.7 REFRIGERANT EXPANSION VALVES

A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Substitutions: Section 016000 - Product Requirements.

B. Angle or Straight Through Type: ARI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with replaceable capillary tube and remote sensing bulb.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and oversized at part load.

2.8 ELECTRONIC EXPANSION VALVES

A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Substitutions: Section 016000 - Product Requirements.

B. Valve:
1. Brass bodies with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.
2. Capacity: As required.

C. Evaporation Control System:
1. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, pre-selection allowance for electrical defrost and hot gas bypass.

D. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Route piping parallel to building structure and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 230529.

E. Install pipe identification in accordance with Section 230548.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 083100.

H. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

I. Flood refrigerant piping system with nitrogen when brazing.

J. Install valves with stems upright or horizontal, not inverted.

K. Insulate piping; refer to Section 230701.

L. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.

M. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

N. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

O. Provide electrical connection to solenoid valves. Refer to Section 26.

P. Fully charge completed system with refrigerant after testing.

Q. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

R. Install refrigerant piping in accordance with ASME B31.5.

3.3 INSTALLATION - REFRIGERANT SPECIALTIES

A. Refrigerant Liquid Indicators:
1. Install line size liquid indicators downstream of liquid solenoid valves.

B. Refrigerant Valves:
1. Install service valves at equipment suction and discharge.

C. Filter-Dryers:
1. Install permanent filter-dryers in low temperature systems.
2. Install permanent filter-dryer in systems containing hermetic compressors.
3. Install replaceable cartridge filter-dryer vertically in liquid line adjacent to receivers.
4. Install replaceable cartridge filter-dryer upstream of each solenoid valve.

D. Solenoid Valves:
1. Install in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Install in liquid line of single or multiple evaporator systems.
3. Install in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

3.4 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test refrigeration system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using halide torch or electronic leak detector.

C. Repair leaks.

D. Retest until no leaks are detected.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Duct Materials.
2. Flexible ducts.
3. Insulated flexible ducts.
4. Single wall spiral round ducts.
5. Double wall spiral round ducts.
6. Ductwork fabrication.

B. Related Sections:
1. Section 23 05 29 - Hangers and Supports: Product requirements for hangers, supports and sleeves for placement by this section.
2. Section 23 33 00 - Duct Accessories: Product requirements for duct accessories for placement by this section.
3. Section 23 07 01 Insulation: Duct liner.

1.2 REFERENCES

A. American Society for Testing and Materials:
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

C. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Air Duct Leakage Test Manual.
2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

A. Section 01300 - Submittal: Submittal procedures.

B. Shop Drawings: Submit duct fabrication drawings indicating:
1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
3. Fittings.
4. Reinforcing details and spacing.
5. Seam and joint construction details.
6. Penetrations through fire rated and other walls.
7. Terminal unit installations.
8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

C. Product Data: Submit data for duct materials.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 – Contract Closeout: Closeout procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A Standard.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with documented experience.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.

B. Stainless Steel Ducts: ASTM A167, type 304 or 316.

C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum connectors and bar stock; alloy 6061-T6 or of equivalent strength.

D. Fasteners: Rivets, bolts, or sheet metal screws.

E. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 FLEXIBLE DUCTS

A. Available Manufacturers:
1. Buckley, Model Fabri-flex, type 2 Insulated.
2. Approved Equal.

B. Product Description: Trilaminate of aluminum, fiberglass, and polyester inner liner supported by helical wound galvanized spring steel wire.
1. Pressure Rating: 12 inches wg positive and 5.0 inches wg negative (up to 16" diameter).
2. Maximum Velocity: 5500 fpm .
3. Temperature Range: -20 degrees F to 250 degrees F.

2.3 INSULATED FLEXIBLE DUCTS

A. Available Manufacturers:
1. Buckley, Model Fabri-flex, type 2 Insulated.
2. Approved Equal.

B. Product Description: Trilaminate of aluminum, fiberglass, and polyester inner liner supported by helical wound galvanized spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
1. Pressure Rating: 12 inches wg positive and 5.0 inches wg negative (up to 16" diameter).
2. Maximum Velocity: 5500 fpm .
3. Temperature Range: -20 degrees F to 250 degrees F.
4. Thermal Resistance: C factor of 0.23 max.

C. Flexible Duct Connectors: Clamps shall be stainless steel band with cadmium plated hex screw to tighten band worm gear action in sizes 3 through 18 inches, to suit size and adhesive mastic.

2.4 SINGLE WALL SPIRAL ROUND DUCTS

A. Available Manufacturers:
1. McGill AirFlow Corporation.
2. Approved Equal.

B. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

C. Construct duct with the following minimum gages:

| | Diameter | Gauge |
|---|---|---|
| 1. | 3 inches to 14 inches | 26 |
| 2. | 15 inches to 26 inches | 24 |
| 3. | 28 inches to 36 inches | 22 |
| 4. | 38 inches to 50 inches | 20 |
| 5. | 52 inches to 84 inches | 18 |

D. Construct fittings with the following minimum gages:

| | Diameter | Gauge |
|---|---|---|
| 1. | 3 inches to 14 inches | 24 |
| 2. | 15 inches to 26 inches | 22 |
| 3. | 28 inches to 36 inches | 20 |
| 4. | 38 inches to 50 inches | 20 |
| 5. | 52 inches to 60 inches | 18 |
| 6. | 62 inches to 84 inches | 16 |

## 2.5 DOUBLE WALL SPIRAL ROUND DUCTS

A. Available Manufacturers:
1. McGill AirFlow Corporation.
2. Approved Equal.

B. Product Description: UL 181, Class 1, round spiral lockseam double wall duct constructed of galvanized steel, with 2” of fiberglass insulation between the walls. Ducts and fittings shall be by the same manufacturer.

C. Construct duct with the following minimum gages:

| | Diameter | Gauge |
|---|---|---|
| 1. | 3 inches to 14 inches | 26 |
| 2. | 15 inches to 26 inches | 24 |
| 3. | 28 inches to 36 inches | 22 |
| 4. | 38 inches to 50 inches | 20 |
| 5. | 52 inches to 84 inches | 18 |

D. Construct fittings with the following minimum gages:

| | Diameter | Gauge |
|---|---|---|
| 1. | 3 inches to 14 inches | 24 |
| 2. | 15 inches to 26 inches | 22 |
| 3. | 28 inches to 36 inches | 20 |
| 4. | 38 inches to 50 inches | 20 |
| 5. | 52 inches to 60 inches | 18 |
| 6. | 62 inches to 84 inches | 16 |

2.6 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes whether the vanes are indicated on the project plans or not. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Maximum length of installed flex duct shall be 4 feet. Flexible duct installation shall be in strict accordance with the details included in the construction drawings.

C. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8-inch and smaller.

E. Install duct hangers and supports in accordance with Section 23 05 29.

F. Use double nuts and lock washers on threaded rod supports.

G. Connect terminal units to supply ducts directly or with maximum 12 inch length of flexible duct. Do not use flexible ducts to change direction.

H. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions.

I. Seal duct seams and joints according to SMACNA's HVAC Duct Construction Standard – Metal and Flexible for duct pressure class indicated.

J. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

K. Coordinate layout with suspended ceiling, fire and smoke dampers, lighting layouts, and similar finished work.

L. Fire-rated partition penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant.

M.

N. Seal ducts before external insulation is applied.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers or light troffer boots to low pressure ducts with 3 feet maximum length of flexible duct held in place with strap or clamp.

C. Connect air terminal unit inlets with 3 feet maximum length of flexible duct held in place with strap or clamp.

3.4 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.5 SCHEDULES

DUCTWORK MATERIAL SCHEDULE

| AIR SYSTEM | MATERIAL |
|---|---|
| Supply | Steel |
| Return and Relief | Steel |
| General Exhaust | Steel |
| Outside Air Intake | Steel |
| Kitchen Hood Exhaust | Steel, Stainless Steel |

DUCTWORK PRESSURE CLASS SCHEDULE

| AIR SYSTEM | PRESSURE CLASS |
|---|---|
| Constant Volume Supply | 1 inch wg |
| Variable Volume Supply Upstream VAV Boxes | 3 inch wg |
| Variable Volume Supply Downstream VAV Boxes | 1 inch wg |
| Kitchen Exhaust | 2-1/2 inch wg (negative) |
| Return and Relief | 1 inch wg (negative) |
| General Exhaust | 1 inch wg (negative) |

END OF SECTION

SECTION 23 33 00

DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Duct access doors.
2. Fire dampers.
3. Smoke dampers
4. Combination Fire/Smoke dampers
5. Volume control dampers.
6. Backdraft dampers.
7. Flexible connectors
8. Duct test holes.
9. Turning vanes

B. Related Sections:
1. Section 23 31 00 - Ducts: Requirements for duct construction and pressure classifications.

1.2 REFERENCES

A. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

B. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. Underwriters Laboratories Inc.:
1. UL 33 - Heat Responsive Links for Fire-Protection Service.
2. UL 555 - Fire Dampers.
3. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

1.3 SUBMITTALS

A. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.

B. Product Data: Submit data for shop fabricated assemblies including fire dampers including locations and ratings, flexible duct connections, volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of access doors and test holes.

B. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

1.7 COORDINATION

A. Coordinate Work where appropriate with building control Work.

B. Coordinate equipment requiring access with ceiling access doors in rooms with hard ceilings. Add access doors as required. Coordinate with architect.

PART 2 PRODUCTS

2.1 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Construction: 24 gauge, galvanized steel with sealing gaskets and quick fastening locking devices; double-walled construction with 1- inch thick insulation.
1. Less Than 12 inches square, secure with sash locks.
2. Up to 18 inches Square: Furnish two hinges and two sash locks.
3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
4. Larger Sizes: Furnish additional hinge.
5. Compression Latch: Zinc plated; cam type.
6. Hinge: Steel
7. Gasket: 0.125-inch thick neoprene.

2.2 FIRE DAMPERS

A. Available Manufacturers:
1. Air Balance Inc.
2. Approved Equal.

B. Fabricate in accordance with NFPA 90A and UL 555, and manufacturer’s condition of listing. Permanently mark dampers for use in dynamic systems.

C. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Furnish stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0-inch pressure class ducts up to 12 inches in height.

E. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

## 2.3 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.

C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

D. Quadrants:
1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches furnish regulator at both ends.

E. Remote Operators:
1. Furnish cable-operated remote controlled volume dampers in branch ducts in inaccessible ceilings and where otherwise indicated. Dampers are adjustable at ceiling with standard tools in concealed ceiling cup.
2. Galvanized steel square-shafted damper shall be worm gear actuated via a brass plated rotary cable which is captured at the damper end by a shaft coupling integral to the worm gear assembly.
3. Cup, cable, and worm gear shall be furnished from the factory as one assembly by Metropolitan Air Technology or approved equal.

## 2.4 BACKDRAFT DAMPERS

A. Product Description: Multi or single blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel, or extruded aluminum. Blades, maximum 6 inch width, center pivoted, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.5 FLEXIBLE CONNECTORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Connector: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
2. Net Fabric Width: Approximately 2 inches wide.
3. Metal: 3 inch wide, 24 gage galvanized steel.

2.6 DUCT TEST HOLES

A. Permanent Test Holes: Factory fabricated flanges fittings with screw cap. Furnish extended neck fittings to clear insulation.

2.7 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards- Metal and Flexible."

B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch wide, curved blades set ¾ inches on-center; support with bars perpendicular to blades set 2 inches on-center; set into side strips suitable for mounting in ducts.

2.8 COMBINATION FIRE AND SMOKE DAMPER

A. Maximum pressure drop for damper assembly shall be 0.05 inches w.g. at 1500 fpm duct face velocity.

B. Dampers shall be UL listed and tested in accordance with UL 555 test criteria and shall be further qualified under UL 555S as a leakage rated damper for use in smoke control systems. The leakage rating shall be no higher than class 1 (4 cfm/sq.ft. at 1 inch w.g.) at 250°F elevated temperature category. UL leakage ratings shall apply to sizes of dampers required herein, and elevated temperature ratings shall apply to operators as well as dampers.

C. Each combination fire and smoke damper shall be equipped with a UL classified firestat which shall function to close damper when duct temperature exceeds 165°F. Firestat package shall

include two damper position indicator switches, both linked directly to a damper blade, to provide capabilities of remotely indicating damper position (open or closed). Firestat and damper position indicators shall have capability of interfacing electrically with smoke detectors, building fire alarm systems and remote indicating/control stations. Motor operator shall be 24 volt electric actuated normally closed.

D. Motor damper and firestat assembly shall have maximum draw of 4.0 amps.

E. Firestat position indicator shall have capabilities of electrically locking damper in a closed position whenever duct temperatures exceed 165°F and the capability of permitting appropriate authority to override the smoke detector and re-open damper as may be required to permit desired smoke control functions only. Damper shall remain closed when firestat temperature is above 165°F.

F. Combination motor/fire dampers shall be Ruskin FSD60 or equivalent.

G. Firestat shall be Ruskin Model TS150 or equivalent.

2.9 SMOKE DAMPERS

A. Maximum pressure drop for damper assembly shall be 0.05 inches w.g. at 1500 fpm duct face velocity.

B. Dampers shall be UL listed and tested in accordance with UL 555 test criteria and shall be further qualified under UL 555S as a leakage rated damper for use in smoke control systems. The leakage rating shall be no higher than class 1 (4 cfm/sq.ft. at 1 inch w.g.) at 250°F elevated temperature category. UL leakage ratings shall apply to sizes of dampers required herein, and elevated temperature ratings shall apply to operators as well as dampers.

C. Each smoke damper shall be equipped with two damper position indicator switches, linked directly to a damper blade to provide damper position indication (open or closed) at a remote location. Damper position indicators shall have capability of interfacing electrically with building fire alarm systems and remote indicating/control stations.

D. Motor operator shall be 24 volt electric actuated normally closed.

E. Motor damper assembly shall have a maximum draw of 4.0 amps.

F. Smoke dampers shall be Ruskin FSD60 or approved equivalent.

G. Equivalent manufacturers: Ruskin, Prefco, National Control Air, Safe-Air, Greenheck.

2.10 DUCT PRESSURE RELIEF DOOR

A. Duct pressure relief doors shall be equivalent to Ruskin PRD18 pressure relief door. Door shall be 12 gauge galvanized steel with polyurethene foam seal, adjustable to relieve pressures from 3 inches to 8 inches positive or negative.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rated walls are ready for fire damper installation.

B. Verify ducts and equipment installations are ready for accessories.

C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Install duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire and smoke dampers, at humidifier dispersion panels and as indicated on Drawings. Install duct access doors at maximum 50 foot spacing. Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Review locations prior to fabrication.

C. Install temporary duct test holes required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

D. Install flexible connectors at all duct connections to fan powered equipment. Install flexible duct to equipment and ductwork with stainless steel or plastic tie straps.

E. Provide fire dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install volume dampers for balancing upstream of each diffuser and grille. Also install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install

dampers with hat channel of same depth as liner, and terminate liner with nosing at hat channel. Locate balancing dampers above ceiling access doors in rooms with hard ceilings or cable-operated remote controlled volume dampers. Add ceiling access doors as required. Coordinate with architect.

G. Install turning vanes on all mitered elbows with a direction change greater than 45°.

H. Install fire and smoke dampers according to UL listing.

3.3 DEMONSTRATION

A. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Centrifugal fans.
2. Propeller wall fans.

B. Related Sections:
1. Section 23 07 01 - Mechanical Insulation: Product requirements for power ventilators for placement by this section.
2. Section 23 31 00 - Ducts: Product requirements for hangers for placement by this section.
3. Section 23 33 00 - Duct Accessories: Product requirements for duct accessories for placement by this section.
4. Section 23 05 13 - Motors: Product requirements for motors for placement by this section.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:
1. AMCA 99 - Standards Handbook.
2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. National Electrical Manufacturers Association:
1. NEMA MG 1 - Motors and Generators.
2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. Underwriters Laboratories Inc.:
1. UL 705 - Power Ventilators.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittals: Submittal procedures.

B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.

C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit fan manufacturers instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 762.

E. Balance Quality: Conform to AMCA 204.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Furnish one-year manufacturer's warranty for general fans.

B. Furnish two-year manufacturer's warranty for combustion air fans.

PART 2 PRODUCTS

2.1 DOWNBLAST CENTRIFUGAL ROOF FANS

A. Manufacturers:
1. Greenheck Corporation Model GB.
2. Loren Cook Company.
3. Penn Ventilation.

B. Fan Unit: Downblast type. V-belt drive, with heavy gauge spun aluminum housing; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets, leak proof.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

D. Wheel: aluminum construction, non-overloading backward inclined centrifugal. Statically and dynamically balanced in accordance to AMCA Standard 204-05.

E. Motor: Open drip proof, high efficiency mounted on vibration isolators, out of the airstream. Accessible for maintenance.

F. Roof Curb: 16 inch high, self-flashing of aluminum construction with continuously welded seams, 1-1/2 inch insulation and curb bottom, and factory installed nailer strip.

G. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 3R.

H. Accessories:
1. NEMA 3R toggle switch mounted and wired, premium efficient motor, 16in roof curb, motorized damper.

I. Performance: As indicated on Drawings.

J. Electrical Characteristics and Components: As indicated on Drawings.

2.2 PROPELLER WALL FANS

A. Manufacturers:
1. Greenheck model SWD.
2. Loren Cook Company.
3. Penn Ventilation.

B. Fan Unit: wall mounted propeller type, direct drive, bolted and welded construction, utilizing corrosion resistant fasteners. The motor shall be mounted on a 12 gauge steel wire guard. The wire guard shall be bolted to a minimum 14 gauge steel panel with continuously welded corners and an integral venturi.

C. Propeller shall have aluminum blades riveted to a painted steel hub. The hub shall be securely fastened to the motor shaft utilizing two setscrews. Propeller shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

D. Motor: Open drip proof, high efficiency type.

E. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor.

F. Accessories:
1. 120v fan speed controller, disconnect mounted and wired, wall collar, wire motor guard.

G. Performance: As indicated on Drawings.

H. Electrical Characteristics and Components: As indicated on Drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Secure roof fans with cadmium plated steel or stainless steel lag screws to roof curb.

B. Suspended Cabinet Fans: Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one-inch flex between ductwork and fan while running.

C. Provide sheaves required for final air balance.

D. Install fans on existing roof penetrations. Modify curbs or provide curb adapters as necessary.

E. Ensure roof openings are square, accurately aligned, correctly located, and in tolerance.

F. Install fans in accordance with manufacturer's instructions.

3.2 FIELD SERVICES

A. Furnish days to start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.3 CLEANING

A. Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding costruction.

3.4 DEMONSTRATION

A. Demonstrate fan operation and maintenance procedures.

3.5 PROTECTION OF FINISHED WORK

A. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

B. Protect installed product and finished surfaces from damage during construction.

END OF SECTION

SECTION 23 36 00

AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Variable volume terminal units.

B. Related Sections:
1. Section 23 09 23 – HVAC Instrumentation and DDC Controls: Controls remote from unit.

1.2 REFERENCES

A. American Refrigeration Institute:
1. ARI 880 - Air Terminals.
2. ARI 885 -Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

B. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

C. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 SUBMITTALS

A. Product Data: Submit data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings indicating airflow, static pressure, heating coil capacity and NC designation. Include electrical characteristics and connection requirements. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 inch to 4 inches wg.

B. Manufacturer's Installation Instructions: Submit support and hanging details, and service clearances required.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists.

1.5 QUALITY ASSURANCE

A. Test and rate air terminal units' performance for air pressure drop, flow performance, and acoustical performance in accordance with ARI 880 and ARI 885. Attach ARI seal to each terminal unit.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.7 COORDINATION

A. Coordinate Work with Section 23 09 23 - HVAC Instrumentation and DDC Controls.

1.8 WARRANTY

A. Furnish five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.1 SINGLE DUCT VARIABLE VOLUME SUPPLY AIR TERMINAL UNITS

A. Available Manufacturers:
1. Trane
2. Approved equal.

B. Product Description: Variable air volume terminal units for connection to central air systems, with hot water heating coils.

C. Identification: Furnish each air terminal unit with identification label and airflow indicator. Include unit nominal airflow, maximum factory-set airflow and minimum factory-set airflow and coil type.

D. Basic Assembly:
1. Casings: Minimum 22 gage galvanized steel.
2. Lining: Hospital grade, 1" dual wall, Non-porous, sealed liner that complies with UL 181 and NFPA 90A. The insulation is covered by an interior liner made of 26 gauge galvanized steel.
3. Insulation: 1.5 lbs per cubic foot density glass fiber, R- value 3.8, with high density facing. All cut edges shall be sealed from the airstream using metal encapsulated edges. All wire penetrations are covered by grommets.
4. Inlet Collar: 18-gauge galvanized steel cylinder to fit standard round duct.
5. Discharge: S slip-and-drive connection.

E. Basic Unit:
1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
2. Volume Damper: Constructed of galvanized steel and with peripheral gasket and self-lubricating bearings; maximum damper leakage: 1 percent of design air flow at 4 inches inlet static pressure.
3. Mount damper operator to position damper normally open.

F. Hot Water Heating Coil:
1. Construction: 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.

G. Sound Ratings: As indicated on Drawing Equipment Schedule.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Verify ductwork is ready for air terminal installation.

### 3.2 INSTALLATION

A. Connect to ductwork as shown on mechanical detail.

B. Install ceiling access doors or locate units above easily removable ceiling components.

C. Locate units above ceiling access doors in rooms with hard ceilings. Add ceiling access doors as required. Coordinate with architect.

D. Support units individually from structure. Do not support from adjacent ductwork.

E. Support air terminal units connected by flexible duct independently of flexible duct.

F. Install transition piece to match flexible duct size to inlet or outlet of variable air volume terminal.

### 3.3 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to scheduled minimum airflow.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Diffusers.
2. Registers
3. Grilles.

B. Related Sections:
1. Section 23 33 00 - Duct Accessories: Volume dampers for inlets and outlets.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittals: Submittal procedures.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Test Reports: Rating of air outlet and inlet performance.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 –Closeout procedures.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.7 WARRANTY

A. Section 01 77 00 – Closeout Procedures: Product warranties and product bonds.

B. Furnish manufacturer's standard warranty for air outlets and inlets.

PART 2 PRODUCTS

2.1 MANUFACTURERED UNITS

A. Manufacturers:
1. Diffusers, registers, and grilles as scheduled on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify inlet and outlet locations.

B. Verify mounting/border type (surface or lay-in) and air-blow pattern with architectural reflected ceiling plan and contractor's approved coordination drawings.

C. Verify ceiling and wall systems are ready for installation.

D. Coordinate color and finish with architect.

3.2 INSTALLATION

A. Install diffusers to ductwork with airtight connection.

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 23 33 00. Install balance dampers in branch to diffusers, grilles, and registers and not in the fixture neck. Locate balancing dampers above ceiling access doors in rooms with hard ceilings or provide remote actuated balancing dampers. Add ceiling access doors as required. Coordinate with architect.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 23 70 00

AIR HANDLING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes modular factory fabricated air-handling units and accessories.

B. Related Sections:
1. Section 15055 – Motors: Product requirements for electric motors for placement by this section.
2. Section 15080 - Mechanical Insulation: Product requirements for insulation for placement by this section.
3. Section 15120 - Piping Specialties: Product requirements for meters and gages for placement by this section.
4. Section 15150 – Sanitary and Vent Piping: Product requirements for unit drain piping connections.
5. Section 15180 - Heating and Cooling Piping: Product requirements for chilled water, and hot water piping connections to air handling units.
6. Section 15820 - Duct Accessories: Product requirements for flexible duct connections for placement by this section.
7. Section 15900 – HVAC Instrumentation and DDC Controls: Controls remote from unit.
8. Section 15940 - Sequence of Operation: Sequences of operation applying to units in this section.
9. Section 15945 – Variable Frequency Drives: Drives for units fan motors
10. Section 16150 - Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:
1. AMCA 99 - Standards Handbook.
2. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
4. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
5. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

C. Air-Conditioning and Refrigeration Institute:
1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

2. ARI 430 - Central-Station Air-Handling Units.
3. ARI Guideline D - Application and Installation of Central Station Air-Handling Units.

D. Air Movement and Control Association International, Inc:
1. AMCA 611-95 – Airflow Monitoring Stations.

E. National Electrical Manufacturers Association:
1. NEMA MG 1 - Motors and Generators.

F. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

G. Underwriters Laboratories Inc.:
1. UL 900 - Air Filter Units.
2. UL - Fire Resistance Directory.

1.3 SUBMITTALS

A. Section 01330 – Submittals: Submittal procedures.

B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

C. Product Data, Submit the following:
1. Published Literature: Indicate capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
3. Fans: Performance and fan curves with specified operating point plotted, power, RPM.
4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring. Indicate factory installed and field installed wiring.

D. Manufacturer's Installation Instructions: Submit.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.

B. All handling and storage procedures shall be per manufacturer's recommendations.

1.7 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

B. The manufacturer's standard warranty shall be for a period of one year from the date of start-up or eighteen months from the date of shipment, whichever occurs first.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS: ACU-13, ACU-14, ACU-15, ACU-16

2.2 MANUFACTURERS

A. Available Manufacturers:
1. Trane Modular Climate Changer.
2. York.
3. McQuay.

B. Configuration: The following chart details the orientation of modules for each air handling unit.

| ***Module*** | ***HVAC-4*** |
|---|---|
| *Air Mixing (Measuring/Mix/Flat-Prefilter)* | **X** |
| *Economizer (Measuring/Mix/Angled-Prefilter)* | |
| *Heating Coil* | **X** |
| *Access* | **X** |
| *Primary Cooling Coil* | **X** |
| *Access* | **X** |
| *Supplemental Cooling Coil* | |
| *Supply Fan Array* | **X** |
| *Diffuser* | **X** |
| *Final Filter* | **X** |
| *Discharge* | **X** |
| *Return Fan* | |

C. Performance Base: Sea level pressure or altitude.

D. Fabrication: Conform to AMCA 99 and ARI 430.

2.3 CASING

A. Channel base of 12-gauge minimum welded steel. Assemble sections with gaskets and bolts.

B. Outside Casing:
1. Galvanized Steel: 18-gauge minimum.

C. Inside Casing:
1. Galvanized Steel: Solid, 20-gauge minimum.

D. Floor Plate:
1. Galvanized Steel: 18-gauge minimum.

E. Insulation: Glass fiber, applied to internal surfaces.
1. 'K' factor at 75 degrees F: Maximum 0.26 Btuh inch/ sq ft/ degrees F.
2. Density: 2 inch thick, 1-1/2 lbs/cu ft.

F. Finish: 1.5 mil enamel finish able to withstand a salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours.

G. Access Doors: Constructed of galvanized steel for flush mounting, with gasket, latch, and handle assembly.

H. Drain Pans: Double thickness stainless steel with insulation between layers with welded corners. Cross break and pitch to drain connection. Furnish drain pans under access sections, moisture eliminator, and all coil sections.

I. Strength: Furnish structure to brace casings for the lesser suction pressure of 1.5 times the static pressure or 8 inches w.g., with maximum deflection of 0.005 inches per inch of panel span.

J. Casing for Exterior Mounted Air Handler (HVAC-4):
1. External Pipe Cabinet: Piping cabinet shall be supplied by the manufacturer and shall be the same construction as the main unit casing. Piping cabinet shall be mounted external to the unit and shipped separate to be field installed. Piping cabinet shall have access door, insulated bottom, and shall be coordinated with steel maintenance platform. The piping cabinet bottom sealing and insulating shall be performed by the mechanical contractor on site after unit installation and piping connections to ensure the cabinet is sealed weathertight.
2. Inlet Hood: Provide inlet hood for each outdoor air intake.
3. Outlet hood: Provide outlet hood for each exhaust air opening intake.
4. Roof Mounting: Unit to be located on structural dunnage by steel contractor. Ductwork roof curbs by mechanical contractor. Ductwork roof openings cut and curb flashed by Roofing Contractor.
5. ACU-16 is an exterior, roof mounted unit. The casing shall be designed for exterior mounting and shall be completely weather-tight. Unit roof shall be sloped at a minimum ¼" per foot, and shall have a 2" overhang on all sides. Unit shall have an R-12 insulation value in all panels, and shall conform to NFPA 90

requirements. External surfaces shall be coated with weather-proof, 1.5 mil enamel finish, and shall be provided in a standard color as selected by the architect. Door gaskets shall have flange for protection from the environment.

2.4 SUPPLY FAN MODULE

A. Type: Backward, inclined airfoil, double width, double inlet, centrifugal type fan.

B. Performance Ratings: Conform to AMCA 210 and label with AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

D. Bearings: Self-aligning pillow block, grease lubricated, ball or roller bearings with an L-50 life of 2000,000 hours.

E. Mounting: Locate fan and motor internally on welded steel base coated with corrosion resistant paint. Factory-mount motor on slide rails. Furnish access to motor, drive, and bearings through removable casing panels or hinged access doors. Mount base on spring vibration isolators.

F. Fan Balancing: For variable speed application, fans shall be balanced over the entire operating range (30% - 100% of RPM).

G. Fan Modulation: Furnish with factory installed Variable Frequency Drive. Refer to Section 15945. VFD to be factory furnished, installed and wired in air handling unit. VFD shall be installed with Isolation Bypass from factory.

H. Flexible Connection: Separate unit from connecting ductwork.

I. Provide 8”x8” shatterproof window in access door.

J. Provide with factory wired vapor proof light with switch mounted on outside of unit.

2.5 COIL MODULE

A. Casing with access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel

B. Drain Pans: 24 inches downstream of coil and down spouts for cooling coil banks more than one coil high.

C. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.

D. Fabrication:
1. Tubes: ½-inch OD seamless copper expanded into fins, brazed joints.
2. Fins: Aluminum.

3. Casing: Die formed channel frame of galvanized steel.

E. Hot Water Heating Coils:
1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.
3. Coils to be coated to minimize deterioration due to concentrations of sea salt in the air.

F. Chilled Water Cooling Coils:
1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.
3. Coils to be coated to minimize deterioration due to concentrations of sea salt in the air.

2.6 ACCESS MODULE

A. A 16” access section with door shall be provided between heating and cooling coil sections on AHU-13 and 14.

B. A 20” access section with door shall be provided between heating and cooling coil sections on AHU-15 and 16.

C. Access doors shall be fully gasketed with zero discernible leakage under actual operating conditions with pressure in housing holding doors closed against gaskets.

2.7 AIR MIXING MODULE (Indoor Air Handlers)

A. Module to include outside airflow measuring station, volume control dampers, return air connection and damper, and flat filter rack.

B. Airflow measuring station shall output signal compatible with Owner’s BAS. Station to be factory calibrated and certified with total accuracy of +/- 5% of actual airflow down to 15% of maximum design airflow.

C. Return and Outside Air dampers to be sized for 100% unit airflow.

2.8 ECONOMIZER MODULE (Outdoor Air Handler)

A. Module to include outside airflow measuring station, volume control dampers, air connections, and angled filter rack.

B. Airflow measuring station shall output signal compatible with Owner’s BAS. Station to be factory calibrated and certified with total accuracy of +/- 5% of actual airflow down to 15% of maximum design airflow.

C. Return and Outside Air dampers to be sized for 100% unit airflow.

D. Rain Hood: A rain hood and bird screen assembly shall protect outdoor and exhaust air dampers for outdoor elements.

2.9 DIFFUSER MODULE

A. A diffuser section shall be provided to assure even distribution of airflow. Diffuser segments shall be constructed with a perforated diffuser plate.

2.10 DISCHARGE PLENUM MODULE

A. A discharge plenum shall be provided to efficiently turn air and provide sound attenuation. Plenum shall have a ¼" wire grid over bottom openings.

B. Gasketed access doors to provide zero discernible leakage under actual operating conditions with pressure in housing holding doors closed against gaskets.

2.11 RETURN FAN MODULE

A. Housed Airfoil fan with brake horsepower no greater than that shown on "M" drawings.

B. Solid steel shaft with heavy-duty, 200,000 hour, greasable ball bearings. Extend grease fittings as required by hospital with copper tubing for ease of maintenance.

C. Fan assembly vibration isolated from air handler bulkheads with 2" spring isolators.

D. Motors
1. Type B, drip-proof, permanently lubricated bearings
2. Designed for operation with variable frequency drive (VFD) and matched to specific VFD that will control respective motor.
3. Designed for low hertz operation without loss of motor or fan life. Coordinate determination of minimum hertz operation with fan manufacturer and controls subcontractor.

E. V belt drive with fixed pitch fan sheave and variable pitch motor sheave.

F. Provide 8"x8" shatterproof window in access door.

G. Provide with factory wired vapor proof light with switch mounted on outside of unit.

H. VFD to be factory furnished, installed and wired in air handling unit. VFD to be installed in sectionalized enclosure and insulated from exterior. VFD shall be installed with Isolation Bypass from factory.

2.12 FILTER MODULE

A. Sectioned with filter guides, access doors from both sides, for side loading with gaskets and blank-off plates. Rack shall be galvanized steel construction.

B. Filter Media: UL 900 listed, Class I.

C. Provide units with filter sections, as shown on schedules, designed to accommodate 2-inch prefilters and high efficiency cartridge filters. Filter frames downstream of supply fans shall be face loading with neoprene gasketing for pressure sealing assembly. Filters shall have efficiency shown on Air Handling Schedule.

D. Filter Gauges: 3-1/2 inch diameter diaphragm actuated dial in metal case.

2.13 DAMPERS

A. Control Dampers shall be low leak design having 16-gauge galvanized steel blades. The damper blades shall be provided with a PVC coated polyester fabric mechanically locked into the blade edge. The jamb shall be a flexible metal, compression type. Leakage shall not exceed 7.20 cfm/square foot at 4 inches w.g. Blades shall be parallel acting.

B. Outdoor Air Damper: 0-100% factory mounted airflow measuring damper assembly. Damper blades shall be galvanized steel, housed in a galvanized steel frame. Leakage shall not exceed 1 percent of nominal airflow at 1 inch w.g.
   1. Airflow Monitoring Output: 2-10 VDC. Transducers provided by DDC controls Contractor.
   2. Measuring Device Accuracy: +/- 5%.

2.14 MOTORS

A. Furnished with units. Refer to Section 15055.

2.15 VARIABLE FREQUENCY DRIVE

A. Furnished with units. Refer to Section 15945 for VFD and Isolation Bypass details.

2.16 CONTROLS

A. Controls: Units shall be shipped without controls. Refer to Mechanical Controls Section 15900 for DDC controls, and Section 15940 for sequence of operation.

2.17 CAPACITY

A. Refer to mechanical schedule.

2.18 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Air Handler shall be provided with all motor disconnect switch with micro-switch to interface with VFD.

B. Roof mounted air handlers to be provided with single point electrical power connection.

C. Refer to mechanical schedules.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install in accordance with ARI 430.

B. Provide modular air handling unit as scheduled on the drawings and specified herein.

C. Install flexible connections between unit and inlet and discharge ductwork. Install metal bands of connectors parallel with minimum 1 inch flex between ductwork and fan while running. Refer to Section 15820..

D. Provide fixed sheaves after final air balance.

E. Installation Hydronic Coil:
1. Make connections to coils with unions or flanges.
2. Connect water supply to leaving airside of coil (counter flow arrangement).
3. Locate water supply at bottom of supply header and return water connection at top.
4. Install water coils to allow draining and install drain connection at low points.
5. Install valves and piping specialties in accordance with details as indicated on Drawings.

F. Install floor mounted units on 6” high concrete bases. See Division 15 Section “Basic Mechanical Materials and Methods” for material and fabrication requirements.

G. Install units to provide all manufacturer recommended service areas and maintenance recommendations.

### 3.2 MANUFACTURER'S FIELD SERVICES

A. Furnish initial start-up.

### 3.3 CLEANING

A. Vacuum coils and inside of unit cabinet. Wipe interior with mild detergent or disinfectant to remove all construction dust and construction coatings.

B. Install new filters in units at Substantial Completion. Install cartridge filters before balancing units.

### 3.4 DEMONSTRATION

A. Section 01700 - Execution Requirements: Requirements for demonstration and training.

B. Demonstrate unit operation and maintenance.

C. Furnish services of manufacturer's technical representative for one, 8 hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.

3.5 PROTECTION OF FINISHED WORK

A. Section 01700 - Execution Requirements: Requirements for protecting finished Work.

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 81 26

DUCTLESS SPLIT SYSTEM AIR-CONDITIONING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Ductless split system air-conditioning units consisting of separate evaporator-fan and compressor condensing unit. Units are designed for exposed mounting.

B. Related Sections:
1. Section 230548 - Mechanical Sound, Vibration, and Seismic Control: Vibration isolators.
2. Section 232113 - Heating and Cooling Piping: Execution requirements for connection to drain piping specified by this section.
3. Section 232300 - Refrigerant Piping: Execution requirements for connection to refrigerant piping specified by this section.
4. Section 233300 - Duct Accessories: Flexible connections.
5. Section 230923 - Direct Digital Controls: Controls remote from unit.
6. Section 26 - Wiring Connections: Electrical connection to units.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
3. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
4. ARI 365 - Commercial and Industrial Unitary Air-Conditioning Condensing Units.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ASTM International:
1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

D. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.

E. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating:
1. Cooling capacities
2. Minimum outdoor ambient conditions.
3. Dimensions.
4. Weights.
5. Rough-in connections and connection requirements.
6. Electrical requirements with electrical characteristics and connection requirements.
7. Controls.
8. Accessories.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of controls installed remotely from units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Energy Efficiency Rating (EER) not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils.

B. Cooling Capacity: Rate in accordance with ARI 210/240.

C. Sound Rating: Measure in accordance with ARI 270.

D. Insulation and adhesives: Meet requirements of NFPA 90A.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.

C. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

D. Protect units from weather and construction traffic by storing in dry, roofed location.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace split system air conditioning units that fail in material and workmanship within five years from the date of substantial completion.

PART 2 PRODUCTS

2.1 DUCTLESS SPLIT SYSTEM AIR CONDITIONING UNITS

A. Manufacturers:
1. Mitsubishi
2. Trane
3. Samsung
4. Model: As Scheduled on Drawings.

B. Product Description: Split system ductless air conditioner including indoor units and outdoor condensing units.

2.2 WALL-MOUNTED UNIT

A. Configuration: Designed for wall-mounted installation. Unit shall be ETL or UL listed.

B. Cabinet:
1. Panels: Constructed of galvanized steel with baked enamel finish.

2. Insulation: Factory applied to each surface to insulate entire cabinet. one inch thick aluminum foil faced glass fiber with edges protected from erosion.

C. Supply Fan: Forward curved, double width wheel of galvanized steel, directly connected to motor.

D. Fan Motor: Multi-speed.

E. Air Filters: 1 inch thick glass fiber disposable media in metal frames. 25 to 30 percent efficiency based on ASHRAE 52.1.

F. Controls: Microprocessor, capable of programmable settings and able to communicate with building managements system. Wall mounted control panel.

G. Air Handling Unit Accessories:
1. Condensate pump.
2. Disconnect.
3. Other as noted on Drawings.

2.3 AIR COOLED, COMPRESSOR CONDENSING UNIT

A. Casing steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: DC inverter-driven twin rotary.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210//240, and with liquid subcooler.

D. Fan: Aluminum propeller type, directly connected to the motor.

2.4 CONTROLS

A. The control system shall be microprocessor based, capable of programmable settings and able to communicate with building managements system. The wall-mounted control enclosure shall include an LCD display providing continuous display of operating status and alarm condition

B. The LCD display shall provide on/off indication, operating mode indication (cooling, heating) and current day, time, temperature indication.

C. Control setpoint parameters: Temp setpoint 65-85ºF, temperature sensitivity 1 to 5 ºF.

2.5 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: In accordance with Section 26 and as shown on Drawings.

B. Disconnect Switch: Factory mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 INSTALLATION – DUCTLESS AIR CONDITIONING UNIT

A. Install air handling units in accordance with manufacturers instructions. Install unit plumb and level, firmly anchored to support the unit's weight in location indicated, and maintain manufacturers clearance recommendations.

B. Connect condensate drains to unit. Unit drain shall be trapped internally, and shall not be trapped externally. See plumbing drawings.

C. Install components furnished loose for field mounting.

D. Install connection to electrical power wiring in accordance with Division 26.

E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3.3 CLEANING

A. Section 017000 - Execution Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install new throwaway filters in units at Substantial Completion.

3.4 PROTECTION OF FINISHED WORK

A. Section 017000 - Execution Requirements: Requirements for protecting finished Work.

B. Do not operate air handling units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 82 39.13

CABINET UNIT HEATERS

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Cabinet unit heaters.

B. Related Sections:
   1. Section 23 21 13.10- Piping Specialties: Product requirements for piping specialties for placement by this section.
   2. Section 23 21 13 - Hydronic Piping: Execution requirements for connection of chilled water, hot water, steam, and drain piping to units specified by this section.

### 1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
   1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

### 1.3 SUBMITTALS

A. Shop Drawings: Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers

B. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### 1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.

B. Operation and Maintenance Data: Submit manufacturer’s descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept units on site in factory packing. Inspect for damage. Store under roof.

B. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.7 WARRANTY

A. Furnish one year manufacturer's warranty for cabinet unit heater motors.

PART 2 PRODUCTS

2.1 CABINET UNIT HEATERS

A. Available Manufacturers:
1. Sterling.
2. Trane.
3. Approved equal.

B. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 100 psi and 220 degrees F.

C. Cabinet: 0.0598 inch thick steel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet and inlet grilles or duct connections as indicated.

D. Finish: Factory applied baked enamel of color as selected on visible surfaces of enclosure or cabinet.

E. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

F. Motor: Tap wound multiple speed [permanent split capacitor] [shaded pole] with sleeve bearings, resiliently mounted.

G. Control: Multiple speed switch, factory wired, located in cabinet.

H. Filter: Easily removed 1 inch thick glass fiber throw-away type, located to filter air before coil.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify wall construction is ready for installation.

B. Verify concealed blocking and supports are in place and connections are correctly located.

C. Coordinate recessed and semi-recessed installations with wall construction.

3.2 INSTALLATION

A. Make connections to coils with unions and flanges.

B. On water coils, install shut-off valve on supply piping and lockshield balancing valve on return piping. Locate water supply at bottom of supply header and return water connection at top. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.

C. Protection: Install finished cabinet units with protective covers during remainder of construction.

D. Cabinet Unit Heaters: Install at locations as indicated on Drawings. Coordinate to assure correct recess size for recessed units.

E. All piping, controls and electrical shall be run concealed in walls.

3.3 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

END OF SECTION

SECTION 23 83 00
RADIANT CEILING HEATING PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Hydronic radiant ceiling heating panels.

B. Related Sections:
1. Section 23 21 13.10 - Piping Specialties: Product requirements for piping specialties for placement by this section.
2. Section 23 21 13- Hydronic Piping: Execution requirements for connection of chilled water, hot water, steam, and drain piping to units specified by this section.

1.2 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Detail equipment assemblies and suspension and attachment. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.

B. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and locations of access doors required for access to valves.

1.4 QUALIFICATIONS

A. Any specializing in manufacturing products specified in this section with minimum three years experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept units on site in factory packing. Inspect for damage. Store under roof.

B. Protect panels and piping from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect piping from entry of dirt and debris with pipe caps or plugs.

PART 2 PRODUCTS

2.1 HYDRONIC RADIANT HEATING PANELS

A. Available Manufacturers:
1. Sterling Modular Radiant Panel.
2. Approved equal.

B. Panels: 18 gauge aluminum sheet with standard square edges or tegular edge detail. Coordinate with Architectural ceiling plans and specifications. Approximate working weight is 1.5lb/sf.

C. Modular lay-in panels to fit in T-bar ceiling grid.

D. Pipework: Seamless copper tubing, 5/8", serpentine, in thermal contact with panel through evenly spaced aluminum saddles.

E. Panels shall be painted with standard baked acrylic powder finish matched to the surrounding acoustic tile ceiling. Final color selection by Architect.

F. Panel dimension shall allow for minimum ¼" expansion in all directions.

G. Design Basis: Sterling.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive radiant heating units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for hydronic piping connections to verify actual locations before radiant heating unit installation.

C. Install the hot water piping system such that the hottest water is always supplied closest to the perimeter wall.

D. Insulation: 3" thick mineral fiber batt insulation with a heat reflecting foil backing (provided and installed by mechanical contractor).

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with Drawings and manufacturer's recommendations.

B. Support for Radiant Heating Panels in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four ceiling support system rods or wires for each panel. Locate not more than 6 inches from panel corners.
2. Support Clips: Fasten to panel and to ceiling grid members at or near each panel corner with clips designed for the application.
3. Panels of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support panels independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on panel. Wire or rod shall have breaking strength of the weight of panel at a safety factor of 3.

C. Unless otherwise indicated, install shutoff valve and union or flange at each connection.

D. Install piping adjacent to unit to allow service and maintenance.

3.3 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units.

B. Touch-up marred or scratched surfaces of factory-finished surfaces, using finish materials furnished by manufacturer.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain radiant panels.

END OF SECTION

SECTION 23 84 13 –

HUMIDIFIERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Gas-fired steam humidifiers.

B. Related Sections:
1. Section 230529 - Hangers and Supports: Product requirements for supports for steam grid humidifiers for placement by this section.
2. Section 230701 - Mechanical Insulation: Execution requirements for insulating humidifier casings specified by this section.
3. Section 221116 - Domestic Water Piping: Execution requirements for cold water supply to units specified by this section.
4. Section 232113 - Heating and Cooling Piping: Execution requirements for connection of chilled water, hot water and steam piping to units specified by this section.
5. Section 233100 - Ducts: Execution requirements for ducts specified by this section.
6. Section 230923 – HVAC Instrumentation and DDC Controls: Control device requirements for units specified by this section.
7. Section 26 - Wiring Connections: Execution requirements for electrical connections to units specified by this section.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
1. ARI 630 - Selection, Installation, Servicing of Humidifiers.

B. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Section 013300 - Submittals: Submittal procedures.

B. Product Data: Submit catalog sheets indicating general assembly, dimensions, weights, materials, and certified performance ratings duct and service connections, electric nameplate data and wiring diagrams.

C. Manufacturer's Installation Instructions: Submit assembly and setting operations.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 – Contract Closeout: Closeout procedures.

B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, cleaning and spare parts lists.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 – Materials and Equipment: Product storage and handling requirements.

B. Accept units on site in factory packing. Inspect for damage.

1.7 WARRANTY

A. Section 017000 – Contract Closeout: Product warranties and product bonds.

B. Furnish two-year manufacturer warranty for units, three years for heat exchangers.

PART 2 PRODUCTS

2.1 GAS FIRED HUMIDIFIER

A. Available Manufacturers:
1. Dri-Steem Humidifier Company
2. Nortec
3. Approved equal

B. Product Description: Packaged gas-fired humidifier with reservoir, injection tube/dispersion panel, and controls, for outdoor installation

C. Medium: Standard Water.

D. Combustion chamber/heat exchanger: Constructed of type 304 stainless steel with welded joints.

E. Removable cover and front access panel for easy cleaning.

F. Cabinet: Outdoor enclosure with electric heater package and roof curb.

G. Gas system with modulating gas valve(s), explosion proof, premix combustion air blower(s), microprocessor controlled ignition, flame sensing and fault indicator light(s),

100% premix infrared burner(s), hot surface igniters(s) and heat transfer efficiency maintained across all operating ranges.

H. Water Fill Valve: Brass body, solenoid operated block style water fill valve with internal strainer factory mounted. Bottom-fill system to prevent collapse of steam head during fill cycle. Located to allow minimum water gap of 1-1/2 inches.

I. Over Temperature Protection: Manual reset over temperature switch factory installed on humidifier reservoir.

J. Injection Tubes: Constructed of Type 304 round stainless steel steam jacketed injection tubes with emission openings to uniform distribution of steam over entire width of duct or air handling unit. Provide sufficient tubes or dispersion panel for rapid absorption in air stream. Furnish duct plate for sealing of duct opening.

K. Humidifier Controls: Microprocessor-based SSR control with the following functions features:
1. Water fill.
2. Water surface skimming.
3. Low water cut-off.
4. Periodic draining of evaporator chamber.
5. BACnet communications protocol.
6. Keypad capable of monitoring and controlling the following:
    a. Relative humidity set point.
    b. Relative humidity high limit set point.
    c. System demand (% humidifier capacity).
    d. System output (lbs.hr).
    e. Real time drain and flush.
    f. System fault indicator.
    g. Air flow proving switch.
    h. Throttling range adjustment.
    i. “Time until Service” message.
7. Water level controlled through sensor mounted on reservoir. Control system continues to maintain humidity during fill cycle.

L. Control Components: Furnish humidifier with the following:
1. Air proving switch.
2. Modulating high limit duct humidistat.

M. Accessories: Furnish humidifier with the following:
1. Automatic timed drain system with motor operated drain valve with brass body, factory installed.
2. Insulation: 1 inch thick glass fiber insulation with aluminum foil facing covering entire unit except front face.
3. SSR Modulating Control: 0 to 100 percent modulation of humidifier output. Factory mounted and wired in control cabinet.
4. Timed cycle modulation: Factory mounted and wired in control panel.
5. Steam hose kit consisting of hoses, injection tube, support rod, hose clamps, and duct plate.

6. Automatic seasonal end-of-use humidifier drain.
7. Auto-selector: Furnish factory mounted and wired dual input, single output auto-selector for single modulating output signal to humidifier control cabinet. Auto-selector allows use of modulating space humidistat and modulating duct high limit humidistat to control critical variable air volume air handling systems. System automatically determines which of two modulating signals is dominant and slowly reduces humidifier output capacity preventing oversaturating of air stream.
8. Condensate cooling system to provide cold water mixing of drain water.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify ductwork is ready for installation.

B. Verify piping rough-ins are correct size and at correct location.

C. Verify power wiring is correct voltage and at correct location.

3.2 INSTALLATION – GAS-FIRED HUMIDIFIERS

A. Install humidifiers and steam dispersion panels per manufacturer's instructions.

B. Seal humidifier dispersion-tube duct penetrations with flange.

C. Install with required clearance for service and maintenance.

D. System shall be rated as class 1 appliance certified for use with exhaust vent type B or class 3 appliance certified for use with exhaust vent type BH.

E. Install loose equipment furnished by manufacturer.

F. Install galvanized steel rods to support distribution manifolds of humidifier and mount in air system plenums.

G. Install galvanized steel rods to support humidifier components.

H. Make connections to equipment with unions or flanges.

I. Connect humidifiers to domestic water and to drain piping. Install shutoff valve and strainer on domestic water piping. Install drain piping with trap of depth recommended by manufacturer.

J. Provide control wiring for field installed accessories.

3.3 FIELD SERVICES

A. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

3.4 DEMONSTRATION

A. Demonstrate operation and maintenance procedures.

END OF SECTION

SECTION 26 05 01

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SYSTEM DESCRIPTIONS

A. The following descriptions are to provide additional information regarding the scope of work, materials and methods and is to be used in conjunction with other sections of this specification and the construction documents or drawings.

1. Service Entrance
A larger padmounted transformer shall be installed by the utility as indicated on the drawings to serve the building along with new CT and meter cabinets, service conduits and conductors and main service breakers. The existing service conduits and conductors shall be abandoned in place. Care shall be taken to not damage the existing primary conductors and conduits.

The contractor is responsible for the following:
a. Furnish all lugs and other material for termination of secondary conductors.
b. Provide and install secondary conduits and conductors into the building subgrade. Furnish secondary lugs and terminate.
c. Install all grounding rods and conductors at the pad and bond to the transformer. Bond to the grounding electrode conductor.
d. Install new main breakers as indicated having an interrupting capacity of 65,000 AIC, SER rated and 100% rated.
e. Provide a transient surge suppressor for each service panel.

2. Panelboards

Install new panelboards and feeders as indicated. Install insulated grounding conductors with all panelboard and branch circuit feeders, size per the NEC Article 250. All panels shall be fully rated with a 22,000 AIC rating (unless otherwise noted), series rated panels shall not be acceptable. Breakers shall be bolt-on type.

3. Lighting
Gray devices and stainless steel plates shall be used. Ballasts shall be electronic type with high power factor and low harmonic distortion as specified in Section 26 51 13 where fluorescent fixtures are used. "Specialty" fixtures and lamps shall not be substituted. Contractor shall refer to architect's reflected ceiling plan to verify ceiling types and fixture mounting option prior to ordering fixtures. Switches are to be installed flush mounted.

4. Receptacles and Branch Circuits

Receptacles will be flush mounted and shall be rated "hospital grade". Ground Fault receptacles shall have pilot lights. All devices shall be commercial grade. Devices shall be gray in color with stainless steel wall plates. All receptacles located in waiting areas shall also be rated as "Tamper Proof". All wiring shall be with "Healthcare Rated" HCF type MC cable or conduit in patient treatment rooms and exam rooms. Conduit and wire shall be utilized for all Life safety wiring, operating rooms and procedure rooms. Other areas of the building may utilize standard MC cable.

5. Telephone

Provide a fire rated ¾" x 4' x 4' plywood panel in the telecommunications room for termination of the Fairpoint and Time Warner entrance cables and branch cabling. Provide a Harger Ground bar with #4 bonding conductor in pvc conduit to the main distribution panel grounding electrode conductor. All wiring shall be Category 6 plenum rated.

6. Computer

Provide a fire rated ¾" x 4' x 4' plywood panel in the telecommunications room for termination of the Fairpoint and Time Warner entrance cables. Provide a Harger Ground bar with #4 bonding conductor in pvc conduit to the main distribution panel grounding electrode conductor. Install cable tray as shown. All wiring shall be Category 6 plenum rated

7. CATV

Contractor shall install conduits, wallboxes, RG-6 quad-shield cable and wallplates and jacks. Install cables from rooms via cable tray. All cabling shall be plenum rated.

All CATV runs over 200 feet in length shall be with RG-11 Quad-shield instead of RG-6.

8. Fire Alarm System

Install a new addressable fire alarm system in the lobby using the same location as the existing panel. All strobes shall be ADA complaint. Install 2 wire multi-candela strobes adjustable in the field. Strobes shall be 75 candela. This system shall include a two line dialer with two telephone connections to outside lines.

9. Emergency and Exit Lighting

All exit signs shall be have red letters, otherwise furnish and install new equipment as indicated the type and model indicated in fixture schedule.

10. Firestopping

The electrical contractor will be responsible for providing all firestopping for the electrical installation. Refer to other sections of the project specification for materials allowed.

11. Temporary Services

Provide temporary facilities in accordance with applicable safety regulations including OSHA.

Power Distribution: Provide weatherproof, grounded circuits with ground fault interruption features, with proper power characteristics and either permanently wired or plug-in connections as appropriate for intended use. Provide overload-protected disconnect switch for each circuit at distribution panel. Space 4-gang convenience outlets (20 amp circuit) so every portion of the work can be reached with 100' extension cords.

Temporary Lighting: Provide lighting of the intensity and quality sufficient for proper and safe performance of the work, and for access thereto and security thereof.

All work will be according to local codes and OSHA standards. Service for this work shall be separately metered and all fees shall be the responsibility of the General Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

B. The following work is not the responsibility of the electrical contractor:
1. Excavation, backfilling for service conduits. Concrete lighting fixture bases and transformer box and pad shall be furnished and installed by the electrical contractor.
2. Roof flashing for electrical conduits.
3. Painting and finishing.

C. 120 volt, electrical power feed requirements of Division 25 are included in this contract. This includes feeds to DDC panels and control devices. Variable frequency drives are furnished by the mechanical contractor and installed by the electrical contractor.

1.3 DEFINITIONS

A. As used in this Section, "provide" shall mean "furnish and install". "Furnish" shall mean "to purchase and deliver to the project site complete with every necessary appurtenance and support," and "Install" shall mean "to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project".

1.4 CODES, PERMITS AND INSPECTION

A. Manufacture, test, and install all work in accordance with applicable publications and standards of the following organizations:
1. American Society for Testing and Materials (ASTM)
2. Underwriters' Laboratories, Inc. (UL)
3. Insulated Power Cable Engineers Association (IPCEA)
4. National Electrical Manufacturers Association (NEMA)
5. Institute of Electrical and Elec Engineers (IEEE)
6. American National Standards Institute (ANSI)
7. National Fire Protection Association (NFPA)
8. Environmental Protection Agency (EPA)
9. Local and State Electrical Codes
10. National Board of Fire Underwriters
11. Occupational Safety and Health Organization
12. Building Officials and Code Administrators (BOCA)
13. International Building Code (IBC)

B. Comply with all laws applying, installations in effect in this City, Town or State; with regulations of any other governmental body or agency having jurisdiction; with regulations of the National Electrical Code where such regulations do not conflict with those laws; and with the regulations of the Electrical Utility Company supplying electrical energy to the premises.

1.5 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."

B. Shop Drawings:
1. The Contractor shall submit complete catalog information and Shop Drawings for all materials and equipment in accordance with the General Requirements. These shall include:
a. Catalog Data: Manufacturer's literature and illustrations.
b. Manufacturer's Specifications and Engineering Data.

C. Shop Drawings: These shall contain sufficient plans, elevations, sections, details and schematics to describe work clearly. Shop Drawings shall be 1/8" = 1'-0" scale unless specified otherwise.

D. Equipment Supplier's Certification (when required).

E. Record Drawings of final approved system before final payment is made for this work.
1. All Shop Drawings shall be checked by the Contractor for accuracy and Contract requirements before the submittal to the Engineer. Shop Drawings shall bear the signature of the Contractor and date checked, and shall be accompanied by a statement that the Drawings have been examined for conformity to Specifications and Drawings. This statement shall also list all discrepancies with the Specifications and Drawings. Shop Drawings not so checked and noted by the Contractor shall be returned to him without approval. Shop drawing review will

be limited to two submittals for each item at which time an hourly charge will be made to the contractor for any subsequent reviews.

2. The Engineer's check shall be only for conformance with the design concept of the project and compliance with the Specifications and Contract Drawings. The Engineer's approval shall in no way relieve the Contractor from the responsibility of, or the necessity of, furnishing materials and workmanship required by the Contract Drawings and Specifications which may, or may not be indicated on the Shop Drawings.
3. Catalog data shall include full information as to names, dimensions, materials, performance data, electrical characteristics and all other information pertinent to the adequacy of the equipment submitted.
4. Shop Drawings shall be submitted for the following specific items:
   a. Service equipment
   b. Panelboards
   c. Lighting Fixtures and Ballast
   d. Circuit Breakers
   e. Starters, Contactors, and Disconnect Switches
   f. Fire Alarm Equipment
   g. Emergency and Exit Lighting Equipment
   h. Wiring Devices
   i. Surge Suppressor Device
   j. Generator
   k. CATV devices and cabling
   l. Security Panel and devices
   m. CCTV cameras
   n. Nurse Call

C. Final Submittals:
1. As-built drawings:
   a. During progress of the work, maintain an accurate record of the installation of the electrical system, locating each circuit precisely by dimension.
   b. Upon completion of the electrical installation, transfer all record data to blueline prints of the original Drawings.
2. Manual:
   a. Upon completion of the electrical installation, and as a condition of its acceptance, deliver to the Owner and the Engineer one copy each of a Manual complied in accordance with the provisions of Section 1 of these Specifications; include one copy of as-built Drawings in each copy of the Manual.

## 1.6 COORDINATION, INTENT AND DISCREPANCIES

A. Intent:
1. The Contract Drawings and the sections of the Specifications are complimentary each to the other.
2. Materials and work which are indicated in one shall be as binding as if indicated in both.
3. Verify all dimensions by field measurements.

4. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
6. The Drawings are intended to indicate only diagrammatically the extent, general character, and approximate locations of the work included.
7. Exact locations must be coordinated with local conditions and with other trades.
8. Work indicated, but having minor details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner.
9. Follow Drawings and this Section of the work fitted thereto.
10. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible, Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
11. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
12. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Electrical equipment shall not be mounted in areas where it will be subject to physical damage or be a hazard to human life. All electrical equipment shall be suitably rated for the area installed taking into consideration the intended use for the area.
13. Install access panel or doors where units are concealed behind finished surfaces.
14. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
15. All equipment shown on the Drawings is intended to be generally representative of the equipment which will be installed under this Contract, but it shall not be assumed that the Drawings indicate the specific configuration, arrangement or points of connection of the actual equipment which will be purchased.
16. The entire work provided for in this specification shall be constructed and finished in every respect in a workmanlike and substantial manner, according to the accompanying Drawings and this specification.
17. The bidder shall include in his bid, all cost required to adopt the actual equipment he intends to purchase to the general layout indicated on the Drawings and to provide a complete and operable system.
18. Typical details shown on the Drawings shall apply to each and every item of the project where such items are incorporated; details are not repeated in full on all Drawings, but the intention that such details shall be applicable in full.

B. Departure from the Contract Drawings:
1. Submit details of such departures and the reasons therefore as soon as practical and within 30 days after award of the Contract, to the Architect for approval.
2. No departures shall be made without signed approval of the Architect or his authorized agent.

C. Coordination:

1. The Contractor shall keep himself fully informed as to the size, shape, and location of all openings required for his pipes and apparatus and shall give full information to the other trades so that the openings may be built in advance.
2. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
3. The Contractor shall confer with all other trades relative to the location of apparatus and equipment and select locations so as not to conflict with work of other trades.
4. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
5. Any conflict with other trades shall be referred immediately to the Architect for resolution.
6. If the interferences occurs, the Architect will determine which work is to be relocated, regardless of which was first installed.

D. Discrepancies:

1. If the Contractor, in the course of the work, finds any discrepancies between Drawings or equipment listed and the physical conditions of the site, or any errors or omissions in dimensions or instructions given by Drawings or equipment lists, he shall immediately notify the Architect, in writing, and the Architect shall promptly adjust the same.
2. Any work performed after such discovery, unless authorized by the Architect in writing, shall be at the Contractor's risk.
3. The Drawings are, in general, made to scale, but all measurements shall be taken from figured dimensions, and not by scaling.
4. Whether or not an error is believed to exist, deviations from the Drawings and dimensions given thereon shall be made only after written approval is received from the Architect.
5. The Contractor shall be responsible for comparing all Drawings and verifying all dimensions before laying out the work.
6. When measurements are affected by existing conditions, the Contractor shall take necessary field measurements and refer any differences in dimensions to the Architect.
7. Any and all errors in the work that might have been avoided by such field measurements shall be the responsibility of the Contractor.
8. When submitting proposal, give written notice to the Architect of any materials or apparatus in violation of laws, ordinances, rules or regulations of all authorities having jurisdiction, and notice of necessary items of work omitted.
9. If the Contractor fails to give such written notice, it shall be assumed that he has included cost of all items in his proposal, and he shall be held responsible for satisfactory functioning and approval of the entire installation without extra compensation.

1.7 ELECTRICAL IDENTIFICATION

A. Nameplates:

1. Provide engraved white laminated phenolic nameplates with black core for all panelboard, main service switchboard, motor starters, disconnects, control stations, etc.
2. Secure nameplates to units by screws.
3. Adhesive units are not acceptable.
4. Nameplates for equipment other than distribution equipment shall state which unit it is for.

B. Color-Coded Conduit Markers:
1. General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, plastic-sheet conduit markers, extending 360 degrees around conduits; designed for attachment to conduit by adhesive, adhesive lap joint of marker, matching adhesive plastic tape at each end of marker, or pretensioned snap-on. Except as otherwise indicated, provide lettering which indicates voltage of conductor(s) in conduit. Provide 8" minimum length for 2" and smaller conduit, 12" length for larger conduit.
   a. Colors: Unless otherwise indicated or required by governing regulations, provide white markers with black letters.

C. Color-Coded Plastic Tape:
1. General: Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 1-1/2" wide.
   a. Colors: Unless otherwise indicated or required by governing regulations, provide orange tape.

D. Underground-Type Plastic Line Marker:
1. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried cable.

E. Cable/Conductor Identification Bands:
1. General: Provide manufacturer's standard aluminum wrap-around cable/conductor markers, of size required for proper application, and numbered to show circuit identification.

F. Plasticized Tags:
1. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention and operational tags, of plasticized card stock with matt finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording, e.g., DANGER, CAUTION, DO NOT OPERATE.

G. Lettering And Graphics:
1. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers,

1.8 EQUIPMENT FINISHES

A. All finishes shall be in good condition at the completion of the job.

B. Restore paint on all cabinets and enclosures by complete repainting if necessary because of damage to exterior finishes.

1.9 EQUIPMENT MOUNTING HEIGHTS

A. Unless otherwise noted, mount devices and equipment at heights measured from finished floor to device/equipment centerline as follows:

| | | |
|---|---|---|
| 1. | Toggle switches (up position "on") | 48" |
| 2. | Receptacle outlets (long dimension vertical, ground pole nearest floor) | 18" |
| 3. | Receptacle outlets, above baseboard heaters | 30" |
| 4. | Receptacle outlets over counter tops and at lavatories | 46" |
| 5. | Receptacle outlets, hazardous areas | 48" |
| 6. | Receptacle outlets weatherproof, above grade | 24" |
| 7. | Clock outlets | 90" |
| 8. | Telephone and computer outlets | 18" |
| 9. | Telephone outlets, wall mounted | 48" |
| 10. | Fire alarm manual station | 48" |
| 11. | Fire alarm audio/visual station or 6" below the ceiling which-ever is lower | 80" |
| 12. | Branch circuit panelboards, to top of backbox | 72" |
| 13. | Distribution panelboards, to top of backbox | 72" |
| 14. | Terminal cabinets, control cabinets, annunciator panels, to top of backbox | 72" |
| 15. | Disconnect switches, motor starters, enclosed circuit breakers | 48" |
| 16. | Emergency Lighting Head | 90" |

B. Where structural or other interferences prevent compliance with mounting heights listed above, consult Architect to change locations before installation.

C. Mount all devices flush unless otherwise specified or shown on the drawings.

1.10 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:

B. Perform cutting, fitting, and patching of electrical equipment and materials required to:
1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures,

6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.

C. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to, removal of electrical items indicated to be removed and items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Protection of installed Work: During cutting and patching operations, protect adjacent installations.

G. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

H. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

1.11 SERVICES OF MANUFACTURER'S REPRESENTATIVES

A. The Contractor shall arrange for the equipment manufacturer to furnish the services of a qualified representative as necessary to check and supervise installations, to supervise its initial operation, and instruct operators in operation and proper maintenance.

1.12 TESTING

A. General:
1. Demonstrate by conducting a test that the electrical system functions and performs as required to meet the needs of the Owner, and in accordance with the Drawings and specifications.
2. Furnish personnel and calibrated instruments required for the tests and the Owner shall furnish power.
3. Conduct tests at a time acceptable to the Contractor and Owner.
4. Take ammeter and voltmeter readings of all motors when the motors are operating under maximum design system loads.
5. Clean and dry motors, contacts, relays, bus, insulators and other electrical apparatus if required.
6. Prior to applying voltage to any apparatus or circuit, make insulation resistance tests and, if necessary, dry the apparatus until resistance values conform to the standards of IEEE.
7. In drying out, use methods such that the insulation temperature of the apparatus does not exceed $90^{o}$C.
8. In case of a low resistance circuit insulation, eliminate the problem before the circuit is energized.

9. Make a recheck after apparatus is dry.
10. Record all insulation values and furnish to the owner for review.
11. Prior to the start of check-out and testing, insure that all equipment is properly and permanently identified.
12. Before energizing any electrical equipment or apparatus, check and verify that no tools, filings, foreign matter or other materials are left inside equipment or enclosures, particularly, bus conductors, conductor, terminal blocks and windings.
13. Check screw and bolt connections and terminal connections for tightness prior to final tests and energization.
14. Check the bearings of all rotating electrical apparatus and, if required, fill with the grease or oil as recommended by the manufacturers.
15. Provide 500 and 1000 V "megger" insulation testing during the construction and check-out period.
16. Megger motors and feeder cable from the starters prior to energizing and at the time of final checkout.
17. Check all motors for rotation and, if necessary, reverse the connections at the starter (for 3 phase) and/or at the motor (1 phase).
18. Test all main loops and major equipment grounds to remote earth or directly referenced to an extremely low resistance (approximately 20 ohms) reference ground benchmark.
19. Record, witness, and report ground test results to the Architect.
20. Make tests with ground testing ohm meter or timegger.
21. Measure ground resistance of the individual networks at 2 points with cables at all the test points disconnected.
22. Reconnect the cables at the test points and make a duplicate set of ground resistance measurements.
23. Resistance shall not exceed 20 ohms.
24. Drive additional ground rods, if necessary.
25. Check all control circuits to see that their operation and sequence are correct.
26. Adjust any adjustable switches such as float switches, limit switches and timers for proper operation.
27. Prior to acceptance of the lighting facilities, clean all lighting fixtures and relamp where required at no additional cost to the Owner.
28. Replace all electrical equipment, wiring, switches and insulators found to be defective or to have failed due to poor workmanship promptly at no additional cost to the Owner.

1.13 GUARANTEE

A. The Contractor shall and does hereby warrant and the General Contractor shall and does hereby guarantee that all work executed under this Section will be free from defects of materials and workmanship for a period of 1 year from the date of acceptance.

B. The Contractor shall further warrant that all materials furnished and work executed in accordance with all applicable laws and regulations.

C. Contractor's guarantee for items furnished under Division 26 covers and includes:
   1. Faulty or inadequate design.
   2. Improper assembly or erection.
   3. Defective workmanship and materials.

4. Leakage, breakage, or other failure.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 26 05 02

BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Requirements of the following Division 25 and 26 Sections apply to this Section:
1. Basic Electrical Requirements - Section 26 05 01
2. Integrated Automation Network Equipment - Section 25 10 00

C. Requirements of the following Division 7 Section apply to this Section:
1. Firestopping – Section 07 84 00

1.2 SUMMARY

A. This Section includes basic materials and methods for application with electrical installations as follows:
1. Raceways
2. Conductor and Cable
3. Boxes and Fittings
4. Wiring Devices
5. Disconnect Switches and Motor starters

1.3 QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with NFPA 70-2014 "National Electrical Code."

B. NEMA Compliance: Comply with applicable requirements of NEMA Standards.

C. UL Compliance and Labeling: Comply with applicable requirements of UL standards, Provide products and components listed or labeled UL, ETL, or CSA.

1.4 SEQUENCING AND SCHEDULING

A. Coordinate with other Work, including site work, metal and concrete deck installation, as necessary to interface installation of electrical components with other Work,

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Conduit Bodies:
   a. Adalet-PLM
   b. American Electric
   c. Appleton Electric Co.
   d. Carlon
   e. Crouse-Hinds Division, Cooper Industries, Inc,
   f. Delta Industrial Products
   g. Killark Electric Mfg. Co.
   h. Krayloy Products Co.
   i. O-Z/Gedney
   j. Steel City Electrical Mfg. Co.
2. Wireway:
   a. Anchor Electric Co.
   b. Hoffman Engineering Co.
   c. Robroy Industries, Inc.
   d. Square D Co.
3. Surface Metal Raceway:
   a. Allied Tube & Conduit
   b. American Electric
   c. B-Line Systems, Inc.
   d. Butler Mfg, Co.
   e. Hoffman Engineering Co.
   f. Isoduct Energy Systems
   g. Isotrol Systems
   h. Keystone/Rees, Inc.
   i. Square D Co.
   j. The Wiremold Co.
4. Surface Nonmetallic Raceway:
   a. Anixter Brothers, Inc.
   b. Hoffman Engineering Co.
   c. Hubbell, Inc.
   d. JBC Enterprises, Inc.
   e. Panduit Corp.
   f. The Wiremold Co.
5. Conductors and Cables:
   a. Carol Cable Co., Inc.
   b. Southwire Co.
   c. Rome Cable Co.
   d. Pirelli Wire and Cable
   e. Canada Wire and Cable
   f. Belden
   g. Alpha
6. Boxes and Fittings:
   a. Adalet-PLM
   b. Appleton Electric
   c. Eagle Electric
   d. OZ/Gedney
   e. Pass and Seymour Mfg., Inc.
   f. RACO
   g. Thomas & Betz Co.

7. Wiring Devices:
   a. Hubbell
   b. Arrow-Hart
   c. Pass and Seymour Mfg., Inc.
   d. Appleton
   e. Leviton
8. Disconnect Switches:
   a. Square D Co.
   b. General Electric
   c. Siemens

2.2 MATERIAL

A. Raceways:
1. Rigid Aluminum Conduit: ANSI C80.5.
2. Rigid Steel Conduit: ANSI C80.1.
3. Intermediate Steel Conduit: UL 1242.
4. PVC Externally Coated Rigid Steel Conduit and Fittings: ANSI C80.1 and NEMA RN 1.
5. Electrical Metallic Tubing and Fittings: ANSI C80.3.
6. PVC Externally-Coated Electrical Metallic Tubing and Fittings: ANSI C80.3 and NEMA RN 1.
7. Flexible Metal Conduit: UL 1, zinc-coated steel.
8. Liquid-tight Flexible Metal Conduit and Fittings: UL 360, Fittings shall be specifically approved for use with this raceway.
9. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
10. Underground PVC and ABS Plastic Utilities Duct: NEMA TC 6. Type 1 for encased burial in concrete, Type 2 for direct burial,
11. PVC and ABS Plastic Utilities Duct Fittings: NEMA TC 9; match to duct type and material.
12. Liquid-tight Flexible Nonmetallic Conduit and Fittings: UL 1660, Fittings shall be specifically approved for use with this raceway.
13. Conduit, Tubing, and Duct Accessories: Types, sizes and materials complying with manufacturers published product information, Mate and match accessories with raceway.
14. Metallic Conduit and Tubing: Use metallic conduit bodies, Use bodies with threaded hubs for threaded raceways.
15. Conduit Bodies 1 Inch and Smaller: Use bodies with compression-type EMT connectors.
16. Surface Metal Raceway: Construct of galvanized steel with snap-on covers, with 1/8-inch mounting screw knockouts in base approximately 8 inches OIC. Finish with manufacturer's standard prime coating suitable for painting. Provide raceways of types suitable for each application required.

B. Conductors and Cables:
1. General: Provide wire and cable suitable for the temperature, conditions and location where installed. Ampacities shall be based on a 75$^{o}$C rating, unless equipment and lugs are rated for 90$^{o}$C use. Provide individual neutral conductors for all circuits. "Shared" or "Common" neutrals shall not be used.

2. Conductors: Provide solid conductors for power and lighting circuits No. 10 AWG and smaller. Provide stranded conductors for sizes No. 8 AWG and larger.
3. Conductor Material: Use the following material for sizes indicated.
   a. No. 6 AWG and Smaller: Copper.
   b. No. 4 AWG and Larger: Copper.
4. Insulation: Provide THHN/THWN insulation for all conductors size 500 KCM and larger, and No. 8 AWG and smaller. For all other sizes provide THW, THHN/THWN or XHHW insulation as appropriate for the locations where installed. Insulation shall be rated 90°C. Motor conductors when used with variable frequency drives shall be XHHW-2. Any motor leads longer than 100' shall utilize shielded cable rated for 1000v when used with variable frequency drives.
5. Color code secondary service, feeder and branch circuit conductors with factory applied finish as follows:

| 208y/120 Volts | Phase | 480y/277 Volts |
|---|---|---|
| Black | A | Yellow |
| Red | B | Brown |
| Blue | C | Orange |
| White | Neutral | White |
| Green | Ground | Green |

   Where systems of different voltages are combined in the same junction box or enclosure, the neutral for the 480/277 volt system shall be white with a colored stripe (other than green).
6. Jackets: Factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90 deg. bends, for pulls in conduits underground or under slabs on grade, and where indicated.
7. Cables: Provide the following type(s) of cables in NEC approved locations and applications where indicated. Provide cable UL listed for particular application:
   a. Conduit: Life Safety Circuits and operating/procedure rooms shall be installed in conduit.
   b. Metal-Clad Cable: Type HCF/MC in exam rooms and patient treatment areas. Other areas of the building may utilize standard MC cable.
   c. Underground Feeder and Branch-Circuit Cable: Type UF
   d. Communication Riser Cable: Type CMR
   e. Fiber Optic Cable – Type OFNR or as specified
8. Connectors for Conductors:
   a. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

C. Boxes and Fittings:
   1. Outlet Boxes: Provide galvanized coated flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths suitable for installation of respective locations, Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides.

Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding. Nominal box sizes shall be 4" x 4" and larger as required.

2. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.
3. Device Boxes: Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding. Nominal box sizes shall be 4" x 4" and larger as required.
4. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.
5. Rain-tight Outlet Boxes: Provide corrosion-resistant cast-metal rain-tight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight caps suitably configure for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.
6. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
7. Floor Boxes: Provide four compartment, multi-service, cast-iron rain-tight adjustable floor boxes as indicated, with threaded-conduit-entrance ends, and vertical adjusting screws, two receptacle brackets and cable management area. Wiremold Walkerbox #RFB4-CI with RAKMII cover. Install carpet from project in cover to match. Furnish blank plates for communications compartments.
8. Floor Box Accessories: Provide flush type two-pole, three-wire, grounded-pole, 125-volts, 20-amperes, receptacles.
9. Poke-Throughs: Provide factory pre-wired poke-through units, suitable for power and communication work, with UL fire resistance rating of 3-hours. Construct integral fire-stop with cold smoke barrier to prevent passage of smoke where heat is not present. Provide units with separation barrier between power and communication compartments, and with above-floor fittings of contoured die-cast aluminum with satin chrome finish covers. Provide poke-throughs with a single divided through-floor conduit, of proper length for floor thickness indicated, and a 4-11/1611 square x 2-9/16" deep junction box, which is self supporting without attachment of above-floor fitting.

10. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

2.3 WIRING DEVICES

A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Provide gray color devices and except as otherwise indicated. Verify color selections with Architect.

B. Receptacles: As scheduled on the drawings. Comply with UL 498 and NEMA WD 1. All receptacles shall be “Hospital Rated”. All receptacles located in waiting rooms or pediatric exam room shall also be “Tamper Proof”. Receptacles powered from Emergency power shall be RED in color and labeled with the circuit number. All exterior receptacles shall be rated as “weather resistant”.

C. Receptacles, Industrial Heavy Duty: Provide pin and sleeve design receptacles conforming to UL 498.

Comply with UL 1010 where installed in hazardous locations. Provide features indicated.

D. Ground-Fault Interrupter (GFI) Receptacles: As indicated on drawing; provide "feed-thru" type ground-fault circuit interrupter, with integral indicator light and heavy-duty NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. Provide unit designed for installation in a 2-3/4 inch deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 94.3.

E. Surge-Suppressor (TVSS) Receptacles: Provide and install as indicated transient voltage surge suppressor type receptacles, with 3-level MOV protection for phase to phase, phase to ground and phase to neutral. TVSS receptacle shall be 20 amp rated, isolated ground where required and shall include an integral indicator light continuously on when protection is active and flashes when protection is deactivated. UL listed per Standard 1449, UL suppression rating in accordance with Category B ANSI/IEEE C62.41-1991.

F. Plugs: 15-amperes, 125-volts, 3-wire, grounding, armored cap plugs, parallel blades with cord clamp, and 0.4 inch cord hole; match NEMA configuration with power sources.

G. Plug Connectors: 15-amperes, 125-volts, bakelite-body armored connectors, 3-wire, grounding, parallel blades, double wipe contact, with cord clamp, and 0.4 inch cord hole, match NEMA configuration to mating plugs. Arrange as indicated.

H. Snap Switches: Quiet type AC switches as indicated on the drawings. Comply with UL 20 and NEMA WD1. Switches shall be gray in color.

I. Combination Switch and Receptacle: General duty 3-way quiet switch, 20-amperes, 120-277 volts AC, with toggle switch handle, and 3-wire grounding receptacle, 15-amperes, 120-volts, equip with plaster ears, and with break-off tab feature which allows wiring with separate or common feed, with NEMA configuration 5-15R.

J. Dimmer Switches: Solid state dimmer switches conforming to NEMA WD 1, mounted in outlet boxes as indicated and in accordance with the following:

1. Incandescent Lamp Dimmers: Modular dimmer switches for incandescent fixtures; switch poles and wattage as indicated, 120-volts, 60-Hz, with continuously adjustable rotary knob or toggle, anodized aluminum face, single-pole, with soft-tap or other quiet on-off switch. Equip with electromagnetic filter to eliminate noise, RF and TV interference, and 5 inch wire connecting leads. Lightolier Neptune slide No. MP1000-1 or equal.

2. Fluorescent Lamp Dimmers: Full-wave modular type AC dimmer switches, for fluorescent fixtures; wattage and voltage ratings as indicated and electromagnetic filters to minimize noise, and RF and TV interference. Construct with continuously adjustable trim potentiometer for adjustment of low end dimming, anodized heat sinks, 5 inch wire connecting leads and quiet on-off switch.

3. LED Fixtures: Dimmers used with LED type fixtures shall be rated for such use.

2.4 WIRING DEVICE ACCESSORIES

A. Wall plates: Single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plate color to match wiring devices except as otherwise indicated. Provide wall plates with engraved legend where indicated. Conform to requirements of Section "Electrical Identification." Provide plates possessing the following additional construction features:

1. Material and Finish: Steel plate, galvanized in unfinished areas.
2. Material and Finish: Brushed stainless steel in all finished areas.

B. Floor Service Outlets: Modular, above-floor service outlets and fittings of types and ratings indicated, Construct of die cast aluminum, satin finish. Use design compatible with floor outlet wiring methods indicated. Provide 20-amperes, 125-volts, gray duplex receptacles, NEMA configuration 5-20R where indicated. Provide with 3/4 inch or 1 inch NPT, 1 inch long, locking nipple for installation where compatible with wiring method.

C. Poke-Through Assembly Devices: Factory-fabricated poke-through assembly devices with modular, above-floor service outlets, multi-channeled thru-floor raceway/fire stop assembly and below-floor junction box assembly. Construct above floor service fitting of die cast, satin finished aluminum with 20-ampere, 125-volts, gray duplex NEMA 5-20R receptacle and modular communication/data service outlet with separation barrier between power and low-tension section. Provide integral assembly UL listed as a total unit, with fire rating consistent with that of floor penetrated.

D. Telephone/Power Service Poles: Factory-assembled combination telephone/power poles of types, sizes and ratings indicated; for use with telephone and power systems installed above suspended ceilings. Construct with provisions for two 4-pair telephone cable, and (2), 20-amperes, 125-volts, 3-wire receptacles. Isolate power section from telephone compartment with separating metal barrier. Extend wiring from receptacles to junction box at top of pole where connections are made above suspended ceiling. Provide ceiling

trim plate and pole foot with carpet pad. Where poles are located in accessible ceiling areas, provide bracing arranged for positive connection to ceiling supports. Provide finish treatment and color as selected by the Architect. Wiremold # 25DTP-412 or equal. Power poles shall not be used without the approval of the Architect.

2.5 CIRCUIT AND MOTOR DISCONNECT SWITCHES, STARTERS AND LIGHTING CONTACTORS

A. Motor Starters: Provide circuit and motor disconnect switches in types, sizes, duties, features, ratings, and enclosures as indicated. Provide NEMA 1 enclosure for general use except for outdoor switches, provide NEMA 3R enclosures with rain-tight hubs, for all others provide whatever NEMA rating is required for the intended use of the room. For motor and motor starter disconnects, provide units with horsepower ratings suitable to the loads, combination type in single enclosure with H-0-A selector switch, green run light and Square D, MPS 8430 phase failure relay connected to control circuitry.

B. Fusible Disconnect Switches: Heavy duty switches, with fuses of classes and current ratings indicated. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses. If fuse type is not indicated provide type RK5 with time delay option.

C. Non-fusible Disconnect Switches: Heavy duty switches of classes and current ratings as indicated, with NEMA rating suitable for the location considering use of space.

D. Lighting Contactors: Provide lighting contactors in size and configuration indicated on drawings with the minimum size being 30 amp rated contacts with three poles. Provide with NEMA 1, lockable enclosure unless otherwise indicated. Enclosure shall include a HAND-OFF-AUTO selector switch on the front cover which will close the contacts in the hand position, open in the off position and connect to photocell and DDC or lighting control system in the auto position. The contactor device shall be mechanically held. Coil voltage shall be 120 volts, 60 HZ unless otherwise indicated. Short circuit rating must be at least 45 KAIC.

PART 3 EXECUTION

3.1 WIRING METHOD

A. Outdoors: Use the following wiring methods:
1. Exposed: Rigid Galvanized Steel.
2. Concealed: Intermediate Metal Conduit.
3. Underground, Concrete Encased: Rigid Galvanized Steel or Schedule 40 PVC Conduit as indicated on the drawings.
4. Underground, Direct Buried: Rigid Galvanized Steel or Schedule 40 PVC Conduit as indicated on the drawings.
5. Connection to Vibrating Equipment: Including transformers and hydraulic, pneumatic, or electric solenoid or motor-drive equipment in moist or humid location or corrosive atmosphere, or where subject to water spray or dripping oil, grease, or water: liquid-tight flexible metal conduit in lengths not exceeding three (3') feet.

B. Indoors: Use the following wiring methods:
   1. Connection to Vibrating Equipment: Including transformers and hydraulic, pneumatic or electric solenoid or motor-operated equipment: flexible metal conduit in lengths not exceeding three (3') feet.
   2. Exposed: Electrical metallic tubing or rigid aluminum conduit. Type HCF/MC cable is allowed behind building finish only.
   3. Concealed: Electrical metallic tubing, rigid galvanized steel, type HCF/MC cable.
   4. Environmental Air Spaces: EMT, rigid galvanized steel, or cable assemblies approved for use in environmental air spaces.

3.2 INSTALLATION OF RACEWAYS AND CABLING

A. General: Install electrical raceways and cabling in accordance with manufacturer's written installation instructions, applicable requirements of NEC, and as follows:
   1. Conceal Conduit and EMT, unless indicated otherwise, within finished walls, ceilings, and floors. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes, Install raceways level and square and at proper elevations.
   2. Elevation of Raceway: Where possible, install horizontal raceway runs above water and steam piping.
   3. Complete installation of electrical raceways before starting installation of conductors within raceways.
   4. Provide supports for raceways as specified elsewhere in Division 16.
   5. Prevent foreign matter from entering raceways by using temporary closure protection.
   6. Protect stub-ups by using temporary closure protection.
   7. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
   8. Use raceways fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.
   9. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated. This does not apply to conduits in crawl spaces.
   10. Raceways embedded in slabs: Install in middle third of the slab thickness where practical and leave at least 1-inch concrete cover.
       Tie raceways to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in the concrete. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement, the conduit shall be close to one of the supports of the slab.
   11. Install exposed raceways parallel or perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.
   12. Run exposed, parallel, or banked raceways together. Make bends in parallel or banked runs from the same center line so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run such as from wall to

ceiling and that the raceways be of the same size. In other cases provide field bends for parallel raceways.

13. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.
14. Tighten set screws of threadless fittings with suitable tool.
15. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.
16. Where terminating in threaded hubs, screw the raceways or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceways so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
17. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.
18. Telephone, Signal and Control System Raceways 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways 2-inch and smaller trade size in maximum lengths of 150 feet and with a maximum of two, 90-deg bonds or equivalent. Install pull or junction boxes where necessary to comply with these requirements.
19. Install raceway sealing fittings in accordance with manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
    a. Where conduits enter or leave hazardous locations.
    b. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
    c. Where required by the NEC.
    d. Where conduits enter or leave moist or damp spaces, such as crawl spaces or cellars.
20. Stub-up Connections: Extend conduits through concrete floor for connection to free standing equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver-operated threaded flush plugs flush with floor.
21. Flexible Connections: Use short length (maximum of 6 ft.) of flexible conduit for recessed and semi-recessed lighting fixtures, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid-tight flexible conduit in wet locations. Install separate ground conductor across flexible connections.

22. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and they pass through concrete, install in a nonmetallic sleeve.
23. Do not install aluminum conduit embedded in or in contact with concrete.
24. PVC externally coated rigid steel conduit: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduit.
25. Surface Metal Raceway: Install a separate green ground conductor in raceway from the junction box supplying the raceway to receptacle or fixture ground terminals.
26. Select each surface metal raceway outlet box to which a lighting fixture is attached to be of sufficient diameter to provide a set for the fixture canopy.
27. Where a surface metal raceway is used to supply a fluorescent lighting fixture having central stem suspension with a backplate and a canopy, with or without extension ring, the backplate and canopy will serve as the outlet box and no separate outlet box need be provided.
28. Provide surface metal raceway outlet box, in addition to the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end stem suspension.
29. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, provide a backplate slightly smaller than the fixture canopy, and no additional surface mounted outlet box need be installed.

3.3 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical cables, wires, and connectors in compliance with NEC.

B. Coordinate cable installation with other Work.

C. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.

D. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.

E. Conceal all cable in finished spaces.

F. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible.

G. Keep conductor splices to minimum.

H. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced.

I. Use splice and tap connectors which are compatible with conductor material.

J. Provide adequate length of conductors within electrical enclosures and trim the conductors to terminal points with no excess. Bundle multiple conductors. Make terminations so there is no bare conductor at the terminal.

K. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

L. Control (HVAC and boiler) system wiring shall be installed in EMT were exposed and shall be otherwise be installed in accordance with this specification.

M. If cable tray is not used, cables shall not be bundled with more than 12 cables per bundle. Separate bundles by at least 8". Cables shall be supported with devices designed for the purpose such as a "Caddy" type clips or “J” hooks. Contractor shall not use excess conductors or wiring as supports.

3.4 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements. All device wallboxes shall be mounted flush unless otherwise indicated.

B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

C. Provide weather-tight outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.

F. Do not install boxes back-to-back in walls. Provide not less than 6" (150 mm) separation. In a fire rated wall, provide 24” of separation.

G. Do not install aluminum products in concrete. Wall boxes installed in concrete or block shall be made of steel as per this specification.

H. Position recessed outlet boxes accurately to allow for surface finish thickness.

I. Set floor boxes level and flush with finish flooring material.

J. Do not use round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surfaces.

K. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry,

L. Provide electrical connections for installed boxes.

M. Subsequent to installation of boxes, protect boxes from construction debris and damage.

N. Install backboxes for all wall mounted Class 2 wiring devices and HVAC wall mounted control devices such as thermostats.

3.5 INSTALLATION OF WIRING DEVICES AND ACCESSORIES

A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other Work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other Work.

C. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.

D. Install galvanized steel wall plates in unfinished spaces.

E. Install wiring devices after wiring work is completed.

F. Install wall plates after painting work is completed.

G. Install telephone/power service poles in accordance with final furnishings arrangement plan, plumb, true, and secure.

H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A, Use properly scaled torque indicating hand tool.

3.6 GROUNDING

A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

3.7 PROTECTION

A. Protect installed components from damage. Replace damaged items prior to final acceptance.

3.8 ADJUSTING AND CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

3.9 FIELD QUALITY CONTROL

A. Testing: Prior to energizing circuits, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.

B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Materials and Methods sections apply to work of this section.

C. Requirements of this section apply to all electrical grounding and bonding work required for the installing of the service entrance, panelboards and all other electrical equipment indicated on the drawings.

1.2 SUMMARY

A. Extent of electrical grounding and bonding work is indicated by drawings and schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. Applications of electrical grounding and bonding work in this section includes, but is not limited to:
1. Interior metal piping.
2. Underground metal piping.
3. Underground metal structures.
4. Metal building frames.
5. Electrical power systems.
6. Grounding electrodes.
7. Raceways.
8. Service entrance equipment and panelboards.
9. Enclosures.
10. Equipment.
11. Lighting standards.
12. Telecommunications equipment.

C. Refer to other Division-26 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work.

D. Service neutral and ground bonding connections located on the exterior shall be exothermic.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of grounding and bonding products, of types, and ratings required, and ancillary grounding materials,

including stranded cable, copper braid and bus, grounding electrodes and plate electrodes, and bonding jumpers whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with electrical grounding work similar to that required for project.

C. Codes and Standards:
1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC (specifically Article 250) as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.
2. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment", and 869, "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL-listed and labeled for their intended usage.
3. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81f 141 and 142 pertaining to grounding and bonding of systems, circuits and equipment.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide grounding and bonding products of one of the following (for each type of product):
1. Adalet-PLM Div; Scott Fetzer Co.
2. Burndy Corporation.
3. Cadweld Div; Erico Products Inc.
4. Crouse-Hinds Div; Cooper Industries.
5. Eagle Electric Mfg Co.
6. Ideal Industries, Inc.
7. Joslyn Corporation.
8. Okonite Company.
9. OZ Gedney Div; General Signal Corp.
10. Harger

### 2.2 GROUNDING AND BONDING

A. General: Except as otherwise indicated, provide all electrical grounding and bonding systems required; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC Articles 250-94 and 250-95.
   1. All equipment grounding conductors shall be insulated copper with green jacket or green with yellow stripe. Conductors under #6 in size shall not be remarked per the NEC.
   2. Conduits and MC type cable jackets shall not be used in lieu of dedicated grounding conductors. All feeders shall have a separate dedicated grounding conductor.

C. Bonding Plates, Connectors, Terminals and Clamp: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.
   1. Grounding Electrodes:
      a. Grounding Electrodes: Copper plated, 5/8" dia. by 10 feet.
      b. Drive rod vertically so top is 2'-0" minimum below finished grade.

D. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service indicated.

E. Field Welding: Comply with AWS Code for procedures, appearance, and quality of welds; and for methods used in correcting welding work. All exterior connections and connections to be left below grade shall be performed using an approved exothermic process

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Architect in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

### 3.2 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

C. Weld grounding conductors to underground grounding electrodes.

D. Ground electrical service system neutral at service entrance equipment to grounding electrodes.

E. Connect together system neutral, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, plumbing systems, and any other metal piping systems at the service entrance.

F. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.

G. Connect grounding electrode conductors to 1-inch diameter, or greater, metallic cold water pipe using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange. Utilize domestic water service, not sprinkler service. Sprinkler service shall be bonded.

H. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

I. Install braided type bonding jumpers with code-sized ground clamps on water meter piping to electrically bypass water meters and backflow preventers.

J. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible to minimize transient voltage rises.

K. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance to ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms, or less, by driving additional ground rods; then retest to demonstrate compliance.

END OF SECTION

SECTION 26 05 48

SEISMIC CONTROLS FOR ELECTRICAL WORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes seismic restraints and other earthquake damage reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. SBC: Standard Building Code.

C. UBC: Uniform Building Code.

D. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.

E. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independent of other mobile structural elements during an earthquake.

1.4 SUBMITTALS

A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.

B. Anchor Bolts and Studs: Tabulate types and sizes, complete with report numbers and rated strength in tension and shear as evaluated by ICBO Evaluation Service.

C. Shop Drawings: For anchorage and bracing not defined by details and charts on Drawings. Indicate materials, and show designs and calculations signed and sealed by a professional engineer.

1. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

2. Details: Detail fabrication and arrangement. Detail attachment of restraints to both structural and restrained items. Show attachment locations, methods, and spacings, identifying components and listing their strengths. Indicate direction and value of forces transmitted to the structure during seismic events.

3. Preapproval and Evaluation Documentation: By ICBO Evaluation Service, showing maximum ratings of restraints and the basis for approval (tests or calculations).

D. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

1.5 QUALITY ASSURANCE

A. Comply with seismic restraint requirements in BOCA and UBC, unless requirements in this Section are more stringent.

1.6 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire protection and other building features in the vicinity.

B. Coordinate concrete bases with building structural system.

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. Amber/Booth Company, Inc.

2. B Line Systems, Inc.

3. Erico, Inc.

4. GS Metals Corp.

5. Loos & Company, Inc.

6. Mason Industries, Inc,

7. Powerstrut.

8. Thomas & Betts Corp.

9. Unistrut Corporation.

2.2 MATERIALS

A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.

2. Outdoors and Damp Locations: Galvanized steel.

2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

B. Concrete and Masonry Anchor Bolts and Studs: Steel expansion wedge type.

C. Concrete Inserts: Steel channel type.

D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

E. Welding Lugs: Comply with MSS SP 69, Type 57.

F. Beam Clamps for Steel Beams and Joists: Double sided. Single sided type is not acceptable.

G. Bushings for Floor Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

H. Bushing Assemblies for Wall Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.4 SEISMIC BRACING COMPONENTS

A. Slotted Steel Channel: 41-by-41-mm cross section, formed from 2.7-mm- thick steel, with 14-by-22-mm slots at a maximum of 50 mm o.c. in webs, and flange edges turned toward web.

1. Materials for Channel: ASTM A 570, GR 33.

2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.

3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.

4. Finish: Baked, rust inhibiting, acrylic enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Cable Type Bracing Assemblies: Zinc coated, high strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.

1. Arrange units for attachment to the braced component at one end and to the structure at the other end.

2. Wire Rope Cable: Comply with ASTM 603. Use 49 or 133 strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.

D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 EXECUTION

3.1 APPLICATION

A. Generator Sets: Comply with Division 15 Section "Mechanical Vibration Controls and Seismic Restraints.

3.2 INSTALLATION

A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

3.3 STRUCTURAL ATTACHMENTS

A. Use bolted connections with steel brackets, slotted channel, and slotted channel fittings to spread structural loads and reduce stresses.

B. Attachments to New Concrete: Bolt to channel type concrete inserts or use expansion anchors.

C. Attachments to Existing Concrete: Use expansion anchors.

D. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.

E. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.

F. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.

G. Attachments to Wood Structural Members: Install bolts through members.

H. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

3.4 ELECTRICAL EQUIPMENT ANCHORAGE

A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.

B. Anchor panelboards, motor control centers, motor controls, transformers, unit substations, fused power circuit devices, transfer switches, busways, battery racks, and capacitor units.

1. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.

2. Concrete Bases for Floor Mounted Equipment: Use female expansion anchors and install studs and nuts after equipment is positioned.

3. Bushings for Floor Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.

4. Anchor Bolt Bushing Assemblies for Wall Mounted Equipment: Install to allow for resilient media where equipment or equipment mounting channels are attached to wall.

5. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

3.5 SEISMIC BRACING INSTALLATION

A. Expansion and Contraction: Install to allow for thermal movement of braced components.

B. Cable Braces: Install with maximum cable slack recommended by manufacturer.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.6 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

END OF SECTION

SECTION 26 09 26

LIGHTING CONTROL PANELBOARDS

## PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

### 1.02 SUMMARY

A. Extent of work is indicated by drawings, schedules and this specification. Work includes the addition of a low voltage control panel, switches, boxes and 120 volt power and control wiring and Category 6 communication wiring. Provide relays, low voltage (control) panels and install as indicated.

B. Provide all programming and commissioning for the relay panels. Coordinate with the owner to program occupancy period for lighting control. Exterior lighting systems under the control of the relay panels shall automatically turn on at a dusk and turn off at a pre-determined time (11:00 PM initially). Exterior pole control shall be capable of having separate time control schedules.

C. Types of equipment in this section include the following:

1. Low Voltage Lighting Control Panels.

2. Cabinets, wallboxes and backboxes.

3. Low Voltage Wiring and 120 volt control wiring.

D. Wires/cables, raceways, and electrical boxes and fittings are specified in Division-26 Basic Materials and Methods sections.

E. Relay panels shall be networked and interconnected with Category 6 cable. Adjust cabling requirements with any substitutions.

### 1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data on low voltage lighting control equipment and accessories including:

1. Low Voltage Lighting Control Panels.

2. Cabinets, wallboxes and backboxes.

3. Wiring.

B. Shop Drawings: Submit riser and connection diagrams for all connections to the Low Voltage Lighting Control Panels, switches and accessories.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of Low Voltage Lighting Control equipment, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 5 years of successful installation experience with projects utilizing service-entrance work similar to that required for this project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC, including Articles 720, and 725, as applicable to installation, and construction of Class 1 and 2 wiring.

2. NEMA Compliance: Comply with applicable construction and installation requirements of the NEMA standards for electrical equipment enclosures.

3. UL Compliance: Comply with construction and installation requirements of the following UL standards for equipment and accessories:

a. UL 916: Energy management Equipment.

1.05 DELIVERY STORAGE, AND HANDLING

A. Deliver equipment components properly packaged. Utilize factory-fabricated type containers or wrappings for equipment and components which protect equipment from damage. Inspect equipment to ensure that no damage has occurred during shipment.

B. Store equipment in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.

C. Handle equipment carefully to prevent physical damage to equipment and components. Remove packaging, including the opening of crates and containers, avoiding the use of excessive hammering and jarring which would damage the electrical equipment contained therein. Do not install damaged equipment; remove from site and replace damaged equipment with new.

PART 2 - PRODUCTS

2.01 LOW VOLTAGE LIGHTING CONTROL PANEL

A. General: Provide low voltage lighting control panel as indicated on the drawings and low voltage wiring. Interconnect to power/lighting panelboards and loads as indicated on the drawings.

B. Operating Features:

1. Each panel shall consist of a number of control relays as indicated. Provide panels with 20 amp control relays. Provide space for up to 4 spare or future relays.

2. Each panel shall be microprocessor controlled and controlled by the existing master controller for the network.

3. Programmable intelligence shall include Time of day control, 32 holiday dates, warn occupants of an impending off, timed inputs, preset control, auto daylight savings, astronomical clock w/offsets, and local control.

4. Relays may be designated as either normally open or normally closed from software. Relay status shall not only disclose commanded relay status but next scheduled state to occur.

5. Each control panel shall provide a Warn Off (flash the lights) to inform the occupants of an impending Off command. The Warn Off command shall provide an adjustable time duration of 1 second to 999 extra minutes. The occupants may exit the premises with adequate lighting or cancel the Warn Off by overriding the lighting zone. This option occurs with all OFF commands except local overrides.

6. Each control panel shall permit lighting to be overridden On for after hours use or cleaning. The controller shall provide switched and timed overrides assigned to specific relays. Once the switch override or the timed override expires the controller shall return the relays to their programmed state. These overrides shall be hard wired inputs. Overrides shall be programmed for a maximum duration of 30 minutes after which time the relay shall de-energize. Relays shall be programmed to de-energize at a certain time of day by default as determined by the owner.

7. Programming the control system shall be through a PC program provided with the system. PC software shall permit either local or remote controller programming. Descriptive information shall assist the user to employ the system without a programming manual. All relay panelboards shall be interconnected and networked so that they may be programmed from one location and the use of digital switches and devices may be interconnected.

C. Hardware Features:

1. Operator Interface: The control panel programming interface shall reside in firmware in the control panel. The programming interface shall consist of a circuit

board mounted keypad capable of linking switch inputs to relay outputs and schedule assignments. Systems that use blocking diode technology for relay assignments shall not be acceptable. The integral keypad shall provide access to the main programming features. The keypad shall permit the user to manually command any or all relays individually. Each panel shall control its loads from internal memory. A control system that relies on a central control computer/processor or external time clocks shall not be permitted.

2. Contact/Switch Inputs: The control system shall permit dry contacts (Digital/Switch Inputs) for override purposes. Momentary 3 wire or 2 wire (toggle) inputs shall be supported. Maintained contacts shall be supported as 2 wire inputs. Inputs shall be dry contacts. An input shall be software link-able to any number of relays for override control. The controller shall provide timers for each switch input. Each switch input timer shall be capable of 0-999 minutes. Software shall enable or disable switch inputs based on Time of day scheduling.

3. Relay Type: Each panel shall include control relays that are rated 20 amps at 120 VAC . The hybrid relay shall combine a high speed electronic switch with mechanical relay to create a unique switching device. The hybrid design shall look at each AC phase and shall close the electronic switch precisely at the absolute zero crossing. The mechanical relay in parallel shall follow and close after the in-rush condition. The relay shall provide an integral switch for both manual hand operation and visual indication of relay status. The relay shall be rated at 10 million mechanical operations. A limited 10 year warranty shall be provided on individual relays. Relays panels shall have the capability to be replace relays individually.

4. Photocell Control: The controller shall accept user adjustable ambient light sensors. The controller shall provide power for the sensor thereby eliminating any external power supply. Sensors shall provide for both outdoor and indoor applications and provide a dry contact to the controller once the threshold is reached. The sensor shall provide user adjustable dead band control.

5. Modular Design: The control system shall employ all modular connectors to avoid repeat wiring in case of component failure. The system CPU board shall be mounted on quick release hinge pins that shall permit an entire change out of the processor and input board in less than one (1) minute.

   All connections for the switch inputs shall incorporate modular connectors. The relay board shall be modular and designed for rapid field replacement or upgrading. Systems that do not employ modular connectors shall not be acceptable.

6. Diagnostic Aids: Each control panel shall incorporate diagnostic aids for confirmation of proper operation, or in case of failure these aids shall guide the individual in rapid troubleshooting of the system.

   The control panels shall employ a backlit supertwist LCD that indicates:

   a. Power.

b. System OK.

c. On/Off status of each relay.

d. System clock and date.

e. Programming confirmation (TOD, HOLIDAY, ON/OFF, and PRESET).

Control systems that do not provide visual self help diagnostics shall not be acceptable.

7. Memory Back-Up: The system shall utilize a memory back-up device that is system integrated and shall be non-serviceable. The data in RAM shall be protected against power interruptions lasting as long as seven (7) days. The power interrupt protection circuit shall be entirely maintenance-free.

8. Multi-Tapped Transformer: The control panel shall incorporate the use of a multi-tapped transformer. The panel shall not require specification of voltage for each control location. The voltages of 120 and 277 VAC shall be available with each control panel.

9. Status Indication of Relays: The system shall provide visible status indication of all relays through the windows of each control panel. The visual indication shall disclose ON/OFF status and relay number.

10. Service Override: The control panel shall provide three (3) position master-service override for the control unit. The service override shall not be accessible from the exterior.

    The master service override provides a single three (3) position switch with the option of "ALL ON, "AUTO", and "ALL OFF", respectively. The master switch shall operate all of the relays in the controller. This switch shall override and supersede all commands from the logic board when the switch is in the "ALL ON or ALL OFF" position. The master switch shall function to override all the relays should the logic board programming differ from the space function.

    The system shall remember the last command to the individual relays. Upon returning the master override switch to the "AUTO" position, the relays shall return to the most recent command state. This will occur even if the last command happened during the master override condition.

11. Lockable Enclosure: Each control panel shall be enclosed in a flush mount, lockable NEMA class one (1) enclosure. The enclosure shall be manufactured out of 1/16" steel and shall provide pre-punched knockouts for efficient installation. The door shall be architecturally appealing and manufactured utilizing 94V0 material.

12. PC Interface (RS-232 port): The controller shall permit PC programming through software included with the system. The controller shall provide a local personal computer connector for programming. Programming shall be permitted through either a local connection or remotely through a modem. PC software shall permit multiple file storage for data archival and for seasonal facility requirements. Operator commands may be issued directly from the PC keyboard. Modem shall be included with the Master panel.

2.02 SWITCHES

A. Provide low voltage, momentary contact, spring return to center control switches utilizing standard electrical wallplates. Wattsptopper LVS-1 or equal.

2.03 ACCEPTABLE MANUFACTURERS

A. Wattstopper or equal with integral UL924 relays if required

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION AND DOCUMENTATION

A. Installation: The control system shall be installed and fully wired as shown on the plans by the contractor. The contractor shall complete all electrical connections to all control circuits, and override wiring. Contractor shall provide all programming and make any adjustments to the programming as required by the engineer. Programming shall include an occupancy cycle with hours determined by the owner and an (adjustable) 30 minute reset.

B. Documentation: The contractor shall provide accurate "as-built" drawings to the owner for correct programming and proper maintenance of the control system. The "as-builts" shall include the load controlled by each relay and relay panel number.

C. Operation and Service Manuals: The factory shall supply all operation and service manuals.

3.02 PRODUCT SUPPORT AND SERVICE

A. Factory Support: Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

3.03 SYSTEM DELIVERY AND ACCEPTANCE

A. Delivery: Delivery of the control system shall be no more than 4 weeks of the "notice to proceed". The contractor is responsible for complete installation of the entire system according to the following requirements:

1. All system equipment shall operate in accordance with specification and industrial standard procedures.

2. All operational user program shall exist in the control system. The program shall execute and perform all functions required to effectively operate the site according to requirements.

3. Demonstration of program integrity during normal operation and pursuant to a power outage.

4. Contractor shall provide a minimum of two training hours on the operation and use of the control system. Additional support services shall be negotiated between the contractor and the building owner or manager.

3.04 WARRANTY

A. Warranty: Manufacturer shall supply a 5 year warranty on all hardware and software. A limited 5 year warranty shall be provided on the relay card. Manufacturer shall provide customer service and support 12 hours per day Monday through Friday. Manufacturer shall guarantee next working day replacement of defective components.

END OF SECTION

SECTION 26 15 00

SERVICE ENTRANCE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

A. Extent of service-entrance work is indicated by drawings and schedules.

B. Types of service-entrance equipment in this section include the following:
1. Circuit-breakers.
2. Main Distribution Panels.
3. Surge Suppressors.
4. Power Metering

C. Wires/cables, raceways, and electrical boxes and fittings are specified in Division-26 Basic Materials and Methods sections.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on service-entrance equipment and accessories including:
1. Main Service Breakers and Main Distribution Panelboards.
2. Feeder Breakers.
3. Surge Suppressor.
4. Power metering/monitoring device

B. Shop Drawings: Submit dimensioned layouts of service-entrance equipment, including spatial relationships to proximate electrical equipment.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of service-entrance equipment, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 5 years of successful installation experience with projects utilizing service-entrance work similar to that required for this project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC, including Articles 230, 250, and 338, as applicable to installation, and construction of service-entrances.
2. NEMA Compliance: Comply with applicable construction and installation requirements of the following NEMA standards for service-entrance equipment and accessories:
   a. Stds Pub/No. AB 1: Molded-Case Circuit Breakers.
   b. Stds Pub/No. AB 3: Molded-Case Circuit Breakers and Their Application.
   c. Stds Pub/No. KS 1: Enclosed Switches.
   d. Stds Pub/No. PB 2: Deadfront Distribution Switchboards.
   e. Stds Pub/No. PB 2.2: Application Guide for Ground-Fault Protective Devices for Equipment.
3. UL Compliance: Provide service-entrance equipment and accessories which are UL-listed and labeled, and marked, "SUITABLE FOR USE AS SERVICE EQUIPMENT." Comply with construction and installation requirements of the following UL standards for service-entrance equipment and accessories:
   a. UL 50: Electrical Cabinets and Boxes.
   b. UL 489: Molded-Case Circuit Breakers and Circuit-Breakers Enclosures.
   c. UL 854: Service-Entrance Cables.
   d. UL 869: Electrical Service Equipment.
4. IEEE Compliance: Comply with applicable requirements of IEEE Std 241 pertaining to service entrances.
5. ANSI Compliance: Comply with ANSI C2 "National Electrical Safety Code", installation requirements for aboveground service-entrance conductors.
6. Local Utility: Comply with all Central Maine Power requirements per equipment and installation.

1.5 DELIVERY STORAGE, AND HANDLING

A. Deliver service-entrance equipment components properly packaged and mounted on pallets, or skids to facilitate handling of heavy items. Utilize factory-fabricated type containers or wrappings for service-entrance equipment and components which protect equipment from damage. Install gravity measuring meters in containers which indicate whether container has been bumped or dropped. Return G-meters to manufacturer for reuse upon delivery of switchgear. Inspect equipment to ensure that no damage has occurred during shipment.

B. Store service-entrance equipment in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.

C. Handle service-entrance equipment carefully to prevent physical damage to equipment and components. Remove packaging, including the opening of crates and containers, avoiding the use of excessive hammering and jarring which would damage the electrical equipment contained therein. Do not install damaged equipment; remove from site and replace damaged equipment with new.

1.6 SEQUENCING AND SCHEDULING

A. Schedule delivery of service-entrance equipment which permits ready building ingress for large equipment components to their designated installation spaces. Coordinate delivery of equipment with the installation of other building components.

B. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad. Concrete, reinforcement, and formwork requirements are specified in Division 3. Trenching and backfilling will be by others. Electrical contractor shall furnish and place concrete for conduits. Electrical contractor shall provide and install transformer pad.

C. Coordinate with other electrical work including raceways, electrical boxes and fittings, and cabling/wiring work, as necessary to interface installation of service-entrance work with other work.

PART 2 PRODUCTS

2.1 SERVICE-ENTRANCE EQUIPMENT

A. General: Provide service-entrance equipment and accessories; of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified.
Service Entrance

The contractor is responsible for the following:

Service Entrance

A larger padmounted transformer shall be installed by the utility as indicated on the drawings to serve the building along with new CT and meter cabinets, service conduits and conductors and main service breakers. The existing service conduits and conductors shall be abandoned in place. The existing primary conduits and conductors shall be reused. Care shall be taken to not damage the existing primary conductors and conduits.

The contractor is responsible for the following:

a. Furnish all lugs and other material for termination of secondary conductors.
b. Provide and install secondary conduits and conductors into the building subgrade. Furnish secondary lugs and terminate.
c. Install all grounding rods and conductors at the pad and bond to the transformer. Bond to the grounding electrode conductor.
d. Install new main breakers as indicated having an interrupting capacity of 65,000 AIC, SER rated and 100% rated.
e. Provide a transient surge suppressor for each service panel.

B. Main Distribution Panelboard: Reuse the existing 1000 amp, 3 phase, 4 wire, 120/208 volt Main Distribution Panel. NEMA 1 enclosure, copper bus, bottom feed with full size neutral and ground bus. Refeed from a new 800 amp service breaker located in an exterior addition to the building.

C. Service Type Surge Suppressor: Provide for each service a panel mounted surge protective device. Device shall be rated 277/480 volts, 3-phase WYE, 4 wire plus ground with individual, replaceable protection modules for each phase. Each unit shall be mounted in a steel, NEMA 1 rated enclosures for flush or surface mounting with hinged, screw down covers. Unit shall be Leviton 57000 series or equal. Unit features shall include:

Hybrid suppression circuitry with built-in redundancy providing complete protection on all phases even if one module fails.

Clamping envelope tracks contour of the AC sine wave.
Modular design to allow easy replacement of modules, without the use of tools or the need to shut down AC power.

Individual module status indication lights on front cover.

Normal mode (phase to neutral) and Common mode (phase to ground) protection.

Dual-stage fuse protection for primary and secondary surge suppression circuits.

UL 1449 listed with a five (5) year warranty.

2.2 ACCEPTABLE MANUFACTURERS

A. Square D

B. GE

C. Cutler-Hammer

D. Anchor

E. Leviton

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which service-entrance equipment and components are to be installed, and notify Architect in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF SERVICE-ENTRANCE EQUIPMENT

A. Install service-entrance equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that service-entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA standards. Comply with applicable installation requirements of Central Maine Power Co.

B. Install service type surge suppressor of type and style indicated and connect to main distribution panelboard and main service breaker.

C. Install ground-fault protection devices complying with electrical winding polarities indicated.

D. Install units on vibration isolators in accordance with Division-25 section; and comply with manufacturer's indicated method of installation.

E. Set field-adjustable GFP devices and circuit breakers for pickup and time-current sensitivity ranges as indicated, subsequent to installation of devices and CB's.

F. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.

G. Install grounding electrodes and conductors, and connect to service equipment as required by the utility, NEC and local codes.

H. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored. Where panelboards are surface mounted, provide a 3/4" minimum thickness backboard of adequate size painted with 2 coats of black enamel paint.

3.3 FIELD QUALITY CONTROL

A. Prior to energization of service-entrance equipment, check accessible connections for compliance to manufacturer's torque tightening specifications.

B. Prior to energization of service-entrance equipment, check with ground resistance tester, phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

C. Prior to energization, check circuitry for electrical continuity, and for short-circuits.

3.4 GROUNDING

A. Provide equipment grounding connections for service-entrance equipment as required by the N.E.C., local utility and local code. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.

3.5 ADJUSTING AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred enclosure surfaces to match original finishes.

3.6 DEMONSTRATION

A. Upon completion of installation of service-entrance equipment and electrical circuitry, energized circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

A. Extent of panelboard, load-center and enclosure work, including cabinets and cutout boxes, is indicated by drawings and schedules, and as specified herein.

B. Types of panelboards and enclosures required for the project include the following:

1. Lighting and appliance and power panelboards.

C. Refer to other Division-26 sections for wires/cables, electrical boxes and fittings, and raceway work required in conjunction with installation of panelboards and enclosures.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on panelboards and enclosures.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of panelboards and enclosures, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects utilizing panelboards similar to those required for this project.

C. Codes and Standards
1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Article 384 as applicable to installation, and construction of electrical panelboards and enclosures.
2. UL Compliance: Comply with applicable requirements of UL 67, "Electric Panelboards", and UL's 50, 869, 486A, 486B, and 1053 pertaining to panelboards, accessories and enclosures. Provide panelboard units which are UL-listed and labeled.
3. Special-Use Markings: Provide panelboards, constructed for special-use, with appropriate UL markings which indicate that they are suitable for special type of

use/application. Main distribution panelboards shall be marked as service entrance rated.

4. NEMA Compliance: Comply with NEMA Stds Pub/No, 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)," Pub/No. PB 1, "Panelboards," and Pub/No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less."
5. Federal Specification Compliance: Comply with FS W-P-115, "Power Distribution Panel", pertaining to panelboards and accessories.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. General Electric Company - Bolt-on type
2. Square D - Bolt-on type
3. Cutler-Hammer - Bolt-on type
4. Siemens – Bolt-on type

2.2 PANELBOARDS

A. General: Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; with the design and construction in accordance with published product information; equip with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for those applications indicated. Panelboards and breakers shall be fully-rated. Series rated panelboards shall not be accepted.

B. Panelboards: Provide dead-front safety type panelboards as indicated, with switching and protective devices in quantities, ratings, types and arrangements shown; with anti-burn solderless pressure type lug connectors approved for use with copper conductors; construct unit for connecting feeders at top of panel; equip with copper bus bars, full-sized neutral bar, with bolt-in type heavy-duty, quick-make, quick-break, circuit-breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required; and provide bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate and match properly with panelboards. Provide panelboards with “feed-thru” bus and lugs where indicated.

C. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage, minimum 16-gage thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Provide enclosures which are fabricated by same manufacturer as panelboards, which mate and match properly with panelboards to be enclosed. Provide “door in door” or double hinged cover.

D. Molded-Case Circuit Breakers: Provide factory-assembled, molded-case circuit breakers of frame sizes, characteristics, and ratings indicated. Breakers shall have a minimum 22,000 amps RMS symmetrical interrupting rating as indicated. Select breakers with permanent thermal and instantaneous magnetic trip, and with fault-current limiting protection, ampere ratings as indicated. Construct with overcenter, trip-free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Construct breakers for mounting and operating in any physical position, and operating in an ambient temperature of 40°C. Provide breakers with 90°C rated mechanical screw type removable connector lugs, AL/CU rated. Breakers with a 200 amp frame size and over shall have an adjustable instantaneous trip setting or shall be programmable as indicated.

E. Accessories: Provide panelboard accessories and devices including, but not necessarily limited to, ground-fault protection units, feed thru lugs, shunt trip units, etc., as recommended by panelboard manufacturer for ratings and applications indicated.

## PART 3 -EXECUTION

### 3.1 EXAMINATION

A. Examine areas and conditions under which panelboards and enclosures are to be installed, and notify Architect in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

### 3.2 INSTALLATION OF PANELBOARDS

A. Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standards of Installation" and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.

C. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored. Where panelboards are surface mounted, provide a 3/4" minimum thickness backboard of adequate size painted with 2 coats of black enamel paint.

D. Provide properly wired electrical connections for panelboards within enclosures.

E. Fill out panelboard's circuit directory card upon completion of installation work.

F. Furnish and install at all panelboards a nameplate of engraved plastic material with panelboard designation.

3.3 GROUNDING

A. Provide equipment grounding connections for panelboard enclosures as indicated. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

3.4 FIELD QUALITY CONTROL

A. Prior to energization of electrical circuitry, check all accessible connections to manufacturer's tightening torque specifications.

B. Prior to energization of panelboards, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

C. Prior to energization, check panelboards for electrical continuity of circuits, and for short-circuits.

3.5 ADJUSTING AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finishes.

3.6 DEMONSTRATION

A. Subsequent to wire and cable hook-ups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

SECTION 26 29 23

VARIABLE SPEED DRIVES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes requirements for variable frequency controllers.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
2. IEEE Standard 519-1981: Unit line noise shall conform to IEEE Standard for special applications.

B. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FU 1 - Low Voltage Cartridge Fuses.
3. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.
4. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.

C. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

C. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

D. Test Reports: Indicate field test and inspection procedures and test results.

E. Manufacturer's Field Reports: Indicate start-up inspection findings.

1.4 CLOSEOUT SUBMITTALS

A. Section 017700 – Closeout Procedures: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions complying with NEMA ICS 7.1. Include procedures for starting and operating controllers, and describe operating limits possibly resulting in hazardous or unsafe conditions. Include routine preventive maintenance schedule.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

1.7 WARRANTY

A. Furnish one-year manufacturer warranty for variable frequency controller.

PART 2 PRODUCTS

2.1 VARIABLE FREQUENCY CONTROLLER

A. Available Manufacturers:
   1. Allen Bradley, ABB or equal

B. Product Description:
   1. NEMA 1 enclosed variable frequency controller suitable for operating indicated loads. Select unspecified features and options in accordance with NEMA ICS 7.1.
   2. VFD shall convert incoming fixed frequency three phase AC power into a variable frequency and voltage for controlling the speed of three phase AC motors.
   3. VFD shall be Pulse Width Modulated (PWM) design utilizing Insulated Gate Bipolar Transistor (IGBT) and Intelligent Power Module (IPM) technology.

C. Ratings:

1. Rated Input Voltage: 208 or 480 volts, three phase, 60 Hertz as indicated.
2. Motor Nameplate Voltage: 208 or 480 volts, three phase, 60 Hertz as indicated.
3. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.
4. Operating Ambient: 0 degrees C to 40 degrees C.
5. Humidity: up to 95 percent RH (non-condensing).
6. Output Frequency Range: 0-250 Hz.
7. Overload Rating: 110 percent of rated current for one minute every ten minutes; 350 percent of rated current instantaneously.

D. Performance Requirements:
1. Minimum Efficiency at Full Load: 97 percent.
2. Line voltage shall be greater than 3% harmonic distortion and no more than a 16,400 volt-microsecond commutation notch area, in accordance with IEEE standard 519-1981 for special applications.

E. Design Features:
1. Microprocessor Logic: 32-bit microprocessor and digital signal processor.
2. A backlit multi-line 30 character, LCD alphanumeric multilingual display and keypad. The display shall be programmable for indication of output status, fault warnings, and process variables.
3. Digital Inputs: Five digital input terminals for remote operation and control. Functions shall be freely selectable and programmable.
4. Analog Inputs: Analog input signal for remote speed control. Signal shall be 0-10VDC or 4-20mA, as required by application.
5. Relay Contact Outputs: Two output relays programmable to indicate Run Status, Frequency Arrival, Alarm Status, and others.
6. Analog Outputs: One programmable analog output signals.
7. DC injection Braking: DC braking control shall include independent adjustments for braking force, braking time, and braking delay time. VFD shall have the capability to activate the DC braking to stop fan or motor rotation before issuing a Run command.
8. Acceleration and Deceleration Control: Two independent programmable settings for acceleration and deceleration time of 0-1800 seconds.
9. PID Control: PID control loop.
10. Auto Restart: VFD shall have the capability to automatically restart the motor after a fault. The number of restarts shall be programmable from 0-5 attempts.
11. Serial Communication: RS485 serial communication port as standard
12. Employ pulse-width-modulated inverter system.
13. Adjustable carrier frequency of 4-16 kHz in 2 kHz increments.
14. **Integral disconnect switch.**
15. **Bypass contactor with associated control devices on cover.**
16. **Input reactor and filter**

F. Safeties and Interlocks: VFD shall have the following protective circuits:
1. Over current.
2. Ground fault.
3. Over voltage.
4. Under voltage.
5. Input power loss of phase.
6. Adjustable current regulator.
7. UL508C approved electronic motor overload.
8. Stop command remote input

G. Required Options:
1. LonWorks communications protocol.
2. Five percent output line reactors to limit output voltage dV/dT, and to increase motor lead length capability up to 1000 feet.

H. Fabrication:
1. Wiring Terminations: Match conductor materials and sizes as indicated on Drawings.
2. Enclosure: NEMA 250, Type 1, suitable for equipment application in places accessible only to qualified personnel.
3. Finish: Manufacturer's standard enamel.

2.2 SOURCE QUALITY CONTROL

A. Shop inspect and perform standard productions tests for each controller.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify building environment is maintained within service conditions required by manufacturer.

3.2 EXISTING WORK

A. Disconnect and remove abandoned controllers.

B. Clean and repair existing controllers to remain or to be reinstalled.

3.3 INSTALLATION

A. Install in accordance with NEMA ICS 7.1.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Install fuses in fusible switches if required.

D. Select and install overload heater elements in motor controllers to match installed motor characteristics.

E. Install engraved plastic nameplates in accordance with Section 26 05 01.

F. Neatly type label inside controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.

G. Ground and bond controller in accordance with Section 26 05 26.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.16 and NEMA ICS 7.1.

3.5 MANUFACTURER'S FIELD SERVICES

A. Prepare and startup variable frequency controller.

3.6 DEMONSTRATION AND TRAINING

A. Furnish 4 hours of instruction each for two persons, to be conducted at project site with manufacturer's representative.

END OF SECTION

SECTION 26 32 13

ENGINE GENERATORS AND TRANSFER SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes a diesel engine generator set, radiator, exhaust silencer and fittings, fuel fittings, control panel, battery, heaters, remote annunciator, automatic transfer switch, charger and enclosure.

B. This generator shall be used for life safety loads and shall comply with NFPA 99 and 110.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
3. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment.
4. NEMA MG 1 - Motors and Generators.

B. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
1. NFPA 30 - Flammable and Combustible Liquids Code.
2. NFPA 99 - Standard for Health Care Facilities.
3. NFPA 110 - Standard for Emergency and Standby Power Systems.

1.3 SYSTEM DESCRIPTION

A. Description: Engine generator assembly and accessories to provide source of power for standby power only.

B. Capacity: 125 kW, 160 kVA at elevation of 50 feet above sea level, standby rating using specified engine cooling scheme.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Include plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and interconnection diagrams.

C. Product Data: Submit data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, transfer switch, battery, battery rack, battery charger, exhaust silencer, vibration isolators, radiator, fuel tank, weatherproof enclosure and remote annunciator.

D. Test Reports: Indicate results of performance testing.

E. Manufacturer's Field Reports: Indicate inspections, findings, and recommendations.

1.5 CLOSEOUT SUBMITTALS

A. Section 017700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions and service manuals for normal operation, routine maintenance, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.

B. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience.

1.7 WARRANTY

A. Section 017700 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty.

1.8 MAINTENANCE SERVICE

A. Section 017700 - Execution Requirements: Maintenance service.

B. Furnish service and maintenance of engine generator and transfer switch for one year from Date of Substantial Completion.

1.9 MAINTENANCE MATERIALS

A. Section 017700 - Execution Requirements: Spare parts and maintenance products.

B. Furnish one set of tools required for preventative maintenance of engine generator system. Package tools in adequately sized metal tool box.

C. Furnish two of each fuel, oil and air filter element.

PART 2 PRODUCTS

2.1 SERVICE CONDITIONS

A. Temperature: -20 degrees F to 104 degrees F.

B. Altitude: 50 feet (15.24 m).

2.2 ENGINE

A. Manufacturers:
1. Caterpiller
2. Cummins Power Generation
3. Generac
4. Substitutions: Section 01600 - Product Requirements.

B. Product Description: Water-cooled in-line or V-type, four-stroke, 4 cycle, spark ignited internal combustion engine with exterior weatherproof, lockable enclosure with 1-150 amp and 1-300 amp, 3 pole, 600 volt breakers.

C. Rating: Sufficient to operate under 10 percent overload for one hour in ambient of 90 degrees F (32 degrees C) at elevation of 600 feet (1829 m.)

D. Fuel System: Diesel with integral base tank meeting NFPA 110 capacity and alarming requirements.

E. Engine speed: 1800 rpm.

F. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.

G. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Furnish remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.

H. Engine Jacket Heater: Provide thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F (32 degrees C), and suitable for operation on 120 volts AC.

I. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F (43 degrees C). Radiator air flow restriction 0.25 inches of water (.62 Pa) maximum.

J. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, gear-driven water pump. Furnish fuel pressure gage, water temperature gage, and lube oil pressure gage on engine/generator control panel.

K. Mounting: Furnish unit with suitable spring-type vibration isolators and mount on structural steel base.

2.3 GENERATOR

A. Manufacturers:
1. Cummins Power Generation
2. Caterpillar
3. Generac
4. Substitutions: Section 01600 - Product Requirements.

B. Product Description: Class H, NEMA MG-1.35, three phase, four pole, brushless, drip proof, revolving field with 2/3 pitch stator. Torque match (shunt) exciter. Direct coupled, flexible disc rotor.

C. Rating: 125 kW, 160 kVA, at 0.8 power factor, 208Y/120 volts, 60 Hz at 1800 rpm.

D. Insulation Class: H.

E. Temperature Rise: 125 degrees C Standby.

F. Enclosure: NEMA MG1, open drip proof.

G. Voltage Regulation: Furnish generator mounted volts per hertz exciter-regulator to match engine and generator characteristics, with voltage regulation plus or minus 1 percent from no load to full load. Furnish manual controls to adjust voltage droop, voltage level (plus or minus 5 percent) and voltage gain.

2.4 GOVERNOR

A. Manufacturers:
1. Generac
2. Cummins Power Generation
3. Caterpillar
4. Substitutions: Section 01600 - Product Requirements.

B. Product Description: Electronic governor to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes. Equip governor with means for manual operation and adjustment.

2.5 AUTOMATIC TRANSFER SWITCH

A. Manufacturers:
1. ASCO
2. Cummins Power Generation
3. Substitutions: Section 01600 - Product Requirements.

B. Product Description: Provide (1) NEMA ICS 10, 260 amp rated, 208/120 volts, 3 phase, 4 wire, 4 pole automatic transfer switch, Provide (1) NEMA ICS 10, 150 amp rated, 208/120 volts, 3 phase, 4 wire, 4 pole automatic transfer switch and Provide (1) NEMA ICS 10, 100 amp rated, 208/120 volts, 3 phase, 4 wire, 4 pole automatic transfer switch.

C. Configuration: Electrically operated, mechanically held, four pole transfer switches.

D. Withstand Current Rating: 30,000 rms symmetrical amperes for 30 cycles, when used with molded case circuit breaker.

E. Control Features and Functions:
1. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, NORMAL SOURCE CONNECTED, ALTERNATE SOURCE CONNECTED, switch position.
2. Test Switch: Mount in cover of enclosure to simulate failure of normal source.
3. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate source to normal source.
4. Transfer Switch Auxiliary Contacts: 1 normally open; 1 normally closed.
5. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.
6. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.
7. In-Phase Monitor: Inhibit transfer until source and load are within 15 electrical degrees.
8. Switched Neutral: Non-Overlapping contacts.

F. Automatic Sequence of Operation:
1. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
2. Time Delay To Start Alternate Source Engine Generator: 0 to 6 seconds, adjustable.
3. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
4. Time Delay Before Transfer to Alternate Power Source: 0 to 60 seconds, adjustable.
5. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
6. Time Delay Before Transfer to Normal Power: 0 to 1800 seconds, adjustable; bypass time delay in event of alternate source failure.

G. Time Delay Before Engine Shut Down: 0 to 10 minutes, adjustable, of unloaded operation.

H. Engine Exerciser: Start engine every 30 days; run for 30 minutes before shutting down. Bypass exerciser control when normal source fails during exercising period.

I. Alternate System Exerciser: Transfer load to alternate source during engine exercising period.

J. Enclosure:
1. Enclosure: NEMA 1
2. Finish: Manufacturers standard

2.6 ACCESSORIES

A. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions.

B. Batteries: Heavy duty, diesel starting type lead-acid storage batteries, 170 ampere-hours minimum capacity. Match battery voltage to starting system. Furnish cables and clamps and battery matt type heater.

C. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.

D. Battery Charger: Current limiting type designed to float at 2.17 volts for each cell and equalize at 2.33 volts for each cell. Furnish overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Furnish wall mounted enclosure to meet NEMA 250, Type 1 requirements.

E. Line Circuit Breakers: Provide one (1) NEMA AB 1, molded case, 300 amp, 3 pole, 600 volt rated circuit breaker and one (1) 150 amp, 3 pole, 600 volt circuit breaker with electronic trip unit supporting LSI settings in each pole. Units mount inside generator enclosure to meet NEMA 250, Type 1 requirements.

F. Engine-Generator Control Panel: NEMA 250, Type 1 generator-mounted control panel enclosure with engine and generator controls and indicators. Furnish provision for padlock and the following equipment and features:
1. Frequency Meter: 45-65 Hz. range, 3.5 inch (89 mm) dial.
2. AC Output Voltmeter: 3.5 inch (89 mm) dial, 2 percent accuracy, with phase selector switch.
3. AC Output Ammeter: 3.5 inch (89 mm) dial, 2 percent accuracy, with phase selector switch.
4. Output voltage adjustment.
5. Push-to-test indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.
6. Engine start/stop selector switch.
7. Engine running time meter.
8. Oil pressure gage.
9. Water temperature gage.
10. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
11. Additional visual indicators and alarms in accordance with by NFPA 110.
12. Remote Alarm Contacts: Factory wire SPDT contacts to terminal strip for remote alarm functions in accordance with NFPA 110.

13. Provide four (4) remote NFPA 110 annunciators to be located at the main nurse's station for each practice.

G. Weather-protective sound Attenuating Enclosure: Reinforced steel housing allowing access to control panel and service points, with lockable doors and panels. Furnish with fixed louvers complete with screens. Cummins QuietSite Level 2 or equal.

2.7 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install engine-driven generator units as indicated, in accordance with the equipment manufacturer's written instructions, and with recognized industry practices, to ensure that engine-generator units fulfill requirements. Comply with NFPA and NEMA standards pertaining to installation of engine-generator sets and accessories.

B. Coordinate with other work, including raceways, electrical boxes and fittings, fuel tanks, piping and accessories, as necessary to interface installation of engine-generator equipment work with other work.

C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A, B and the National Electrical Code.

D. Install units on vibration isolators in accordance with Division-25 section; and comply with manufacturer's indicated method of installation.

E. Connect fuel piping to generator equipment as indicated, and comply with manufacturer's installation instructions.

F. Align shafts of engine and generator within tolerances recommended by engine-generator unit manufacturer.

3.2 GROUNDING

A. Provide equipment grounding connections for engine-driven generator units as indicated and required by the National Electrical Code. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

**B. This unit is considered a separately derived source. Bond the generator neutral and ground. Provide grounding per the NEC and connect to building ground system.**

3.3 FIELD QUALITY CONTROL

A. Start-Up Testing

1. Engage local authorized equipment manufacturer's representative to perform start-up and building load tests upon completion of installation, with the Architect/Engineer in attendance; provide certified test record. Tests are to include the following:

a. Check fuel, lubricating oil, and antifreeze in liquid cooled models for conformity to the manufacturer's recommendations under environmental conditions present.

b. Test prior to cranking engine for proper operation, accessories that normally function while the set is in a standby mode. Accessories include: battery charger, and exerciser clock.

c. Check during start-up test mode, for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.

d. Test by means of simulated power outage, automatic start-up by remote-automatic starting, transfer of load, and automatic shut-down. Prior to this test adjust, for proper system coordination, transfer switch timers. Monitor throughout the test, engine temperature, oil pressure, battery charge level, generator voltage, amperes, and frequency.

2. Upon completion of installation demonstrate capability and compliance of system with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting. Initial testing and

retesting to be at no cost to Owner Section 01400 - Quality Requirements: Testing and inspection services.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.22.

3.4 MANUFACTURER'S FIELD SERVICES

A. Section 014000 - Quality Requirements: Manufacturer’s field services.

B. Prepare and start up engine-generator assembly.

3.5 ADJUSTING

A. Section 017700 - Execution Requirements: Testing, adjusting, and balancing.

B. Adjust generator output voltage and engine speed to meet specified ratings.

**C. Provide and configure proper timing a sequencing of the different branches of the Essential Electrical System to load the generator in three distinct steps. Timing shall be approximately 4-5 seconds apart with immediate connection of the Life Safety branch following generator stabilization.**

3.6 CLEANING

A. Section 017700 - Execution Requirements: Final cleaning.

B. Clean engine and generator surfaces. Replace oil and fuel filters with new.

3.7 DEMONSTRATION AND TRAINING

A. Furnish 4 hours of instruction each for 3 persons, to be conducted at project site with manufacturer's representative to train owner’s personnel in procedure for start-up, testing and operation of diesel driven Generator sets.

B. Describe loads connected to emergency and standby system and restrictions for future load additions.

C. Simulate power outage by interrupting normal source, and demonstrate system operates to provide emergency and standby power.

D. Train owner’s personnel in periodic maintenance of lead acid batteries.

E. Provide load testing of the generator per NFPA 110 if required by the local code enforcement officer and AHJ.

END OF SECTION

SECTION 26 51 13

LIGHTING FIXTURES, LAMPS, BALLAST AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

A. Extent, location, and details of lighting fixture work are indicated on drawings and in schedules.

B. Types of lighting fixtures in this section include the following:

1. High-intensity-discharge (HID).

a. Metal Halide

2. Fluorescent

3. Light emitting diode (LED)

C. Lighting controls includes ceiling mounted and wallbox type motion detectors. Provide all devices, wiring and components for a fully operational system. Include commissioning by a manufacturers representative for final placement and adjustment of all lighting controls.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions on each type building lighting fixture and component, including ballasts.

B. Shop Drawings: Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. Submit details indicating compatibility with ceiling grid system.

C. Maintenance Data: Submit maintenance data and parts list for each lighting fixture and accessory; including "trouble-shooting" maintenance guide. Include that data, product data, and shop drawings in a maintenance manual; in accordance with general requirements of Division 1.

D. Submit plans indicating final locations of all motion detectors and daylighting controls including locations of photocell controls. Drawing shall be reviewed and approved by the daylighting manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting fixtures and controls of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with lighting fixtures and controls work similar to that required for this project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 220, 410, and 510 as applicable to installation, and construction of building lighting fixtures.

2. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No.'s LE 1 and LE 2 pertaining to lighting equipment.

3. IES Compliance: Comply with the following IES publications:

a. RP-1; Office Lighting.
b. RP-3; School Lighting.
c. RP-4; Library Lighting.
d. RP-5; Daylighting.
e. RP-15; Illuminance Levels.
f. RP-16; Nomenclature and Definitions for Illuminating Engineering.
g. RP-20; Lighting for Parking Facilities.
h. RP-24; Lighting for VDT Areas.

4. UL Compliance: Provide lighting fixtures and components which are UL listed and labeled. Comply with the following UL standards:

a. UL 57; Electric Lighting Fixtures.
b. UL 506; Specialty Transformers.
c. UL 486A; Wire Connectors and Soldering Lugs for Use with Copper Conductors.
d. UL 486B; Wire Connectors for use with Aluminum Conductors.
e. UL 542; Lampholders, Starters and Starter Holders for Fluorescent Lamps.
f. UL 935; Fluorescent-Lamp Ballasts.
g. UL 1029; High-Intensity-Discharge Lamp Ballasts.

h. UL 1570; Fluorescent Lighting Fixtures.
i. UL 1571; Incandescent Lighting Fixtures.
j. UL 1572; High-Intensity-Discharge Lighting Fixtures.

5. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.

B. Store lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.

C. Handle lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.6 SEQUENCING

A. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

Fixture manufacturers shall be per the drawing fixture schedule and approved equals.

Ballast and lamp manufacturer for fixtures utilizing T8 lamps shall be GE “Super T8” or equal. All lighting fixtures utilizing T8 type lamps (none dimming) shall be furnished with the GE “Ultramax” Type “N” system with electronic ballast and 28 watt lamps. An equivalent may be substituted providing all specifications are met including lamp wattage, lamp life of 30,000 hours, lamp and ballast system. All fluorescent ballast shall be programmed start, Efficiency Maine compliant.

Occupancy sensors and low voltage relay controls shall be provided by Wattstopper or equal as indicated.

2.2 FIXTURES

A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy-efficient lamps, lamp holders, reflectors, energy efficient ballasts, starters and wiring. Ship fixtures factory-assembled, with those components required for a complete installation, including lamps. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast generated noise. Fixtures shall be post-painted and shall be ordered with

lamps pre-installed. Fixtures installed in a grid type ceiling shall include any optional clips or devices designed to meet NEC requirements for attachment or security to grid.

B. Wiring: Provide electrical wiring within fixture suitable for connecting to branch circuit wiring.

C. Fluorescent Lamp Ballasts: Provide electronic fluorescent lamp ballasts, capable of operating lamp types indicated; with high power factor over 90%, instant start or programmed start, Hi frequency + 20 KHZ and Class A low-noise features; Type 1; U.L. Listed Class P. A total harmonic distortion of less than 20%, 1.4 lamp current crest factor and a ballast factor of not less than .77, GE or equal. Provide multi-volt ballast whenever possible.

D. High-Intensity-Discharge Lamp Ballasts: Provide HID lamp ballasts, of ratings, types and makes as recommended by lamp manufacturer, which properly mates and matches lamps to electrical supply by providing appropriate voltages and impedances for which lamps are designed. Design ballast to operate lamp within the lamp's power trapezoid requirements. Ballast factor of .85 or greater.

E. LED Light Fixtures:

1. General:

   LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.

   LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.

   LED drivers shall include the following features unless otherwise indicated:
   a. Minimum efficiency: 85% at full load.
   b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
   c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
   d. Integral short circuit, open circuit, and overload protection.
   e. Power Factor: ≥ 0.95.
   f. Total Harmonic Distortion: ≤ 20%.
   g. Comply with FCC 47 CFR Part 15.

   LED modules shall include the following features unless otherwise indicated:
   a. Comply with IES LM-79 and LM-80 requirements.
   b. Minimum CRI 80 and color temperature 3000˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
   c. Minimum Rated Life: 50,000 hours per IES L70.
   d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

2. LED Downlights:
   a. Housing, LED driver, and LED module shall be products of the same manufacturer.

3. LED Troffers:

a. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.

4. Housing, LED driver, and LED module shall be products of the same manufacturer.

F. Lamps:

1. Provide fluorescent lamps of energy saving types as indicated, with a CRI rating of at least 85 and a Kelvin rating of 3500K unless otherwise specified. Where "Full Spectrum" lamps or fixtures are indicated on the drawings, provide lamps with a CRI of at least 92 with a Kelvin rating of 5000K.

2. Provide phosphor coated metal halide lamps in wattages and chromaticity as indicated. Clear lamps may be used in fixtures with refractors. Lamps of the highest lumen output per watt shall be used.

3. Provide LED lighting where indicated with integral LED type light source and power supply. LED light source shall be replaceable in modules with a "white" light source and color rating of approximately 3500 K.

G. Support:

1. Install support wires at all four corners of troffer type lighting fixtures and one wire at all others to structure. Support wires shall be of similar type for support of acoustical tile ceilings. Discarded electrical conductors or similar scrape material shall not be utilized for this purpose.

## 2.3 CONTROLS

A. Occupancy Sensors:

1. Occupancy sensors utilized in restrooms and certain other locations shall be of the ultrasonic type for use in rooms with high partitions. Occupancy sensors for offices and certain other areas shall be dual-technology type. Refer to drawings for model numbers used in specific areas.

2. The ultrasonic occupancy sensors shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound.

3. The ultrasonic frequency shall be 25 khz at 0.005%. The sensor shall be precision crystal controlled and shall not interfere with each other when two or more are placed in the same area.

4. Sensor shall utilize Advanced Signal Processing to automatically adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow through the controlled space. Ultrasonic circuit shall be solid state crystal controlled.

5. Sensors of varying frequencies shall not be allowed so as to prevent sensors from interfering with each other and to assure compatibility in the event more sensors are added or units replaced.

6. Sensor shall have a multi-directional transmitter with temperature and humidity resistant, 25 KHZ tuned ultrasonic receivers. Ultrasonic receivers shall be temperature and humidity resistant with less than 6db shift in the humidity range of 10% to 90% and less than a 10db shift in the temperature range of -20 degrees to 60 degrees Celsius.

7. Detection shall be maintained when a person of average size and weight moves only within or a maximum distance of twelve inches either in a horizontal or vertical manner at the approximately speed of 12 inches per second. The sum of this distance, volume and speed represent the average condition ultrasonic sensors must meet in order for the lights to not go off when a person is reading or writing while seated at a desk.

8. Each sensor shall be furnished with a convenient shunt provision which will enable a custodian or building maintenance person to bypass the sensor in the event of failure. This bypass provision pin shall remain in the sensor in the event of a failure. This bypass provision pin shall remain in the sensor.

9. Sensors to be ceiling mounted, shall not protrude more than 1.25 inches and should blend in aesthetically with the ceiling. Sensors that are wall mounted shall include a wall bracket and shall be mounted below the level of pendant type lighting fixtures.

10. Time delay range shall be adjustable from 15 seconds to 15 minutes.

11. Sensors shall cover 360 degrees and shall be appropriately sized for the area in square feet.

12. The sensors shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

13. Sensors shall be UL and CUL listed.

14. Sensors shall have a 5 year warranty.

15. Contractor shall include all necessary components including power pack, switches sensors, boxes for a completely operational system.

16. The contactor shall confer with the manufacturer to select the best model for adequate coverage for each individual space and best sensor placement for best operation.

17. Certain occupancy sensors are wired with low voltage momentary switches located at the door to each room. This switch is intended for the room occupant to turn lighting on should the occupancy sensor fail or to turn fixtures on immediately.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify Architect in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF LIGHTING FIXTURES

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standard, IBC 2012 and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Architect. Hangers shall be installed on all four corners and designed to meet BOCA or IBC seismic requirements.

C. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface.

D. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

E. Fasten fixtures securely to indicated structural supports; and ensure that pendant fixtures are plumb and level. Provide individually mounted pendant, fixtures longer than 2 feet with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum one inch vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures in the row.

F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors, Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B and the National Electrical Code.

G. Support surface mounted fixtures greater than 2 feet in length at a point in addition to the outlet box fixture stud.

H. The manufacturer's name and catalog numbers referred to are given for identification of type of fixtures desired for locations as indicated on the drawings. Fixtures of other manufacturers, similar in design and equal in operation, efficiency, utilization quality and finish to the various units scheduled may be submitted as substitutes, provided cuts of units, together with all necessary and pertinent photometric and construction data are provided during the submittal phase. Fixtures must be equal in operation, construction,

quality and appearance. Exterior fixtures shall be provided with matching poles and shall be substituted by special permission only.

I. Each fixture shall be supplied with the necessary end caps, straps, supports, hangers, canopies, or other miscellaneous materials and devices to install them in a satisfactory manner and to conform to the architectural treatment in the areas in which they are to be installed. The Contractor shall consult all architectural and structural plans, etc., in order that he may familiarize himself with all necessary details for the various units to be installed throughout the project. Failure to do this will not relieve him of furnishing the necessary materials, etc., to perform the function intended for the lighting system as shown on the drawings.

J. The Contractor shall determine and coordinate the proper ceiling mounting apparatus (i.e., grid, flange, etc.) for all lighting fixtures. It shall be the responsibility of the Contractor to modify any and all fixtures as listed in the Fixture Schedule such that the fixtures shall adapt to the ceiling (including sloped ceiling adapters). All fixtures shall be in independently supported apart from the ceiling grid.

K. The contractor shall coordinate exterior pole concrete base anchor bolt layout with construction and installation of bases. If bases indicates are not appropriate for poles as recommended by manufacturer, it shall be brought to the attention of the Engineer. All poles shall be round, non-tapered and constructed of painted aluminum unless otherwise noted.

3.3 FIELD QUALITY CONTROL

A. At Date of Substantial Completion, replace lamps in lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Architect.

1. Refer to Division-1 sections for the replacement/restoration of lamps in lighting fixtures, where used for temporary lighting prior to Date of Substantial Completion.

B. Furnish stock or replacement lamps amounting to 15%, of each type and size lamp used in each type fixture. Deliver replacement stock as directed to Owner's storage space.

C. All fluorescent lamps used with dimming ballast must be “burned in” for a period of 1000 hours operating continuously prior to being dimmed.

3.4 ADJUSTING AND CLEANING

A. Clean lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses or parabolic surfaces.

B. Protect installed fixtures from damage during remainder of construction period.

3.5 GROUNDING

A. Provide equipment grounding connections for lighting fixtures and poles as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

3.6 DEMONSTRATION

A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION

SECTION 26 52 00

EMERGENCY LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK

A. Extent of emergency lighting work is indicated by drawings and schedules. Install new devices where indicated on the drawings.

B. Types of emergency lighting fixtures in this section include the following:

1. Exit fixtures
2. Emergency Ballasts
3. Battery packs and remote heads

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of emergency lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with emergency lighting work similar to that required for project.

C. Codes and Standards:
1. NEC Compliance: Comply with NEC as applicable to installation and construction of emergency lighting.
2. NEMA Compliance: Comply with applicable requirements of NEMA Std Pub No.'s 1B 4, 1B 5, and FA 1 pertaining to emergency lighting.
3. UL Compliance: Provide emergency lighting fixtures which comply or exceed UL-924.
4. NFPA Compliance: Comply with applicable requirements of NFPA 101, "Life Safety Code".

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data on emergency lighting fixtures.

B. Shop Drawings: Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical, or numerical order, with proposed fixture and accessories clearly indicated on each sheet.

C. Maintenance Data: Submit maintenance data and parts list for each emergency lighting fixture and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; replace with new.

B. Store lighting fixtures in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Dual-Lite Inc.

B. Prescolite

C. Lithonia

D. Surelite

E. Litealarms

F. Substitutions are allowed of equal quality, appearance and functionality

2.2 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.

c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

C. Provide surface, wall, or ceiling mounted cast aluminum LED type fixtures as indicated for all floors, with capability for adjusting exit arrows as required. Cooper #LPX70RWHSD or equal.
1. Polycarbonate Panels: Provide stencil face, white-finish permanent, red letters, 6" high, 3/4" stroke. Provide with optical diffuser.
2. Lamps: Lamps shall be LED type.
3. Enclosure: Polycarbonate.
4. Options: Energy-Star Compliant.
5. Provide battery option with diagnostics
6. Provide with single or dual chevrons as required

## 2.3 EMERGENCY BALLASTS

A. For each lighting fixture designated as an emergency egress lighting fixture, provide a self contained, modular, battery-inverter emergency lighting ballast complete with batteries, charger and lamp interface electronics factory mounted within the lighting fixture body and compatible with the ballast. Ballasts shall be UL924 listed and meet all requirements of NFPA 101 & 70. Ballast shall include the following features:
1. Sealed maintenance free nickel cadmium batteries
2. Fully automatic battery charger, solid-state, constant-current type with sealed power transfer relay
3. Diagnostic functions for automatic testing and exercising
4. UL Listed
5. Capable of full operation for 90 minutes
6. 7-10 year battery life
7. 5 year warranty

B. Emergency Connection: Operate 1 fluorescent lamp(s) continuously at an output of **1100** lumens each. Connect unswitched lighting feeder circuit to battery-inverter unit and switched circuit to fixture ballast.

C. Provide Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

1) Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
2) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

D. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

E. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

## 2.4 SELF CONTAINED BATTERY PACKS

A. Description: Comply with UL 924 and NFPA 101; for colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Battery Packs:
1. Lamps for AC Operation: LEDs with 10 years of rated life.
2. Battery Unit:

a. Battery: Sealed, maintenance-free, lead-cadmium type, rated with 15 year life.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

C. Remote Head Features:
1. Injection molded thermoplastic housing, white in color, suitable for wall mounting.
2. 12 or 24v input
3. Track and swivel arrangement to permit full head adjustment.
4. Adjust head to illuminate path of egress.
5. Provide weather resistant heads when located on the exterior.
6. Remote heads shall employ LED lamps.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which emergency lighting is to be installed, and substrate which will support lighting fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF EMERGENCY LIGHTING FIXTURES

A. Install emergency lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, NFPA, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with other electrical work as appropriate to properly interface installation of emergency lighting fixtures with other work.

3.3 ADJUSTING AND CLEANING

A. Clean emergency lighting fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during remainder of construction period.

3.4 GROUNDING

A. Provide equipment grounding connections for emergency lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

3.5 FIELD QUALITY CONTROL

A. Upon completion of installation of emergency lighting fixtures, and after building circuitry has been energized with normal power source, apply electrical energy to demonstrate capability and compliance with requirements. Test emergency lighting to demonstrate operation under emergency conditions. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes exterior luminaries, poles, and accessories.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
2. ANSI C82.4 - American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).
3. ANSI O5.1 - Wood Poles, Specifications and Dimensions.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire not standard Product of manufacturer.

C. Product Data: Submit dimensions, ratings, and performance data. Pole and fixture color to be selected and approved by architect.

D. Samples: Submit two color chips 3 x 3 inch (75 x 75 mm) in size illustrating luminaire finish color where indicated in luminaire schedule.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 MOCK-UP

A. Section 01 40 00 - Quality Requirements: Mock-up requirements.

B. Locate where directed by Architect/Engineer or as indicated on Drawings.

C. Incorporate accepted mockup as part of Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store and handle solid wood poles in accordance with ANSI O5.1.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.8 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution Requirements: Spare parts and maintenance products.

B. Furnish two of each lamp installed.

C. Furnish two gallons of touch-up paint for each different painted finish and color.

D. Furnish two ballasts of each lamp type installed.

PART 2 PRODUCTS

2.1 LUMINARIES

A. Product Description: Complete exterior luminaire assemblies, with features, options, and accessories as scheduled.

B. Refer to Section 01 60 00 - Product Requirements for product options. Substitutions are not permitted for decorative fixtures.

C. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy-efficient lamps, lamp holders, reflectors, energy efficient ballasts, starters and wiring. Ship fixtures factory-assembled, with those components required for a complete installation, including lamps. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast generated noise. Fixtures shall be post-painted and shall be ordered with lamps pre-installed.

2.2 FLUORESCENT BALLASTS

A. Manufacturers:
1. Motorola.
2. Duro-Test Corp.
3. General Electric Co.
4. Hubbell Lighting.
5. Magnetek Inc.

6. Pass & Seymour.
7. Philips Electronic North America.
8. Thomas Industries, Inc.
9. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: High-power-factor type electromagnetic ballast certified by Certified Ballast Manufacturers, Inc. to comply with ANSI C82.1, Electronic ballast, rapid start, suitable for lamps and environmental conditions specified, with voltage to match luminaire voltage. Fluorescent ballast must be listed as “Super T8” or “High Performance”.

2.3 HIGH INTENSITY DISCHARGE (HID) BALLASTS

A. Manufacturers:
1. Motorola.
2. General Electric Co.
3. Philips Electronics North America.
4. Radiant Lamp Co.
5. Siemens Corp.
6. Venture Lighting International Inc.
7. Substitutions: Section 01600 - Product Requirements.

B. Product Description: ANSI C82.4, lamp ballast with a factor of .85 or greater, suitable for lamp specified and environmental conditions specified, with voltage to match luminaire voltage and manufacturer’s recommendation.

2.4 FLUORESCENT LAMPS

A. Manufacturers:
1. Sylvania
2. Phillips
3. GE
4. Substitutions: Section 01600 - Product Requirements.

B. Provide fluorescent lamps of energy saving types as indicated, with a CRI rating of at least 85 and a Kelvin rating of 3500 unless otherwise specified.

C. Provide fluorescent lamps where described as “Full Spectrum” as indicated, with a CRI rating of at least 95 and a Kelvin rating of 5000.

2.5 HID LAMPS

A. Manufacturers:
1. Sylvania
2. Phillips
3. GE

4. Substitutions: Section 01600 - Product Requirements.

B. Provide phosphor coated metal halide lamps in wattages and chromaticity as indicated. Clear lamps may be used in fixtures with refractors. Lamps of the highest lumen output shall be used.

C. Provide Pulse Start for metal halide fixtures.

2.6 LED FIXTURES

A. Provide fixtures with 3500 Kelvin rating, illumination intensity and electrical power consumption as indicated on the drawings.

B. Fixtures shall contain solid state ballast capable of operating in a range of 120 to 277 volts.

C. Fixtures shall be equal in appearance as specified.

D. Provide fixtures with similar light distribution pattern as fixtures specified. Exterior fixtures shall be full cutoff type and Dark Sky compliant.

E. Fixtures shall be constructed of cast aluminum and wet listed for exterior use.

F. LED bars shall be constructed with integral heat sink and capable of operating with one or more failed LED lamps. Light bars shall be capable of being changed and replaced individually.

G. LED bars shall be warrantee for a period of at least 5 years with an operating life rated at 70,000 hours.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and Project conditions.

B. Verify foundations are ready to receive fixtures.

3.2 EXISTING WORK

A. Disconnect and remove abandoned exterior luminaries.

B. Extend existing exterior luminaire installations using materials and methods compatible with existing installations, or as specified.

C. Clean and repair existing exterior luminaries to remain or to be reinstalled.

3.3 INSTALLATION

A. Provide and install concrete bases for lighting poles at locations as indicated on Drawings.

B. Install poles plumb. Install shims and /or double nuts to adjust plumb. Grout around each base. Install base flush with grade.

C. Install lamps in each luminaire.

D. Bond and ground luminaries ,metal accessories and metal poles in accordance with Section 26 05 26. Install supplementary grounding electrode at each pole.

E. Each fixture shall be supplied with the necessary end caps, straps, supports, hangers, canopies, or other miscellaneous materials and devices to install them in a satisfactory manner and to conform to the architectural treatment in the areas in which they are to be installed. The Contractor shall consult all architectural and structural plans, etc., in order that he may familiarize himself with all necessary details for the various units to be installed throughout the project. Failure to do this will not relieve him of furnishing the necessary materials, etc., to perform the function intended for the lighting system as shown on the drawings.

F. The contractor shall coordinate exterior pole concrete base anchor bolt layout with construction and installation of bases. If bases indicates are not appropriate for poles as recommended by manufacturer, it shall be brought to the attention of the Engineer. All poles shall be square, non-tapered and constructed of painted aluminum unless otherwise noted.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services 01 70 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

C. Measure illumination levels to verify conformance with performance requirements.

D. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.5 ADJUSTING

A. Section 01 70 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Aim and adjust luminaries to provide illumination levels and distribution as indicated on Drawings.

3.6 CLEANING

A. Section 01 70 00 - Execution Requirements: Final cleaning.

B. Remove dirt and debris from enclosures of lighting fixtures upon completion of installation. Clean fingerprints and smudges from lenses or parabolic surfaces

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution Requirements: Protecting finished work.

B. Replace any light bars, lamps or luminaries at Substantial Completion if any components have failed or are non-functional.

END OF SECTION

SECTION 27 15 00.19

DATA COMMUNICATIONS HORIZONTAL CABLING

## PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

### 1.02 SUMMARY

A. This section includes a computer network wiring system wiring.

1. Remove existing data wall jacks and cabling. Provide new wall jacks, cabling and Category 6, type 110 wall jacks and patch panels for new wall jacks as indicated. Provide testing and labeling for all jacks and connections.

3. Provide cabling with a colored jacket as indicated and label all jacks and cables with their respective room and jack number.

B. Related Sections: The following Division 26 sections contain requirements that relate to this section.

1. "Basic Materials and Methods" for raceways used for cables, for certain system wiring and for wiring enclosures.

### 1.03 SYSTEM DESCRIPTION

A. The computer network wiring system will be wired in a "star" configuration with termination panels as the central termination point to individual jacks. Termination panels shall be as indicated on the drawings. Jacks shall be located in all rooms as indicated on the drawings. Jacks and termination panels shall conform and be wired in accordance to the EIA/TIA 568A Telecommunications Facilities & Wiring Specification for the Category 6 rating. There may be multiple wall plates in any given room. Active computer equipment including, switches and hubs will be furnished and installed by the owner. All cabling shall be terminated and tested by the contractor. All cables shall be routed through conduit sleeves and “J” hooks as shown. Neatly bundle.

Provide all new data cabling as indicated on the drawings.

### 1.04 SUBMITTALS

A. Manufacturer's Data

A. Termination Patch Panels and modular jacks
B. Equipment Racks
C. Wall Jacks and Plates
D. Cables
E. "J" hooks

B Shop Drawings: Provide a listing that clearly and completely indicate termination point of devices and inter-connections of all cables. Listings shall cross reference room numbers and designated device numbers.

C. Wiring Diagrams: Submit analog and digital data transmission wiring diagrams for each system, including rack, terminal, control panel and device connections. Also show wiring connections to electrical power feeders. Differentiate between portions of wiring that are manufacturer-installed and portions that are field-installed.

D. Operation and Maintenance Manual: Provide six copies, bound securely in durable, hard cover, water-resistant binders. Include instructions for operating and maintaining system components, assemblies and accessories. Include as-built circuit diagrams complete with conductor color codes, a parts list by name, model number, manufacturer and serial number and a listing of computer wall jack locations and numbers. General system descriptions included in manufacturer's catalogs or advertising media will not be acceptable in meeting the requirements of this section.

D. Test Manual: Provide two copies, bound securely. Manual shall include individual test data sheets for each cable run.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of computer network systems, components and accessories, of types, capacities and characteristics required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firms with at least 3 years of successful installation experience with computer network distribution systems and wiring similar to that required for this project. Contactor must have and be familiar with testing equipment required for this project and must possess testing equipment. Contractor must provide three references for similar size projects completed if requested.

C. Codes and Standards:

A. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC 725 and 800-Series articles as applicable to installation, and construction of telephone and computer network distribution systems.

2. UL Compliance: Comply with applicable requirements of UL Standards. Provide telephone and computer network systems and components which are UL-listed and labeled.

3. EIA Compliance: Comply with applicable requirements of Electronic Industries Association Standards 568A, 569A, 570, 606, and 607.

4. BICSI: Follow installation guidelines as described in the Building Industry Consulting Service International organization Telecommunications Distribution Methods Manual.

1.06 SPARE PARTS

A. Spare parts shall be directly interchangeable with the corresponding components of the installed system, spare parts shall be suitably packaged and identified by nameplate, stamping or tagging.

B Furnish the following:

1. Four Modular 45 Jacks and Wall Plates

PART 2 - PRODUCTS

2.01 SYSTEM, EQUIPMENT AND REQUIREMENTS

A. Computer Network: Provide a complete IEEE 1000-BASE-T rated Ethernet network to include:

1. Patch Panels - High density patch panels with jacks number in sequential order. Panel shall be rack mountable with modular 8 position jacks (RJ-45) with 8-110 type connectors per jack, Category 6 rated, UL verified. Panels may contain 48 or 96 jacks and measure 3.5” or 7” respectively. Provide 3” x 3” horizontal management wireways between each patch panel. Provide number of patch panels required with 25% spare. Patch panels shall not be shared by systems components with different functions. Allow space for one or two future patch panels. 110 termination points shall utilize the 568B color coding scheme.

2. Wall Plates - Wall plates quantity and location are as indicated on the drawings. Wall plates shall be constructed of stainless steel, four (4) position with 2-8-position, Category 6 modular connectors, one (1) blue and one (1) green in color, for data type of usage and clearly marked on the front of the plate, "Data". The third and fourth positions shall have a blank plate. Jacks used for wireless shall be yellow in color and white when used for telephone.

All plates shall be clearly marked with room/closet, patch panel and jack number integral to plate (i.e.: 2-45). Marking shall be with a commercial, permanent

marking device and shall not be with a thermoplastic punch device or hand marked sticker.

All wall plates shall be provided with a standard electrical "wall case" or box recessed in the wall and properly secured with conduit stub to ceiling space. 110 termination points shall utilize the 568B color coding scheme.

3. Cable - All data cable utilized shall be Category 6 rated, 24 gauge, solid conductor, 4 pair, 8 conductor, UL verified Category 6 plenum rated cable as required, tested to 400 MHZ. Conductor pairs shall be color coded per EIA/TIA 568B for identification and color coding shall be observed when terminating to panel and jacks. Cable jacket shall have the Category 6 performance marking and length or foot markings. Cable color shall be blue for data, yellow for wireless ceiling jacks and white for telephone. DC resistance of any conductor shall not exceed 9.38 ohms per 100 meters and a characteristic impedance of approximately 100 ohms +/- 15%. Cable attenuation at 100 meters and 250 mhz shall be 20 db or less. PS-NEXT at 100 meters and 250 MHZ shall be 42.3 db or higher. PS-ACR at 100 meters and 250 MHZ shall be 5.5 or lower. PS-ELFEXT at 100 meters and 250 MHZ shall be 24.8 or higher. Return Loss at 100 meters and 250 MHZ shall be 20.1 or higher.

4. Equipment Racks – Provide one floor mounted, two post standard 19" painted steel racks with pre-drilled and tapped mounting holes and screws. Anchor to floor per specifications. Provide with 4" x 7" vertical wire management and attach to racks. Hubble # HPW84CMRR19 or equal.

## 2.02 ACCEPTABLE MANUFACTURERS

A. Patch Panels

Hubble
Leviton
Ortronics

B. Jacks and Faceplates

Hubble
Leviton
Ortronics

C. Equipment Racks

Chatsworth
Hubble
Equivalent

D. Cable

Belden
AMP
Mohawk/CDT

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which the computer network is to be installed, Do not proceed with work until satisfactory conditions have been corrected in manner acceptable to installer.

3.02 INSTALLATION

A. Install the computer network at locations and as indicated. Components shall be installed in accordance to manufacturers written instructions. Applicable requirements of NEC, IEEE's 1000-BASE-T and EIA/TIA 568A specifications and with recognized industry practices to ensure that the computer network fulfills requirements.

Cable length shall not exceed 90 meters (295 feet) or routed near electromagnetic sources. Color coding shall match between all devices. Cables shall be clearly marked on both ends with jack number during installation and permanently marked on the termination panel end with a shrink sleeve type of marker with jack number machine produced. Measure cable route prior to installation and notify the engineer if distance exceeds 297'.

Cable installation precautions should be observed, including the elimination of cable stress caused by cable tension. Cables should not be routed in tightly cinched bundles. Cable bending radius shall not be less than 1/4 inch or 2 times the cable diameter. Cables shall be neatly bundled and routed without strain, protected and supported per NEC requirements. All cabling in walls shall be in metal conduit with three cables maximum in 3/4" conduit and seven cables maximum in 1" conduit.

Pairs shall not be untwisted any more than 1/4 inch for termination at patch panel and wall jacks. Do not split pairs. All cabling shall be installed in conduit in wall spaces to cable tray located in corridors. Seal all penetrations through fire rated barriers.

B. All telecommunications cables must be placed so as to avoid electrical interference caused by inductive loads such as fluorescent light ballast, electric motors, generators, etc.

C. All cables must be placed within 297 cable-feet (90 meters) of the patch panel in which the jack wiring terminates, per EIA/TIA specifications for such cables.

3.03 FIELD INSPECTION AND TESTING

A. Before final acceptance of the work, test each system, station and wall jack to demonstrate compliance with the contract requirement. Each system shall be subjected to complete

functional and operational tests including tests in place of each jack with a telecommunications wiring and equipment analyzer for testing of transmission quality. Tester shall test for the following parameters, PS-NEXT, length, impedance, attenuation, resistance, capacitance, and PS-ACR. Tested parameters must equal or exceed cable specifications listed in this specification. If test fails, cable must be replaced. When tests have been completed and any corrections made, submit two (2) signed and dated listing of the test results for each cable to the owner. All malfunctioning equipment will be replaced and retested.

END OF SECTION

SECTION 27 15 00.23

TELEVISION SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

A. Extent of television systems work is indicated by drawings and schedules. Television systems are comprised of, but not limited to, modulators, signal transmission lines, splatters and accessories.

B. Work of this section includes raceways, electrical boxes and fittings, wiring/cabling, and control/signal transmission media, as specified in applicable Division-26 Basic Electrical Materials and Methods sections, which are used in conjunction with installation of TV systems.

C. Contractor shall contact Time Warner and make arrangements for service and any required amplifiers.

1.3 SYSTEM DESCRIPTION

A. The system shall consist of a telecommunications room located on the ground floor and associated cable and jacks. Each individual room shall be wired back to the room with numbered jacks. Cable shall be RG-6 Quad-Shield for lengths under 200 feet. For lengths over 200 feet, provide RG-11 Quad-shield. A fire resistant plywood panel shall be installed in the closet for termination of cables and mounting of amplifier and splitters. Cables shall be numbered on both ends with room numbers. Wall jacks shall be Type “F” with stainless steel wall plates where installed individually or part of the telecommunications wallplate (see detail on drawings). The contractor shall provide all terminations and testing.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's data on television systems including components and accessories.

B. Wiring Diagrams: Submit wiring diagrams for television systems, including interconnecting signal/video units and electrical power connections to equipment and

components. Show physical layout of signal and power cabling. Differentiate between portions of wiring which are manufacturer-installed and portions which are field-installed.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of television systems, components and accessories, of types, capacities and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with at least 3 years of successful installation experience with projects utilizing television system work similar to that required for this project.

C. Codes and Standards:
1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC 800-Series articles as applicable to installation, and construction of television equipment and signal distribution systems.
2. NFPA Compliance: Comply with applicable requirements of NFPA 78, "Lightning Protection Code," pertaining to television and antenna systems.
3. UL Compliance: Comply with applicable requirements of UL Standards and 468B, 813, 983, 1409, 1410f 1412, 1414, 1416, 1417, and 1418 pertaining to television system products. Provide television systems and components which are UL-listed and labeled.
4. NEMA Compliance: Comply with requirements of Stds Pub/No, WC 41, "Coaxial Communication Cable," pertaining to testing of coaxial cable.
5. EIA Compliance: Comply with applicable requirements of Electronic Industries Association Standards RS-170, 222, 232, 312, 330, 403f 412f 420, 439, and 455 pertaining to television equipment and accessories.
6. FCC Compliance: Comply with Subpart J of PART 15t FCC pertaining to computing devices including Class A, Class B, personal and peripheral types. Provide equipment which complies with technical standards for both radiated and power line conducted interference.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver TV system components properly packaged in factory-fabricated type containers. Enclose an operating impact sensor in each container, which are holding sensitive electronic equipment capable of recording a 5G rating.

B. Handle TV equipment and components carefully to avoid breakages, impacts, denting and scoring finishes. Do not install damaged equipment; replace and return damaged units to equipment manufacturer.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with other work, including electrical wiring work, as necessary to interface installation of cable TV systems with other work.

B. Sequence TV system installation work with other work to minimize possibility of damage and soiling system during remainder of construction period.

C. Coordinate with the owner so that a complete system is installed in the building.

1.8 MAINTENANCE

A. Maintenance Data: Submit maintenance data and parts list for each television system component; including "trouble shooting" maintenance guide. Include that data, product data and shop drawings in a maintenance manual; in accordance with requirements of Division-1.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. TV Wire/Cable: Belden RG-6 and RG-11 Quad-SHLD or equal rated for 2000 MHz, plenum rated.

B. TV Jacks: Leviton, Ortronics, AMP, or equal. Match telecommunications jacks and manufacturer.

2.2 RACEWAYS, AND ELECTRICAL BOXES AND FITTINGS

A. General: Provide raceways, and electrical boxes and fittings complying Division-16 Basic Electrical Materials and Methods sections "Raceways" and "Electrical Boxes and Fittings", in accordance with the following listing:
1. Rigid Steel Conduit.
2. Rigid Metal Conduit Fittings. Type 1.
3 Electrical Metallic Tubing (EMT).
4. EMT Fittings.
5. Interior Outlet Boxes.
6. Junction and Pull Boxes.
7. Bushings, Knockout Closures and Locknuts.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which television systems are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF TELEVISION SYSTEMS

A. Install television systems and components in accordance with equipment manufacturer's written instructions, in compliance with National Electrical Code, and with recognized industry practices, to ensure that television system complies with requirements and serves intended purposes.

B. Use extreme care in handling, fishing and pulling-in electronic coaxial cable to avoid damage to cable and shielding. Avoid excessive and sharp bends. Ensure manufacturer's recommended pulling tensions are not exceeded.

C. Install television equipment properly to avoid causing mechanical stresses, twisting or misalignment of equipment being exerted by clamps, supports, and cabling.

D. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B. and the National Electrical Code.

E. Pull conductors simultaneously where more than one is being installed in same raceway.

F. Splices in media (cable) runs are not allowed.

G. Install TV cable from common signal source (splitters) directly to TV terminal, looping cables from TV outlet to TV outlet is not allowed.

3.3 GROUNDING

A. Provide equipment grounding connections for television systems as indicated, Tighten connections to comply with tightening torques specified in UL standard 486A to assure permanent and effective grounds. Provide grounding conductors for antennas and antenna supporting structures without splices or connections in the conductor. Ensure and demonstrate that resistance to solid earth for signals is less than, or equal to 3 ohms.

3.4 ADJUSTING AND CLEANING

A. Set field-adjustable television system components for input voltages, current settings and frequency settings.

B. Touch-up scratched and marred surfaces to match original finishes; remove dirt and construction debris.

3.5 FIELD QUALITY CONTROL

A. Upon completion of installation of TV system components, and after circuitry has been energized with normal power source, test television systems to demonstrate capability and compliance with requirements including, but not limited to, video output signal strength at outlets selected by Owner. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance, otherwise remove and replace.

END OF SECTION

SECTION 27 30 00

TELEPHONE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Electrical materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

A. Extent of telephone system work is hereby defined to include work as indicated on the drawings including telephone wiring/cabling, punchdown blocks, raceways and wall jacks. Provide cabling from each individual jack as indicated on the drawings to the central building telecommunications wiring closet. Terminate with 110 style blocks and test. Document all terminations with room number and pair color coding.

B. Wires/cables, control/signal transmission media, raceways, electrical boxes and fittings, and cable trays, which are required in connection with the installation of telephone systems, are specified in other Division-26 sections.

C. Requirements are indicated elsewhere in these specifications for work including, but not limited to cable riser closets, equipment rooms, lateral cable distribution systems, attendants' cabinets and turrets, required in connection with the installation of telephone systems.

D. Telephones for Maine Eye are VoIP type and utilize data jacks. Telephones jacks shall be provided for the Fire Alarm system, DDC system and elevator.

E. Where wall phone jacks are indicated for special locations such as operating rooms or procedure rooms, they shall be wired as data jacks.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on telephone systems and components.

B. Shop Drawings: Submit layout drawings of telephone systems and accessories including, but not necessarily limited to, service-entrance penetrations, plywood mounting panels, apparatus, racks, terminals, and switching equipment.

C. Wiring Diagrams: Submit analog and digital data transmission wiring diagrams for telephone systems, including rack and terminal connections. Also show wiring connections to electrical power feeders. Differentiate between portions of wiring that are manufacturer-installed and portions that are field-installed.

D. Agreement to Maintain: Prior to time of final acceptance, the Installer shall submit 4 copies of an agreement for continued service and maintenance of telephone system, for owner's possible acceptance. Offer terms and conditions for furnishing parts and providing continued testing and servicing, including replacement of materials and equipment, for one-year period with option for renewal of Agreement by Owner.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of telephone systems and ancillary equipment, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with at least 5 years of successful installation experience with projects utilizing telephone systems and equipment similar to that required for this project.

C. Codes and Standards:
1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC, including BOO-Series articles as applicable to installation, and construction of telephone systems.
2. FCC Compliance: Comply with Part 68 and Subpart J of Part 15, Federal Communications Commission Rules, pertaining to telephone equipment and Class A computer registration by manufacturer.
   a. Provide telephone and computer equipment with FCC labels indicating applicable FCC registration and numbering.
3. IEEE Compliance: Comply with Std 241i, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to communication systems.
4. NEMA Compliance: Comply with NEMA's Pub No, 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."
5. REA Compliance: Comply with Rural Electrification Administration specifications pertaining to construction and installation of telephone cabling.
6. EIA Compliance: Comply with EIA Standards RS-453, 455, and 464 pertaining to installation of telephone systems.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver telephone equipment and components in factory-fabricated containers or wrappings, which properly protect equipment from damage.

B. Store telephone equipment and components in original packaging. Store inside in a well-ventilated space protected from weather, moisture, soiling, humidity, and extreme temperatures.

C. Handle telephone equipment and components carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.6 SEQUENCING AND SCHEDULING

A. Installer shall notify local telephone operating company in writing of telephone interface connection requirements to ensure proper and timely interfacing of building telecommunication systems with the telephone operating company's systems.

B. Coordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of telephone system with other work.

C. Sequence installation of telephone system with other work to minimize possibility of damage and soiling during remainder of construction.

1.7 MAINTENANCE

A. Agreement to Maintain: Engage Installer who is willing to execute with Owner the required agreement for continued maintenance of the telephone system.

PART 2 PRODUCTS

2.1 TELEPHONE SYSTEMS

A. Provide a complete telephone wiring system to include:

1. 110 type punchdown termination panels, Category 6 rated.

2. Wall plates quantity and location are as indicated on the drawings. Wall plates shall be constructed of plastic, white in color with 1-RJ-45 modular connectors rated for telephone type of usage and clearly marked on the front of the plate, "Voice". Connections shall be 110 type, Category 6 rated. All plates shall be clearly marked with block and jack number integral to plate (i.e.: 2-45). All wall plates shall be provided with a standard electrical "wall case" or box recessed in the wall and properly secured with conduit stub to cable tray located in corridor ceiling cavity as detailed on the drawings.

3. All telephone cable utilized shall be Category 6 rated, 24 gauge, solid conductor, 4 pair, 8 conductor, UL verified Category 6 plenum cable as required. Conductor pairs shall be color coded per EIA/TIA 568B for identification and color coding shall be observed when terminating to panel and jacks. Cable jacket shall have the Category 6 performance marking and length or foot markings. DC resistance of any conductor shall not exceed 9.38 ohms per 100 meters and a characteristic impedance of approximately 100 ohms +/- 15%. Cable attenuation at 100 meters and 100 mhz shall be 20.4 db or less. NEXT loss at 100 meters and 100 MHZ shall be approximately 47 db. All cabling shall be installed in conduit in wall spaces to cable tray located in corridors.

2.2 ACCEPTABLE MANUFACTURERS

A. Punchdown Blocks
1. Lucent Technologies 110 wiring blocks # 110AW2-25, 25 pair, with legs or equal.

B. Jacks and Faceplates
   1. Category 6, modular 8 pin wall mounted jack

C. Cable
   1. To individual walljacks: Category 6 rated, 4 pair. Color code cable jacket shall be ivory.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which telephone systems are to be installed. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF TELEPHONE SYSTEMS

A. Install the telephone jacks at locations as indicated. Components shall be installed in accordance to manufacturers written instructions. Applicable requirements of NEC and EIA/TIA 568A specifications and with recognized industry practices to ensure that the telephone system fulfills requirements. Cable length shall not exceed 90 meters (295 feet) or routed near electromagnetic sources. Color coding shall match between all devices. Cables shall be clearly marked on both ends with jack number during installation and permanently marked on the termination panel end with a shrink sleeve type of marker with jack number machine produced. Cable installation precautions should be observed, including the elimination of cable stress caused by cable tension. Cables should not be routed in tightly cinched bundles. Cable bending radius shall not exceed 1/2 inch or 4 times the cable diameter. Cables shall be neatly bundled and routed without strain, protected and supported per NEC requirements. All cabling shall be in metal conduit with three cables maximum in 3/4” conduit and seven cables maximum in 1” conduit. Pairs shall not be untwisted any more than 1/4 inch for termination at patch panel and wall jacks.

B. All telecommunications cables must be placed so as to avoid electrical interference caused by inductive loads such as fluorescent light ballast, electric motors, generators, etc.

C. All cables must be placed within 295 cable-feet (90 meters) of the patch panel in which the jack wiring terminates, per EIA/TIA specifications for such cables.

B. Coordinate with other electrical work as appropriate to properly interface installation of computer network with other work.

C. Pairs shall not be untwisted any more than 1/4 inch for termination at patch panel and wall jacks. Do not split pairs. All cabling shall be installed in conduit in wall spaces to cable tray located in corridors. Cable shall be neatly bundled in tray and on the 19” rack. Seal all penetrations through fire rated barriers.

3.3 GROUNDING

A. Provide equipment grounding connections for telephone systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.4 ADJUSTING AND CLEANING

A. Clean telephone equipment and components of dirt and construction debris upon completion of installation.

B. Touch-up scratched or marred enclosure surfaces to match original finishes.

C. Protect installed equipment and components from damage during remainder of construction period.

3.5 DEMONSTRATION

A. Upon completion of installation of telephone systems, and after telephone wire circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with testing. Demonstrate to Owner that requirements for basic output signal levels, and values for attenuation and signal-to-noise ratios, have been achieved.

END OF SECTION

SECTION 27 52 23

NURSE CALL SYSTEM

PART 1 GENERAL

1.01 SCOPE

A. The intention of this specification is to provide a nurse call system which will include the following:

1. Bathroom stations.
2. Exam room stations.
3. Corridor dome lights.
4. Two floor control stations (nurse consoles).

B. The system shall include capacity and provisions for adding stations at a later date.

1.02 WORK INCLUDED

A. Furnishing a new nurse call system.

B. Installation, testing, commissioning and training.

1.03 QUALITY ASSURANCE

A. The nurse call system shall be furnished and installed by one supplier who shall assume complete and sole responsibility to insure that all equipment, regardless of manufacturer, is compatible and operates as intended and as described in the specifications and detailed on the plans. Submit to the engineer a list of installations furnished by the supplier having the same type of system which has been in successful service for a minimum of five years.

1.04 REFERENCE STANDARDS

A. National Electrical Code (NEC) - NFPA-70, current edition.

B. The system shall conform to the current NFPA standards and shall be listed as a total system by Underwriters Laboratories, Inc. Listing shall be under NBRZ Hospital Signaling and Nurse Call Equipment, conforming to UL 1069 standards. Proof of such listings shall be made by submitting the UL listing cards describing the equipment by model number with the bid documents. Alternate manufacturers shall submit the listing cards as part of prior approval ten days before the bid date.

C. Each major component shall bear the manufacturer's name, catalog number, and UL label.

1.05 ALTERNATE EQUIPMENT

A. Alternate equipment will be considered only when the following have been submitted and approved in writing by the architect-engineer ten (10) days prior to opening of bid: A list of such alternate equipment and materials, together with three (3) copies of working and shop drawings, and a list of six (6) installations of similar audio-visual-nurse call systems, which have been satisfactorily installed and maintained on user's premises over a minimum period of

five (5) years. The equipment as specified is based on a system equal in features and functions to the Rauland 4000 system.

1.06 GENERAL PROVISIONS

A. The CONTRACTOR shall furnish and install all equipment, accessories, and materials necessary for a complete operating system in accordance with the specifications and applicable drawings.

B. The equipment furnished under this specification shall be the standard product of one manufacturer and shall be equal in performance and quality to that manufactured by Rauland-Borg Corporation, Health Care Communications Division.

C. The CONTRACTOR shall be responsible for providing a complete functional system including all necessary components, whether included in this specification or not.

D. The CONTRACTOR shall guarantee availability of local service by factory-trained personnel from an authorized distributor of the equipment manufacturer. The distributor shall have available a stock of the manufacturer's standard parts. On-the-premises maintenance shall be provided, at no cost to the purchaser, for a period of twelve (12) months from date of completion of installation, unless damage or failure is caused by misuse, abuse, or accident.

E. On-the-premises demand service at other than normal working hours shall also be available and may be charged for by the manufacturer's distributor at the prevailing labor rates.

PART 2 PRODUCTS

2.01 DESCRIPTION OF SYSTEM

A. The system shall be a Rauland 4000 or an approved equivalent and shall provide at least the following features and functions:

1. Two-way signaling and communications between nurses control station(s) and patient exam rooms or bathroom locations. Signalling shall be by indication only. Voice communication is not included in this system.

2. Stacks incoming calls.

3. Incoming calls displayed by room number, room designation, and priority.

4. Automatic selection of calls by priority and/or time of call.

5. Provisions for up to eight (8) call priority levels with automatic sequencing.

6. Patient priority status programmable at nurse control station.

7. Patient privacy programmable at nurse control station.

8. Provisions for registering and locating staff members by sequential display providing staff registers.

9. Solid-state waterproof membrane touchpad on control station.

10. User programmable, permitting simple on-site changing of room numbers in nonvolatile memory.

11. Twelve or twenty-four hour clock displaying time in hours, minutes and seconds.

12. Staff follow mode permitting incoming call tones to be automatically routed to a room or rooms where staff members are registered.

13. Ability to monitor one or several rooms simultaneously.

14. Ability to display all patients in "Priority" status.

15. Ability to display all patient stations in "Privacy" mode.

16. "Privacy" indicator on floor control station.

17. Ability to respond to calls out of sequence using numeric touchpad without losing calls in progress or calls waiting.

18. Provisions for making paging announcements to one, several, or all areas. If a network controller is being used during night mode it is possible to page from one (1) to four (4) or all systems involved in the capture.

19. Visual display of zone(s) being paged.

20. Automatic display of service requirements not answered within an allotted time frame (overtime display).

21. Individually programmable software timers for each of three (3) service required priorities.

22. Choice of communications via floor control station handset or "Push-to-Talk" loud-speaking communications via built-in speaker/microphone.

23. Ability to communicate with registered staff members without losing call in progress.

24. Ability to place current call on hold while answering a higher priority call.

25. Preannounce tone to alert patient of call from floor control station.

26. Provisions for operating floor control station(s) in parallel or in day/night transfer mode.

27. Full operation (including intercom and page) during power failure utilizing standard built-in battery back-up power supply for up to seven (7) minutes.

28. Color-coded plug-in terminations on all floor control stations, patient, staff and duty stations.

29. All solid-state plug-in modular construction.

30. Single touchpoint operation of all system functions.

31. Provisions for including optional features/functions by simply installing the appropriate system components. Software changes or special software shall not be required.

PART 3 EXECUTION

3.01 SYSTEM OPERATION

A. The specified Responder System 4000 shall operate in the following manner:

1. Patient station - "Normal" Call: Normal calls shall be originated at the patient station by momentarily depressing the "Call" button or pulling the call cord. This action shall cause the following to occur:

a. The "Call Placed" indicator on the patient station shall illuminate.

b. The corridor dome light shall illuminate steady white.

c. An alert tone shall sound and the "Normal" indicator shall illuminate at the appropriate duty/nurses stations.

d. An alert tone shall sound and the patient's room number, bed designation and "n" call priority shall be displayed on the floor control station(s) incoming call screen.

2. Patient station - "Priority" call: When programmed in the priority status mode, a patient priority call shall be originated at the patient station by momentarily depressing the "Call" button or pulling the call cord. This action shall cause the following to occur:

a. The "Call Placed" indicator on the patient station shall illuminate.

b. The corridor dome light shall flash white.

c. An "Emergency" alert tone shall sound and the "Emergency" indicator shall illuminate at the appropriate duty stations.

d. A "Priority" alert tone shall sound in the patient's room number, bed designation and "P" call priority shall be displayed on the floor control station(s) incoming call screen, automatically moving ahead of all lower priority calls.

e. "Priority" calls shall be answered in the same manner as "Normal" calls. When appropriate action has been initiated, the priority call shall be automatically transferred to the "Nurse Service" mode by pressing the "Cancel" touchpoint, thus maintaining the integrity of the call while permitting the floor control station operator to handle other incoming calls.

3. Patient station - "Staff Emergency Call": When a staff member has registered into a patient room using a staff register station, calls placed from that station shall automatically be classified as staff emergency and shall cause the following to occur:

a. The "Call Placed" indicator on the patient station shall illuminate.

b. The corridor dome light shall flash white.

c. An "Emergency" tone shall sound and the "Emergency" indicator shall illuminate on all duty stations.

d. An "Emergency" alert tone shall sound and the patient's room number, bed designation and "E" call priority will be displayed on the floor control station(s) incoming call screen, automatically moving ahead of all lower priority calls.

e. "Staff Emergency" calls shall be answered in the same manner as patient "Priority" calls.

f. Patient "Priority" and "Staff Emergency" calls must be canceled at the patient station.

4. Patient station - miscellaneous functions:

a. Removal of the patient's call cord accidentally or intentionally shall automatically place a "Staff Emergency" call. It shall be necessary to replace the cord sets in order to cancel the call.

b. All other patient station calls may be canceled in the patient's room by depressing the "Cancel" button on the patient station or by a staff member registering in by means of a staff registration station.

5. Calls from bath, shower, or emergency stations: Activating the switch on a bath, shower, or emergency station shall cause the following to occur:

a. The "Call Placed" indicator on the bath/emergency station shall light to assure the patient that his call has been properly placed.

b. The corridor dome light shall flash red.

c. An alert tone shall sound and the "Bath" or "Emergency" indicator shall illuminate at all duty stations.

d. A bath or emergency tone shall sound and the room number and "b" or "E" call priority shall be displayed on the floor control station(s) taking precedence over all unanswered calls of lower priority. This call cannot be canceled except at the bath, shower, or emergency station itself.

e. A staff/emergency tone shall sound and the room number and "E" call priority shall be displayed on the floor control station(s) taking precedence over all unanswered calls of lower priority.

f. It shall be possible to cancel "Staff/Emergency" calls by resetting the switch at the calling station. It shall not be possible to cancel "Staff/Emergency" calls by any other means.

6. Call storage: Any calls placed on the system in excess of display space available shall be automatically stored in the memory of the microprocessor-based area control unit. As calls are completed, waiting calls will automatically register on the floor control station display screen in order of priority and/or time placed.

7. Answering calls at the floor control station:

a. To answer a call at the floor control station, the operator shall simply lift the handset and converse in a conventional telephone manner or, if preferred, operate

the "Push-to-Talk" touchpoint and converse over the built-in speaker. An indicator shall illuminate on the "Push-to-Talk" touchpoint when in use. The "Push-to-Talk" touchpoint shall **not** be required when conversing over the handset.

b. This action shall cause all audio and visual signals for the call station to cease for the normal call level, while continuing to display the room number, bed designation and call priority in the "Current Call" screen. Hanging up the handset or pressing the "Cancel" touchpoint shall complete the call.

c. As the call is answered, a preannounce tone shall sound at the patient station and a "Monitor" indicator shall light. The patient shall then be able to converse in a normal voice without the necessity of operating any switches or turning toward the speaker/microphone.

d. Calls from staff or duty stations shall be handled in the same manner as described above.

e. It shall be possible to answer a call using the "Push-to-Talk" method and then, if required, transfer to the handset mode by simply lifting the handset.

f. It shall be possible, should the need arise, to manually control speech direction while conversing over the handset, by operating the "Push-to-Talk" touchpoint.

g. Patient "Priority," "Bath/Emergency," and "Staff Emergency" calls shall automatically be placed in the "Nurse (GREEN LEVEL) Service Required" mode when answered at the floor control station.

h. Calls from "Bath/Emergency," "Staff Emergency" or "Code Blue" stations cannot be canceled at the floor control station and shall require dispatching the proper personnel to the calling station.

i. Stand-alone bath stations shall automatically be placed in the "Nurse (AMBER LEVEL) Service Required" mode when answered at the floor control station.

8. Originating calls from the floor control station:

a. The control station operator shall be able to place outgoing calls by simply dialing the desired room number and bed designation by means of the touchpad dial on the membrane control panel.

b. It shall be possible to dial the desired room number with the handset on or off the hook switch.

c. As the call is dialed, the call station's number shall appear on the utility display of the floor control station. The called number shall move to the "Current Call" screen, a preannounce tone shall sound, and the "Monitor" lamp shall illuminate at the patient station when communication is established.

d. When the call is placed with the handset on the hook, voice communications shall be established by lifting the floor control station handset and conversing in a conventional telephone manner, or by pressing the "Push-to-Talk" touch- point and conversing over the master speaker/microphone.

e. When the call is placed with the handset off-hook, communications will be established when the last digit is dialed.

f. The "Privacy" indicator shall illuminate below the utility display if the operator dials a room and has been placed in the "Privacy" mode. It shall be possible to talk to the patient in this mode but it shall not be possible to hear the patient until the "Privacy" mode has been reset.

g. It shall be possible to interrupt "Privacy" for the duration of the call by instructing the patient to press his "Call" button. "Privacy" shall be automatically re-established when the call is completed.

h. The "Privacy" mode shall not operate when the patient initiates the call to the floor control station, making normal two-way conversations possible without the need to reset the "Privacy" mode for each call.

i. Any system which does not provide an absolute "Privacy" mode or which does not indicate "Privacy" on the floor control station when the called station is in this mode will **not** be acceptable.

9. Placing a call on hold:

a. It shall be possible for the floor control station operator to place the current call on "Hold" without terminating it, while answering another call. A "Hold" call shall move to the end of the calls waiting stack and shall automatically return to the current call screen when all other calls have been cleared, or it may be manually recalled at any time by simply touching the recall touchpad.

b. Any system which forces the operator to hurriedly finish or cancel a call in progress in order to answer a higher priority call will not be acceptable.

10. Placing a nurse (green level), nurse (amber level) or stat service requirement: If the floor control station operator determines that service is required, the appropriate level of staff may be dispatched by pressing the "Nurse (GREEN LEVEL) Service," "Nurse (AMBER LEVEL) Service" or "Stat Service" buttons. This action shall cause the following to occur:

a. The green (nurse service), amber (nurse service), or both (stat service) corridor lamp(s) shall flash.

b. The overtime reminder circuit, if utilized, shall be activated.

c. The "Calling/Responding" indicator on the patient station shall illuminate. On dual patient stations, only the indicator for the patient requiring service shall illuminate.

d. Upon responding to the service requirement, the nurse shall cancel the service requirement by pressing the "Cancel" button on the patient station or, if staff register stations are utilized, by registering into the patient's room.

e. Upon cancellation of the service requirement, all associated signaling shall cease and the overtime function, if utilized, shall be reset.

f. It shall be possible, by software adjustment at the time of installation, to individually program the overtime period for each service priority from two to nine minutes or off.

g. In the event that a service requirement is not answered within the allotted time, the patient's room number shall reappear in the incoming calls screen followed by an "O" priority to indicate "overtime." Overtime priorities are as follows:

1) Stat Required

2) Nurse (GREEN LEVEL) Required

3) Nurse (AMBER LEVEL) Required

11. Monitoring a patient's room(s):

a. To monitor a room, the floor control station operator shall dial the room and press the "Monitor" touchpoint. The operator may monitor one or several rooms at random without the need to monitor an entire zone.

b. When a patient is selected for monitoring, a preannounce tone shall sound and the "Monitor" indicator on the patient station(s) shall illuminate to insure the patient's privacy.

c. It will **not** be possible to monitor a patient station in the "Privacy" mode.

d. Any system that requires the operator to monitor an entire zone in order to monitor more than one station will **not** be acceptable.

12. Placing patient station in "Priority" status mode:

a. It shall be possible to place a patient station in the "Priority" status mode at the floor control station by dialing the room number and bed number and pressing the "Change Priority" touchpoint. The number dialed and priority status shall be verified on the "Utility" screen.

b. If the patient station is already in the "Priority" status mode, the same procedure shall be used to remove the station from the "Priority" mode.

13. Placing patient station in "Privacy" mode:

a. It shall be possible to place a patient station or stations in the absolute "Privacy" mode using the same procedure described for changing "Priority" and pressing the "Change Privacy" button.

b. Systems that require the nurse to go to the patient's room to set or cancel the "Privacy" mode will **not** be acceptable.

14. Displaying stations in "Priority" or "Privacy" modes:

a. It shall be possible to display patient stations in the "Priority Status" mode or "Privacy" mode by simply pressing the "Display Priority" or "Display Privacy" touchpoint.

b. Pressing the "Display Priority" touchpoint will sequentially display all stations in the "Priority" mode. Pressing the "Display Privacy" touchpoint will sequentially display all stations in the "Privacy" mode.

c. It shall be possible to change "Priority" or "Privacy" status during the sequential display sequence by simply pressing the "Change Priority" or "Change Privacy" touchpoint when the appropriate room number is displayed in the "Utility" Screen.

d. Displaying stations in "Priority" or "Privacy" modes shall not interfere with calls displayed on the "Calls Waiting" or "Current Call."

15. Contacting registered staff:

a. It shall be possible to contact the nurse registered **nearest** the calling patient while in communications by simply pressing the "Nurse (GREEN LEVEL)" or "Nurse (AMBER LEVEL)" touchpoint on the floor control station. This single action shall automatically register the location of the **nearest** nurse in the "Utility" screen and shall place the operator in voice contact with the selected staff member.

b. If the selected staff member cannot respond, pressing the "Nurse (GREEN LEVEL)" or "Nurse (AMBER LEVEL)" touchpoint again shall automatically connect the operator to the next **nearest** staff member.

c. The current time shall reappear in the "Utility" screen when no more staff members are registered.

d. When the proper staff member has been dispatched, pressing the "Recall" touchpoint shall automatically reconnect the floor control station to the calling patient permitting the operator to assure the patient that help is on the way.

16. Locating nurses:

a. It shall be possible to locate registered staff members at any time by simply touching the "Nurse (GREEN LEVEL)" or "Nurse (AMBER LEVEL)" touchpoint.

b. This action shall cause registered staff members to be sequentially displayed in the "Utility" screen.

17. Reviewing "Nurse (GREEN LEVEL)," "Nurse (AMBER LEVEL)" or "Stat" service requirements:

a. It shall be possible to review unattended service requirements at any time by pressing the "Nurse (GREEN LEVEL)," "Nurse (AMBER LEVEL)" or "Stat" touch-points.

b. This action shall cause all locations awaiting service to be sequentially displayed in the "Utility" screen.

18. Placing the system in the staff follow mode: In the event that the floor control station is to be left unattended, it shall be possible to reroute incoming call tones to rooms where staff are located by utilizing the "Staff Follow" mode. "Staff Follow" shall function in either of two ways:

a. Automatic staff follow: When staff register stations are utilized, the "Staff Follow" mode shall be initiated by simply pressing the "Staff Follow" touchpoint. This single action shall cause the following to occur:

1) The LED indicator on the "Staff Follow" touchpoint shall light.

2) Incoming calls shall continue to annunciate in the normal manner at the floor control station.

3) Incoming call tones shall annunciate by priority over the patent station(s) and/or staff station(s) in all locations where staff members have registered in.

4) It shall be possible for the nurse to silence the incoming call tones by simply pressing the "Cancel" button on the station.

b. Manual staff follow:

1) It shall be possible to manually program one or more patient staff station(s) into the "Staff Follow" mode by dialing the appropriate room number(s) and then pressing the "Staff Follow" touchpoint.

2) The same sequence of events, as described in the preceding paragraph A shall occur.

3.02 EQUIPMENT

To provide the preceding features and functions, the following equipment shall be provided:

A. Area control unit:

1. The area control unit shall be a Rauland Responder 4000 micro-processor-based model NCS4000 or approved equal.

2. The area control unit shall be modular in construction and shall provide quick disconnect circuitry for switching, storing, programming, reviewing, amplifying, signaling and inter-connecting system components.

3. The area control unit shall have built-in diagnostics to assist in locating and servicing component failure.

4. In the event of power failure, the floor control station utility screen shall display P-Fail, indicating power failure. The built-in battery supply shall provide full operation including intercom and paging during the time (up to seven minutes) required for the hospital to switch to auxiliary power.

5. It shall be possible to reprogram room numbers in nonvolatile memory whenever the need arises. It shall not be necessary to change components or order new programming from the factory to accomplish these changes.

6. All programmable information entered from the floor control station, i.e., room number, bed number, priority, paging unit, station designation, staff search location, pocket pager assignment etc., shall be programmed in nonvolatile memory.

7. Systems requiring external equipment for programming functions or back-up battery to retain memory will **not** be acceptable.

B. Nurses station: The nurses' station or annunciator shall have the following features:

1. 36 "Call placed" indicator lamps listed by room number for each annunciator panel. Provide the number of annunciators required.

2. One momentary action "acknowledged" button.

3. One momentary action "cancel" button.

4. One speaker/microphone.

C. Exam room stations:

1. Exam room stations shall be Rauland model(s) R4KPB12 or approved equal.

2. A call placed indicator shall be located on the face plate to assure the patient that the call has been placed. The exam room stations shall be equipped with a cancel button.

3. The exam room station shall mount in a single-gang electrical box; a face plate for flush mounting shall be provided.

D. Bathroom stations:

1. The bath station shall be Rauland model R4KPC11 pull chain type or approved equal.

2. A water-resistant gasket shall be provided with all stations mounted in shower areas. A extension cord shall be provided, where necessary, to insure the pull cord is within easy reach of the patient. This cord shall reach to within 4" of the finished floor.

3. A call placed indicator shall be located on the face plate to assure the patient that the call has been placed. The bath station shall be equipped with a cancel button.

4. The bath station shall mount in a single-gang electrical box; a face plate for flush mounting shall be provided.

E. Corridor dome lights:

1. The corridor dome lights shall be Rauland or approved equal, and shall consist of:

a. A wedge-shaped, temperature resistant, translucent lens of even-glow polystyrene.

b. A single gang sub-mount plate complete with four LED type lamps colored white, red, green and amber.

2. The lens shall be snap fitted to the back plate assembly to facilitate changing lamps without the use of tools.

3. The wires shall be color coded to match the lamp color to reduce installation time.

4. Corridor dome lights shall be installed as indicated on the Drawings.

3.03 TRAINING OF PERSONNEL

A. Nursing staff of the facility/hospital as well as maintenance staff shall be thoroughly instructed in the use of the Rauland 4000 system by authorized distributor personnel. Such service shall be provided in conjunction with the nurse's call equipment.

B. The nurse call supplier shall provide the facility one in-service color video tape of professional quality which shall provide audio and visual instructions for the proper use of the nurse call system by staff members after the training period. The tape provided shall be furnished in the format requested. The in-service tape shall be a standard product of the manufacturer and not created for this particular project. The nurse call supplier shall provide additional copies and/or updated video tape information, when available, for the OWNER to purchase.

C. The nurse call supplier shall provide instruction to the staff by means of an actual instructional system which shall be set up in the conference room or auditorium and allow hands on experience by the staff without disrupting the staff on duty. The instructional system shall consist of a floor control station, single and dual patient stations, staff, duty and emergency stations, and assorted call-in cord sets. The instructor shall demonstrate each function on the system with all lamps, screens and tones in operation. Maintenance instruction shall be performed in the same manner as described above.

D. Training shall include a minimum of three (3) hours per shift.

END OF SECTION

SECTION 28 10 00

ELECTRONIC ACCESS CONTROL

## PART 1 - GENERAL

### 1.01 RELATED WORK SPECIFIED ELSEWHERE

A. 26 05 01 – Basic Electrical Requirements.

### 1.02 DESCRIPTION

A. Provide complete card access systems to be installed connected, tested and left in operating condition. **This system integrator and supplier shall be Cunningham Security.**

B. Provide new card access system components including central control unit and web browser based software. Provide card readers, cards, control devices, power supplies, wiring and all software and labor for a complete functional system.

C. Include panic button devices located at each receptionist desk.

D. Include two dedicated telephone lines to the main control unit to call the central station.

### 1.03 SYSTEM OPERATION

A. The system shall be comprised of the number of zones shown on the drawings. Zones shall be programmable for Instant, Delay, Day Supervisory, Silent, Priority (non-shuntable). Loop Response Time shall be programmable. System shall detect faulty read only memory (ROM) and EEPROM on power up. System shall log events to a printer.

B. The system shall be armed, disarmed, reset, monitored and altered by the use of a remote one (1) wire multiplex keypad. The system shall support up to five (5) remote keypads. The system shall provide "fail safe arming" preventing arming of the system if a zone has been violated or is ajar. System shall indicate which zone is ajar. As an option, the system shall be single zone programmable for keyswitch arm and disarm function with tamper.

C. Zones shall be provided to alert of medical, panic/emergency and fire emergency situations. Functional parameters, such as dialer activation and signaling shall be fully programmable.

D. Actuation of any zone shall cause the following to occur:

1. Close a form "C" contact to the intercom for activation of a predefined tone.

2. Indicate an alarm condition on the keypad.

3. Activate the built in digital communicator, seize the protected premises telephone line and automatically report the alarm to a remote location.

4. Indicate the alarm condition at the printer, identifying zone with time and date.

F. System deactivation and acknowledgement of alarms or troubles, in conjunction with interrogation of other systems activity (i.e. alarm memory, bypassing of zones, etc.) shall require the use of a Personal Authorization Code (PAC) number to be entered in the keypad.

G. Up to 99 user PAC codes per system shall be available. Programming of these codes shall be field programmable into EEProm memory without the use of any special programming tools, Programming will occur through the systems digital remote keypad. A Master programming code will be required to make such changes. The remote keypad shall provide a means to verify programmed instructions through binary information displayed by the system's status indicators. No special displays or other associated hardware will be permitted to review program contents. Power outages or complete battery discharge shall not affect programmed field instructions.

H. Zones shall be programmable for exit/entry time delays (1-255 seconds), providing a warning tone when in the timing sequence. All other zones shall provide an instant alarm if system has been armed and in the timing sequence.

I. During the daytime "Disarmed" condition, all motion detectors, glass break detectors, or doors switches or any initiating alarm appliance if in alarm condition shall be indicated through the system status indicators. The system ready lamp will extinguish. If the panel is "armed", these appliances will activate the control, sound the signals and alert the monitoring station through the built in communicator.

J. Signal cut off time shall be programmable from 1-255 minutes.

K. The panel shall contain a daytime "disarmed" supervisory mode. It shall be configurable to either provide a latching or auto-restore mode of operation. With this function any zone that is violated will provide local annunciation without sounding the signals or activating the communicator if in the auto-restore mode, the keypad sounder will activate and restore when the contact is open then closed. If in the latching mode, the keypad will sound until reset from the keypad with the PAC code. A SPDT relay will be provided in the control to activate auxiliary sounding devices.

L. The system shall incorporate a door strike output timed or toggled (on/off) to provide manual activation through the keypad with PAC number, utilizing a relay.

M. System alarms shall be retained in EEProm memory until reset using the PAC number. Complete power outage shall not affect alarm memory recall.

N. An auxiliary light output shall be provided when system is in alarm.

O. Card access system shall automatically unlatch door magnetic strike when a card is passed next to the card reader. System shall record the card number, person identification, time and date of entry and door accessed.

1.04 SYSTEM FEATURES

A. The system shall include the following features as a minimum:

1. Supervised monitoring of all indicating appliance wiring both in the daytime or bypassed condition (Utilize UL listed resistor).

2. Separate alarm, trouble, bypass, ready to arm, and secure indicators at each keypad control station. Keypad shall be flush mountable on standard electrical box.

3. "Dead Front" design control panel/with all indicators and control switches located behind a locked door.

4. Automatic transfer to standby batteries upon power failure.

5. Inclusion for a digital dialer compatible with all major receivers including Adcor, Ademco, Franklin, Osborne, Hoffman, Radionics, Sescoa, Silent Knight and Varitech. Coordinate with owner's central station provider "Protection One" for supply of compatible equipment.

6. Fully field keypad programmable EEProm memory.

7. Dynamic 24 hour battery load test.

8. Continuous monitoring of fuses for auxiliary voltage outputs.

9. 6 stage lightning protection.

10. Shunt by zone from keypad.

11. Zone auto shunt or auto/restore after alarm.

12. Retained alarm memory.

13. Digital communicator shall be approved to comply with applicable FCC codes. Unit shall feature either pulse or touch tone dialing. "Call Waiting" tones shall not prevent proper operation. The following communicator parameters shall be

programmable from the keypad and not require either Prom burners or other factory programming methods.

a. Report by zone
b. Single or 2 line extended reporting
c. Two account codes
d. Split reporting
e. Opening and closing reports by user codes
f. Closing ring back
g. Restoral reporting
h. Programmable abort
i. Supervisory reporting of all trouble conditions
j. Programmable delay before dialing
k. Programmable dial attempts
l. Programmable delay between dial attempts
m. Programmable test reporting for intervals of 12 hours up to 7 days
n. Shunt by zone reporting
o. AC failure and AC restoral reporting
p. Low battery and battery restoral reporting
q. Memory error reporting
r. Listen in capabilities with optional module

14. Bell test on arming.

15. Auxiliary light output during alarm conditions. The “Panic” button zone shall activate a separate blue strobe/horn located outside the gymnasium.

16. Courtesy output, keypad accessible.

17. Keypad tamper.

18. Exit/Entry follower zones. The control may be programmed to provide follower zones which automatically provide additional exit/entry delay functions for the zone which persons would enter after walking through the initial exit/entry delayed zone. If the initial exit/entry zone has been violated activating the delay function, then the follower zone shall also provide time delay; but if the initial exit/entry delayed zone is not violated, then the follower zone will remain as an instant zone.

1.05 SHOP DRAWINGS

A. Shop drawings for systems provided under this section of the specification shall contain, but not be limited to, the following:

1. Specification data sheets on each individual system component.

2. Wiring diagrams indicating all system components, number and size of required conductors, interconnecting components and conduit size required to house conductors.

B. Wiring diagrams shall be point-to-point wiring diagrams prepared for this project. Typical wiring diagrams will not be accepted.

C. Construction Manuals.

## PART 2 - PRODUCTS

### 2.01 CONTROL PANELS AND RELATED HARDWARE

A. Provide new card access control system as indicated on the drawings. Include all hardware, software, and programming.

B. Control panels shall have built-in battery backup and shall provide to power auxiliary devices. Voltage shall be regulated. Automatic system shutdown will occur at 60% of nominal voltage to prevent false alarming. System shall include any independent power supplies required for powering initiating devices with 25% reserve capacity.

C. During alarm conditions sufficient power shall be available to drive sirens and auxiliary functions.

D. Control panel shall be provided with two form “C” contacts indicating alarming conditions. One contact shall be connected to the intercom system and the other to the fire alarm system.

E. Interconnect all devices on the security network bus as recommended by the system manufacturer. Utilize cabling recommended by the manufacturer and provide any end-of – line resistors required.

F. Door access strikes shall be furnished by the door hardware supplier and wired by this contractor. Furnish line or low voltage power, surge suppressors, access systems interfaces and door contacts. Interconnect as recommended by the manufacturer. Provide 120 volt power for all door strikes or mag lock power supplies from the nearest power panel using an unused/available circuit.

G. Provide all software required for a fully operational and functional system. System must provide a Windows based user interface for allowing system modifications and reporting.

### 2.02 DOOR CONTACTS

A. Provide where shown on drawings, UL listed magnetic flush mounted Recessed) contacts and magnets as shown on plans. Utility room metal doors may utilize surface mounted,

wide gap type contacts with armored cable. Each contact shall be provided with matching magnet. All contacts shall be hermetically sealed for long term cycle contact. Switch contacts shall be of the reed blade type with rhodium plating eliminating cold-welding; sticking and resistance build-up. Contacts and wiring shall be encased in a potting compound. All switches shall be 100% factory tested prior to installation. Contacts used in metal doors shall be built for the purpose.

2.03 MOTION DETECTORS/REQUEST TO EXIT DEVICES

A. Provide passive infrared request to exit motion detectors with narrow activation zone limited to door handle area with D.P.D.T. relay with 2 amp rated contacts and adjustable time delay of 1 to 60 seconds. Capable of operating at 12 or 24 VAC or DC.

2.04 ACCESS CARDS AND READERS

A. Access cards shall be magnetic stripe utilizing the 26-bit Wiegand format. Cards shall be 3.375” x 2.125” constructed of plastic with hot stamped or printed number equal to the encoded number. Cards shall be per-numbered at the factory with holder identification and privileges programmed at the administrative terminal.

B. Readers shall be Wiegand type card readers suitable for interior or exterior use with an operating range of –40 to 130 degrees. Connect to system in such a way that wiring is concealed and not accessible. Furnish all required boxes, plates, conduits and wire.

C. Provide 50 spare blank cards and card printer/programmer for creation of new cards.

2.05 MAGNETIC LOCK COMPONENTS OR DOOR STRIKES

A. Provide door magnets, magnet type door locks or deadbolts or door strikes compatible with both the doors being installed and the security system. Match manufacturer and lock style and model currently in use at the hospital.

B. Provide all line or low voltage power as require for the door holding or locking hardware. Provide all wiring per manufacturer’s recommendations.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide all equipment, wiring, conduit and outlet boxes required for the installation of a complete and operating system in accordance with applicable local, state and national codes, the manufacturer's recommendations, these drawings and specifications. All connections shall be made inside detectors and panels or utilize Sentrol 1990 or 1991 junction boxes or equivalent. Open "wire nut" type connections will not be acceptable.

Color coded wires shall be used throughout. Wiring shall conform to the National Electrical Code Article 725.

B. The manufacturer's authorized representative shall provide supervision for initial sensor selection and of final system panel connections, perform a complete functional test of the system and submit a written report to the contractor attesting to the proper operation of the system.

C. All equipment and wiring shall be guaranteed against defects in materials and workmanship for a one year period from the start up and beneficial use of the system. Warranty service of the equipment shall be provided by the system supplier's factory trained representative during normal working hours, Monday through Friday, excluding holidays. Emergency service provided at times other than as stipulated above shall be available from the same source at additional cost to the owner.

D. Upon satisfactory completion of system tests, the system supplier's representative shall present, for the owner's consideration, a proposal to provide semiannual inspection and tests of the system.

E. Upon completion of the installation, the contractor shall provide to the architect, with a copy to the system supplier's representative, a signed written statement attesting that all system equipment was installed in accordance with these specifications and in accordance with wiring diagrams, instructions and directions provided to the contractor by the system supplier.

F. Following system start-up and operation provide system programming and reporting training to facility personnel in two separate sessions. Training must be adequate so that personnel are familiar with operation and programming of the system.

END OF SECTION

SECTION 28 31 00

# INTERIOR FIRE ALARM SYSTEM

## PART 1 GENERAL REQUIREMENTS

### 1.1 MANUFACTURER'S REPRESENTATIVE

A. Furnish the services of a qualified fire alarm system manufacturer's representative or technician, experienced in the installation and operation of the type of system being provided, to supervise the testing, including formal testing, adjustment of the system, and instruction to maintenance personnel.

### 1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Electrical materials and Methods sections apply to work specified in this section.

### 1.3 AGENCY APPROVALS

All equipment shall be listed by Underwriters Laboratories, Inc., approved by Factory Mutual or as accepted by the authority having jurisdiction (AHJ).

The fire alarm system in its entirety shall be in compliance with all applicable fire and electrical codes and comply with the requirements of the local authority having jurisdiction over said systems. Accessory components as required shall be catalogued by the manufacturer and U.L. Listed to operate with the manufacturer's control panel.

### 1.4 SPECIFIC U.L. PROVISIONS

The system shall comply with the applicable provisions of the following U.L. Standards and Classifications:

No. 864, Control Units, Fire Protective Signaling Systems
UOJZ, Control Units, System
UOXX, Control Unit Accessories, System
SYZV, Control Units, Releasing Device
No. 268, Smoke Detectors for Fire Protective Signaling Systems.
No. 521, Heat Detectors for Fire Protective
No. 464, Audible Signaling Appliances.
No. 38, Manually Actuated Signaling Boxes.
No. 346, Waterflow Indicators for Fire Protective Signaling Systems.
No. 1076, Control Units for Burglar Alarm Proprietary Protective Signaling Systems.
No. 1971, Visual Notification Appliances.

1.5 SPECIFIC NFPA STANDARDS

The system shall comply with the applicable provisions of the following current National Fire Protection Association (NFPA) standards:

| | |
|---|---|
| NFPA 71 | Installation, Maintenance, and Use of Signaling Systems for Central Stations |
| NFPA 72 | Chapters 6, 7, 8, & 9 (formally NFPA 72A, B, C, & D), Installation, Maintenance, and Use of Protective Signaling Systems |
| NFPA 72 E | Automatic Fire Detectors |
| NFPA 90 A | Installation of Air Conditioning and Ventilating Systems |
| Life Safety Code #101 | Safety to Life from Fire in Building and Structures |
| UL | Underwriters Laboratories |
| FM | Factory Mutual |

1.6 DESCRIPTION OF WORK

A. The work includes providing a new addressable, microprocessor based, interior fire alarm panel, including associated equipment and appurtenances. Provide each system complete and ready for operation. Equipment, materials, installation, workmanship, inspection, and testing shall be in strict accordance with the required and advisory provisions of NFPA 72A and NFPA 72E, except as modified herein. Devices and equipment for fire alarm service shall be listed by Underwriters Laboratories Inc. or approved by the Factory Mutual System. In the NFPA publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the State of Maine Fire Marshall or City of Portland Fire Chief.

B. The system shall sound a general alarm for all detection signals.

C. Provide sprinkler waterflow and tamper switches for all zones.

D. Provide all duct smoke detectors and test stations as indicated.

E. Provide all smoke and fire damper interface modules.

F. Provide all elevator control and recall devices as required.

G. Provide all output and remote power supplies required.

1.7 SUBMITTALS

A. Manufacturer's Data:
   1. Control Panel
   2. Remote Annunciator Panel with Trouble Sounder
   3. Batteries and Power Supplies
   4. Smoke, Heat and Duct Smoke Detectors

5. Smoke Detectors with Sounder Bases (in sleeping rooms)
6. Alarm Strobes and Horns/Strobes
7. Door Hold Opens
8. Pull Stations and Alarming Guards

B. Shop Drawings: Provide drawings that clearly and completely indicate the function of the control panel and devices connected thereto. Indicate termination points of devices and indicate the interconnection of modules required for proper operation of the system. Indicate interconnection between modules and devices connected thereto. Drawings shall be not less than 18 inches by 24 inches.

C. Calculations: Provide calculations that verify battery capacity exceeds supervisory and alarm power requirements.

D. Operation and Maintenance Manual: Provide six copies, bound securely in durable, hard cover, water-resistant binders. Include instructions for operating and maintaining system components, assemblies, and accessories; include a detailed description of the control panel and system operation under both routine and emergency conditions. Include as-built circuit diagrams complete with conductor color codes, a parts list by name, model number, and manufacturer, and a listing of smoke detector locations, with the serial number and firing voltage for each. General system descriptions included in manufacturer's catalogs or advertising media will not be acceptable in meeting the operation and maintenance manual requirement. Include detailed instructions for programming system variables.

1.8 SPARE PARTS

A. Spare parts shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, stamping, or tagging. Keys and locks for equipment shall be identical where possible. Furnish the following:
1. Four keys or tools for resetting manual stations
2. Four keys for locks of control panels or cabinets
3. Four horn/strobe units.
4. Four smoke detectors

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Notifier

2.2 SYSTEM DESIGN

A. Alarm System: Provide a complete, addressable, Class B, electrically supervised, manual and automatic, microprocessor based, annunciated fire alarm system. The actuation of any manual station, automatic sprinkler system, heat detector, smoke detector, elevator panel emergency shutdown panels shall cause:

1. Building Alarm Devices to Sound
2. Appropriate Annunciator Lamps to Light
3. Actuation of the Station Fire Alarm System
4. Heat and/or Smoke Detector Annunciator Lamp(s) to Indicate the Detector(s) in Alarm.
5. Activation of the system digital dialer.

B. Operations: A ground fault condition which prevents system operation or a single break or open condition in any circuit shall result in activation of system audible trouble signals. Loss of ac power shall also result in operation of system trouble signals. Trouble signals shall sound continuously until system has been restored to normal at the control panel or manually switched to a trouble indicating lamp. Upon correction of the trouble condition, trouble signals shall automatically resound until the control panel is restored to the normal position. Electrical supervision of wiring external of control panel for mechanical equipment shutdown will not be required. System shall be electrically supervised for:
1. Signal Initiating Circuits
2. Alarm Signal Notification (Audio and Visual) Circuits
3. Battery Supply Circuits, Including Low and no Voltage across the Standby Battery Terminals
4. Activation of the automatic dialer Transmitter

C. Primary Power: Provide 120 volts ac service. Obtain primary power at the location indicated.

D. Auxiliary Power: Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.
1. Batteries: Provide rechargeable gel-cell type with sufficient ampere-hour rating to operate the system under supervisory conditions, including audible trouble signal devices for 24 hours and audible and visual signal devices under alarm conditions for an additional 10 minutes. House batteries either within the control panel or in a separate substantial steel cabinet and; finish on inside and outside with enamel paint; equip with a non-corrosive base and cylinder lock. Separate cells to prevent contact between terminals of adjacent cells and between terminals and other metal parts.
2. Battery Charger: Provide solid state automatic two rate type, capable of recharging completely discharged batteries to fully charged condition in 24 hours or less. Locate charger within the control panel or within the battery cabinet.

E. Wiring: Provide in accordance with NFPA 70 and NFPA 72A. Conductors shall be copper. Conductors for 120-volt circuits shall be No. 14 AWG minimum; single conductors for low-voltage DC circuits shall be No. 16 AWG minimum. Conductors shall be color-coded. Provide wiring with non metallic cable designed for the purpose electrical metallic tubing conduit may be provided in dry locations not subject to mechanical damage. Conceal conduit in finished areas of new construction. Identify conductors within each enclosure where a tap, splice, or termination is made. Identify conductors by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Wire the alarm initiating and notification signal devices so that removal will cause the system trouble device to sound. Pigtail or "T" tap connections to alarm initiating devices, evacuation alarm bells, horns, and fire warning light are not acceptable.

2.3 MAIN FIRE ALARM CONTROL PANEL

A. 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 50 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 programmable EIA-485 driven relays.
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 back-lit 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, SYSTEM ALARM, SYSTEM TROUBLE, SIGNAL SILENCED, SUPERVISORY, and PRE-ALARM.
4. The Display shall provide a 21-key touch key-pad 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: SIGNAL SILENCE, RESET, DRILL, and ACKNOWLEDGE.

E. Signaling Line Circuit (SLC)
1. The SLC interface shall provide power to and communicate with up to 50 intelligent detectors (Ionization, Photoelectric, or Thermal) and/or 50 intelligent modules (monitor or control) for a system capacity of 50 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 they will not be affected by voltage surges or line transients, consistent with UL standard 864.

I. Optional plug-in modules shall be provided for by NFPA 72, Chapter 4, Transmitters.

J. Provide a Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station.
1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet (1828.8 m) from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
3. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.
4. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
5. Communication shall include vital system status such as:
    - Independent Zone (Alarm, trouble, non-alarm, supervisory)
    - Independent Addressable Device Status
    - AC (Mains) Power Loss
    - Low Battery and Earth Fault
    - System Off Normal
    - 12 and 24 Hour Test Signal
    - Abnormal Test Signal (per UL requirements)
    - EIA-485 Communications Failure
    - Phone Line Failure

6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

K. An optional module shall be available which provides 8 Form-C relays rated at 5.0. The relays shall track programmable software zones.

L. 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. An 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.

M. Auxiliary Field Power Supply - Addressable
1. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
2. The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
3. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
4. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
5. The addressable power supply shall operate on 120 VAC, 50/60 Hz.
6. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.

7. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
8. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.
9. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
10. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
11. Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
12. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
13. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
14. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
15. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
16. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

N. 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 an attractive 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.

O. Field Wiring Terminal Blocks

1. 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 which are permanently fixed are not acceptable.

P. Operators Controls
1. Acknowledge Switch:
   a. 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.
   b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
2. Signal 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. 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.

Q. 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.

R. 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. 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. 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. 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. 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.

S. Reporting

1. Coordinate with the Security System provider to provide the interface required for the security system dialer to properly identify all alarms from the fire alarm system.

2.4 Manual Stations: Provide addressable type with double action mechanical reset features, Locate stations as indicated. Stations shall be flush mounted, Provide each station with screw-type terminals of proper number and type to perform functions required. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset. Break-glassfront stations will not be permitted; however, a pull-lever, break-glass-rod type is acceptable. Housings shall be painted red and labeled FIRE ALARM using permanently affixed, engraved, red and white plastic identification signs. Identification signs shall be affixed to the face of the housing cover; letters shall be a minimum of 0.75-inch high. Provide separate screw terminal for each conductor connected to the manual alarm station. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

2.5 Heat Detectors: Provide addressable type detectors as shown on the Drawings. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature and rate-of rise principle only. Detectors shall be hermetically sealed and automatically resetting type which shall operate when ambient air temperature reaches detector setting regardless of rate of temperature rise. Locate detectors as indicated. Mount detectors at the underside of ceilings or roof decks unless otherwise indicated. Detectors shall be semiflush mounted. Each detector shall be designed for outlet box mounting, shall be supported independently of wiring connections, and shall be connected by separate screw terminal for each conductor. Temperature rating of detectors shall be in accordance with NFPA 72E. No detector shall be located closer than 12 inches to any part of any lighting fixture. Detectors, located in areas subject to moisture or exterior atmospheric conditions, or hazardous locations as defined by NFPA 70, shall be types approved for such locations. Detectors shall be provided with screw-type terminal connections. Provide wire guards where indicated.

2.6 Smoke Detectors: Designed for detection of abnormal smoke detectors by the photoelectric principle. Detectors shall be of the addressable type. Control or power panels required for operation of the device shall be provided either as individual units or integral with the main control panel. Detectors and associated panels shall be compatible with main control panel that is provided and shall be suitable for use in a supervised circuit. Malfunction of the electrical circuitry to the detector or detector control or power units shall actuate the system trouble devices. Detector spacing and location shall be in accordance with manufacturer's recommendations, the requirements of NFPA 72 and as indicated. Each detector shall contain an alarm lamp which shall illuminate when the detector is activated into an alarm condition. Detector base shall be provided with screw-type terminals for wiring connections. Provide remote indicator lamp for each detector located above suspended ceilings, beneath raised floors, or otherwise concealed from view.

A. Photoelectric Detectors: Multiple chamber type which is responsive to both invisible and visible particles of combustion. Detectors shall not be humidity sensitive. Smoke detectors will provide remote LED capabilities and shall provide simplified wiring using TWO SEMS screw terminals for easy supervised in/out wiring. The detector must be completely back sealed to eliminate contamination from dust, dirt and insects that penetrate the detector from the ceiling or wall and also to eliminate back-pressure

problems which may prevent smoke from entering the chamber. The detector must also be equipped with an insect screen which keeps insects away from the sensing chamber.

B. Duct Smoke Detectors: Detectors in ducts shall be photoelectric type and listed by UL or FM for duct installation. Duct detectors shall be provided with approved duct housing, mounted exterior to the duct, and shall be provided with perforated sampling tubes extending across the width of the duct. Activation of detectors shall cause shutdown of the associated air-handling unit, annunciation at the control panel.

2.7 Detector Bases: Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature**.** A relay base and an isolator base designed for Style 7 applications shall be provided where required for control. Sounder base shall include an alarm delay of 10 seconds prior to sounding alarm after its detector head latches on. An additional delay shall be programmed in to the system to initiate alarming the entire system if the local detector head has not returned to normal status.

2.8 Audiovisual Alarms: Provide recessed approved audiovisual alarm devices consisting of a single alarm horn suitable for use in an electrically-supervised circuit and top-mounted integral flashing strobe light with characteristics matching Part G. of this section. Strobes shall be 75 candela. Horn shall have a sound rating of at least 90 decibels at 10 feet. The word "FIRE" shall be prominently displayed on the device. Horns shall be low current draw electronic sounders which are capable of producing eight different field selectable tones and shall be capable of operating the horns and strobes independently or simultaneously. The audiovisual unit shall mount to standard electrical boxes; either four inch square or two-gang and shall be provided with a matching trim plate.

2.9 Visual Strobe Alarms: Provide recessed, strobe light with a flash rate of 1/3 to 3 Hz meeting standard UL 1971 and clear lens, Federal signal model V1971 or equal. Strobes shall be 75 candela. Visual strobe must comply with the American with Disabilities Act (ADA).

2.10 Remote LCD Alphanumeric Display Annunciator: Back-lit, alpha-numeric, liquid crystal display, eighty (80) character remote annunciator located at the main entrance area to indicate any alarm or abnormal condition and status of all devices when desired. Annunciator shall be of the digital readout type with the ability to display in plain English the room number of the initiating device, location name and problem. The unit shall also contain system status LED's and audible trouble sounder. The LCD display annunciators shall mimic the main control panel 80 character display and shall not require special programming. The LCD annunciator shall have switches which may be programmed for System control such as, Global Acknowledge, Global Signal Silence and Global System Reset. These switch inputs shall be capable of being disabled permanently or by a key lockout function on the front plate. The unit shall be flush mounted with backbox.

2.11 Door Hold Opens: Provide 120 volt electromagnetic door hold open devices as indicated on the drawings. Include any relays or wiring required for interface with the fire alarm control panel. Initiation by the fire alarm panel will de-energize hold opens and cause the doors to close. Units shall be capable of holding 35 lbs. Power shall be taken from the nearest local power panel with spare breaker.

2.12 Waterflow Indicator:

1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.

2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All waterflow switches shall come from a single manufacturer and series.
4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

2.13. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser, zone control valve, and 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. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted 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 supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The switch housing shall 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.

PART 3 EXECUTION

3.1 INSTALLATION

A. Equipment, materials, installation, workmanship, inspection, and testing shall be in accordance with NFPA publications and as modified herein.

3.2 PRELIMINARY TESTS

A. Conduct the following tests during installation of wiring and system components. Correct any deficiency pertaining to these requirements prior to formal functional and operational tests of the system.
   1. Ground Resistance: Measure the resistance of each connection to ground. Ground resistance shall not exceed 10 ohms.
   2. Dielectric Strength and Insulation Resistance: Test the dielectric strength and the insulation resistance of the system interconnecting wiring by means of an instrument capable of generating 500 volts DC and equipped to indicate leakage current in 1000 megohms. For the purpose of this test, the instrument shall be connected between each conductor on the line and between each conductor and ground at the control panel end of the line, with the other extremity open circuited and all series-connected devices in place. The system shall withstand the test without breakdown and shall indicate a resistance of not less than 500,000 ohms,

the measurement being taken after an electrification of not more than 1.0 minute with a DC potential of not less than 100 volts nor more than 550 volts.

3. Smoke Detector Tests: Prior to formal inspection and tests, clean and perform sensitivity tests on each smoke detector. Clean the smoke detectors in accordance with the manufacturer's recommended procedures. Perform voltage activation sensitivity test on each detector and record the results. Remove detectors with a sensitivity level above or below the UL accepted sensitivity range for that detector and replace with new detectors. Present recorded data at the formal inspection for verification. Approved copies shall become part of the operations and maintenance manual for the fire alarm system.

## 3.3 FIELD INSPECTION AND TEST

A. Before final acceptance of the work, test each system to demonstrate compliance with the contract requirement. Each system shall be subjected to complete functional and operational tests including tests in place of each heat and smoke detector. When tests have been completed and corrections made, submit a signed and dated certificate to the engineer with a request for formal inspection and tests.

## 3.4 FORMAL INSPECTION AND TEST

A. The owner, engineer and fire authority having jurisdiction (FAHJ) will witness formal tests after receipt of written certification that preliminary tests have been completed and that the system is ready for final inspection. The system manufacturer's technical representative shall be present for the final inspection and test. Preliminary tests shall be repeated, and functional and operational tests conducted, as requested by the FAHJ. Correct defects and conduct additional tests to demonstrate that the system conforms to contract specifications.

END OF SECTION

**Section 32 31 16 – Welded Wire Fences and Gates**

## PART 1 – GENERAL:

### 1.01 SECTION INCLUDES
A. Decorative welded wire fencing, gates, and accessories.

### 1.02 RELATED SECTIONS

A. DIVISION 31 - Earthwork
B. Section 033000 – Cast-in-Place Concrete
C. Section 062013 – Exterior Finish Carpentry

### 1.03 SYSTEM DESCRIPTION
A. The manufacturer shall supply a total ornamental welded wire fence system of the style, strength, size, and color defined herein. The system shall include all components as required, and shall be fabricated, coated, and assembled in the United States.

### 1.04 QUALITY ASSURANCE
A. The contractor shall provide laborers and supervisors who are familiar with the type of construction involved, and the materials and techniques specified.

B. Manufacturer of fence system must have ten (10) years of documented experience in manufacturing the products specified in this section.

### 1.05 REFERENCES
A. ASTM A525 - Specification for General Requirements for Steel Sheet, Zinc-coated (Galvanized) by the Hot-Dip Process

B. ASTM A641 – Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

C. ASTM A185 – Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

D. ASTM B117 – Practice for Operating Salt Spray (Fog) Apparatus

E. ASTM D2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity

### 1.06 SUBMITTALS
A. Manufacturer’s submittal package shall be provided prior to installation.

B. Samples of assembled materials, components, hardware, accessories, and/or colors, if requested.

### 1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Upon receipt, materials should be checked for damage that may have occurred in shipping to the job site.

B. Each package shall bear the name of the manufacturer.

C. Store products in manufacturer's unopened packaging.

D. Store materials in a secure and dry area to protect against damage, weather, vandalism, and theft.

E. Transport, handle and store products with care to protect against damage before installation.

## PART 2 – PRODUCTS:

### 2.01 MANUFACTURER

A. The Basis of Design for the framing and fencing system shall be Patriot Ornamental Wire Fence as manufactured by Jerith Manufacturing Co., Inc., 14400 McNulty Road, Philadelphia, PA 19154. Telephone: 800-344-2242; Fax: 215-676-9756; email: sales@jerith.com.

B. Substitutions: May be submitted in accordance with Section -12500

C. Nominal fence height shall be 72 inches.

E. Color shall be selected from mfr's full range of finishes.

### 2.02 MATERIALS

A. Structural Components: All posts and rails used in the fence system shall be manufactured from coil steel having a minimum yield strength of 55,000 psi. The steel shall be galvanized to meet the requirements of ASTM A525 with a zinc coating weight of 0.60-1.0 ounces per square foot.

B. Infill: Section infill wires shall be steel with a minimum yield strength of 50,000 psi. The steel shall be galvanized to meet the designation of "regular coating" in accordance with requirements of ASTM A641.

1. Additional infill material to be face-mounted composite decking boards. See drawings and Section 062013 – Exterior Finish Carpentry.

### 2.03 FINISH

A. Pretreatment: A five stage non-chrome pretreatment shall be applied. The final stage shall be a dry-in-place activator which produces a uniform chemical conversion coating for superior adhesion.

B. Coating: Fence materials shall be coated with a TGIC polyester powder-coat finish system. Epoxy powder coatings, baked enamel or acrylic paint finishes are <u>not</u> acceptable. The finish shall have a cured film thickness of at least 2.0 mils.

C. Tests: The cured finish shall meet the following requirements:

1. Humidity resistance of 1,000 hours using ASTM D2247.
2. Salt-spray resistance of 1,000 hours using ASTM B117.
3. Outdoor weathering shall show no adhesion loss, checking or crazing, with only slight fade and chalk when exposed for 3 years in Florida facing south at a 45 degree angle.

**2.03 FABRICATION**

A. Fence Sections shall be manufactured with 1" square x 18 gauge (.049") tubing welded every 12" to the top and bottom of welded wire panels, unless recommended otherwise at custom infill by manufacturer.

B. Welded wire panels shall be comprised of [4 (.225"), 6 (.192")] gauge (Washburn & Moen Standard) vertical wires and 6 (.192") gauge horizontal wires. 4 gauge vertical wires shall be placed 3½" on center. 6 gauge vertical wires shall be placed 1¾" on center. Horizontal wires shall be 6 gauge and spaced to provide style differences but no further apart than would allow substantial rigidity of vertical wires. Horizontal and vertical wires shall be assembled by automatic machines or other suitable mechanical means that will ensure accurate spacing and alignment of all members of the finished fabric. The wires shall be connected at every intersection by electric resistance welding in accordance with all requirements in ASTM A185. Sections shall be capable of supporting a 550 lb. load applied vertically at midspan and a concentrated load of 225 lbs. applied horizontally at midspan without permanent deformation.

B. Posts shall be 4" square x .125" gauge steel tubing. Posts shall be spaced 70" apart from inside face to inside face. Steel rail ends shall be screwed to terminal posts to receive the 1" square top and bottom rails. The rails shall be secured to the rail ends by stainless steel screws. Steel caps shall be provided with all posts.

C. Residential and light commercial grade gates shall be assembled using gate uprights with 1" outside cross-section dimensions having 7/8" tubes welded to them. A Fence Section shall then be cut to size and secured to two uprights using stainless steel screws. A 1" x .125" diagonal brace shall be provided, cut to length, cold galvanized, touched up, and screwed into position from the top hinge side to the bottom latch side of the gate. All gates shall support a 300 lb. vertical load on the latch side of the gate without collapsing.

D. Heavy duty grade gate frames shall consist of 2" square x .125" wall gate uprights and 1.5" x 1.5" x .125" U-channels for top and bottom members welded at each connection with a 1" x .125" wall diagonal brace welded into place. Infill of matching Fence Section shall be welded into frame.

**2.05 WARRANTY**

A. The entire fence system shall have a written 8 Year Warranty against rust and defects in workmanship and materials. In addition, the finish shall be warranted not to crack, chip, peel, or blister for the same period.

**PART 3 – EXECUTION:**

**3.01 PREPARATION**

A. Verify areas to receive fencing are completed to final grades and elevations.

B. Ensure property lines and legal boundaries are clearly established.

C. Remove any surface irregularities which may cause interference with the installation of the fence.

**3.02 FENCE INSTALLATION**

A. Install fence in accordance with the manufacturer's instructions.

B. Excavate post holes to proper depth to suit local conditions for stability and support of the fence system without disturbing the underlying materials. Excavate deeper as required for adequate support in soft and loose soils.

C. Set fence posts in concrete footers at 70” spacing from inside of post to inside of post. Note that this fence must be stepped for installations on a slope. It can not follow the grade.

D. Center and align posts in holes to required depth. Place concrete around posts in sonotubes. After tamping, check alignment of posts, and make necessary corrections before the concrete hardens.

E. Insert rail ends into horizontal rails and fasten in place to the posts.

**3.03 GATE INSTALLATION**

A. Set gate posts plumb and level for gate openings specified in construction drawings.

B. Install gates to allow full opening without interference after concrete has hardened around gate posts. Adjust hardware for smooth operation. Install one drop rod for double gates.

**3.04 ACCESSORIES**

A. Install post caps and other accessories to complete fence.

**3.05 CLEANING**

A. Contractor shall clean site of debris and excess materials. Post hole excavations shall be scattered uniformly away from posts.

B. If necessary, clean fence system with mild household detergent and clean water. Excess concrete must be removed from posts and other fencing material before it hardens.

# Structural Statement of Special Inspections

Project: *Maine Eye-Retina & Surgery Center*

Location: *Portland, ME*

Owner: *161 Marginal Way LLC, c/o Fore River Company*

This *Statement of Special Inspections* encompass the following discipline: **Structural**

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project as well as the name of the Structural Special Inspection Coordinator (SSIC) and the identity of other approved agencies to be retained for conducting these inspections and tests.

The Structural Special Inspection Coordinator shall keep records of all Structural inspections and shall furnish inspection reports to the Building Code Official (BCO) and the Structural Registered Design Professional in Responsible Charge (SRDP). Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Structural Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Building Official and the Structural Registered Design Professional in Responsible Charge at an interval determined by the SSIC and the BCO.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted to the BCO prior to issuance of a Certificate of Use and Occupancy.

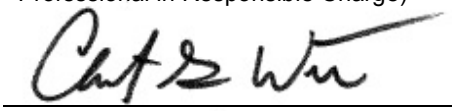
Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Interim Report Frequency: ☐ *Upon request of Building Official* _____ or ☐ per attached schedule.

Prepared by:

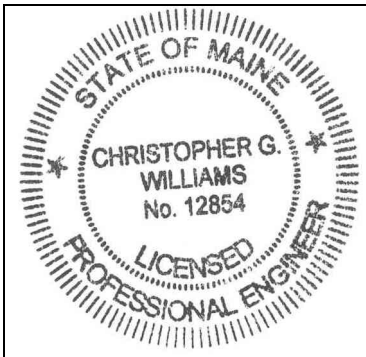
*Christopher G. Williams, P.E, S.E.*

(type or print name of the Structural Registered Design Professional in Responsible Charge)



*4/11/16*

Signature Date




**Design Professional Seal**

Owner's Authorization:

Signature Date

Building Code Official's Acceptance:

Signature Date

# Structural Statement of Special Inspections (Continued)

## *List of Agents*

Project: *Maine Eye-Retina & Surgery Center*

Location: *Portland, ME*

Owner: *161 Marginal Way LLC, c/o Fore River Company*

This *Statement of Special Inspections* encompass the following discipline: **Structural**

**(Note: *Statement of Special Inspections* for other disciplines may be included under a separate cover)**

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- ☒ Soils and Foundations
- ☒ Cast-in-Place Concrete
- ☐ Precast Concrete System
- ☐ Structural Masonry Systems
- ☒ Structural Steel
- ☐ Wood Construction
- ☐ Special Cases

| Special Inspection Agencies | Firm | Address, Telephone, e-mail |
|---|---|---|
| **1. STRUCTURAL Special Inspections Coordinator (SSIC)** | *Becker Structural Engineers, Inc.* | *75 York St.*<br>*Portland, ME 04101*<br>*(207)879-1838* |
| 2. Special Inspector (SI 1) | *Becker Structural Engineers, Inc.* | *75 York St.*<br>*Portland, ME 04101*<br>*(207)879-1838* |
| 3. Special Inspector (SI 2) | *T.B.D.* | *T.B.D.* |
| 4. Testing Agency (TA 1) | *T.B.D.* | *T.B.D.* |
| 5. Testing Agency (TA 2) | | |
| 6. Other (O1) | | |

Note: The inspectors and testing agencies shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official, prior to commencing work.

# Structural Statement of Special Inspections (Continued)

## Final Report of Special Inspections (SSIC/SI 1)

[To be completed by the Structural Special Inspections Coordinator (SSIC/SI 1). Note that all Agent's Final Reports must be received prior to issuance.]

Project: *Maine Eye-Retina & Surgery Center*

Location: *Portland, ME*

Owner: *161 Marginal Way LLC, c/o Fore River Company*

Owner's Address: *5 Milk St., PO Box 7525*
*Portland, ME 04112*

| | | |
|---|---|---|
| Architect of Record: | *Becca Casey* | *PDT Architects* |
| | *(name)* | *(firm)* |
| Structural Registered Design Professional in Responsible Charge: | *Christopher G. Williams, P.E, S.E.* | *Becker Structural Engineers, Inc.* |
| | *(name)* | *(firm)* |

To the best of my information, knowledge and belief, the Special Inspections required for this project, and itemized in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved.

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report.

Respectfully submitted,
Structural Special Inspection Coordinator

*Christopher G. Williams, P.E., S.E.*
(Type or print name)

*Becker Structural Engineers, Inc.*
(Firm Name)

*4/11/16*
Signature Date

***Licensed Professional Seal***

# Structural Statement of Special Inspections (Continued)

## Special Inspector's/Agent's Final Report

Project: *Maine Eye-Retina & Surgery Center*

Special Inspector or Agent: _____

*(name)* *(firm)*

Designation: SI2 (Licensed Geotechnical Engineer)

To the best of my information, knowledge and belief, the Special Inspections or testing required for this project, and designated for this Inspector/Agent in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved.

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report.

Respectfully submitted,
Special Inspector or Agent:

_____
(Type or print name)

_____
Signature Date

***Licensed Professional Seal or***
**Certification Number**

# Structural Statement of Special Inspections (Continued)

## Special Inspector's/Agent's Final Report

Project: *Maine Eye-Retina & Surgery Center*

Special Inspector or Agent: _____

*(name)* *(firm)*

Designation: TA1 (Certified Testing Agency)

To the best of my information, knowledge and belief, the Special Inspections or testing required for this project, and designated for this Inspector/Agent in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved.

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report.

Respectfully submitted,
Special Inspector or Agent:

_____
(Type or print name)

_____
Signature Date

SEAL NOT REQUIRED FOR TESTING AGENCY

***Licensed Professional Seal or***
**Certification Number**

# Structural Schedule of Special Inspections

## Qualifications of Inspectors and Testing Technicians

The qualifications of all personnel performing Special Inspection and testing activities are subject to the approval of the Building Official. The credentials of all Inspectors and testing technicians shall be provided to the Special Inspector for their records. *NOTE VERIFICATION THAT QUALIFIED INDIVIDUALS ARE AVAILABLE TO PERFORM STIPULATED TESTING AND/OR INSPECTION SHOULD BE PROVIDED PRIOR TO SUBMITTING STATEMENT. AGENT QUALIFICATIONS IN SCHEDULE ARE SUGGESTIONS ONLY; FINAL QUALIFICATIONS ARE SUBJECT TO THE DISCRETION OF THE REGISTERED DESIGN PROFESSIONAL PREPARING THE SCHEDULE.*

### Key for Minimum Qualifications of Inspection Agents:

When the Registered Design Professional in Responsible Charge or Special Inspector of Record deems it appropriate that the individual performing a stipulated test or inspection have a specific certification, license or experience as indicated below, such requirement shall be listed below and shall be clearly identified within the schedule under the Agent Qualification Designation.

| | |
|---|---|
| PE/SE | Structural Engineer – a licensed SE or PE specializing in the design of building structures |
| PE/GE | Geotechnical Engineer – a licensed PE specializing in soil mechanics and foundations |
| EIT | Engineer-In-Training – a graduate engineer who has passed the Fundamentals of Engineering examination |

### Experienced Testing Technician

| | |
|---|---|
| ETT | Experienced Testing Technician – An Experienced Testing Technician with a minimum 5 years experience with the stipulated test or inspection |

### American Concrete Institute (ACI) Certification

| | |
|---|---|
| ACI-CFTT | Concrete Field Testing Technician – Grade 1 |
| ACI-CCI | Concrete Construction Inspector |
| ACI-LTT | Laboratory Testing Technician – Grade 1&2 |
| ACI-STT | Strength Testing Technician |

### American Welding Society (AWS) Certification

| | |
|---|---|
| AWS-CWI | Certified Welding Inspector |
| AWS/AISC-SSI | Certified Structural Steel Inspector |

### American Society of Non-Destructive Testing (ASNT) Certification

| | |
|---|---|
| ASNT | Non-Destructive Testing Technician – Level II or III. |

### International Code Council (ICC) Certification

| | |
|---|---|
| ICC-SMSI | Structural Masonry Special Inspector |
| ICC-SWSI | Structural Steel and Welding Special Inspector |
| ICC-SFSI | Spray-Applied Fireproofing Special Inspector |
| ICC-PCSI | Prestressed Concrete Special Inspector |
| ICC-RCSI | Reinforced Concrete Special Inspector |

### National Institute for Certification in Engineering Technologies (NICET)

| | |
|---|---|
| NICET-CT | Concrete Technician – Levels I, II, III & IV |
| NICET-ST | Soils Technician - Levels I, II, III & IV |
| NICET-GET | Geotechnical Engineering Technician - Levels I, II, III & IV |

### Other

**Project: Maine Eye-Retina & Surgery Center**
**Date Prepared: 4/11/16**

# Structural Schedule of Special Inspections
## SOILS & FOUNDATION CONSTRUCTION

| VERIFICATION AND INSPECTION<br><br>IBC Section 1704.7, 1704.8, 1704.9 | REQD Y/N | EXTENT: CONTINUOUS, PERIODIC, SUBMITTAL, OR NONE | COMMENTS | AGENT | AGENT QUALIFICATION | TASK COMPLETED |
|---|---|---|---|---|---|---|
| 1. Required Verification and Inspection of Soils: | | | | | | |
| a. Verify materials below shallow foundations are adequate to achieve the design bearing capacity. | Y | P | IBC 1704.7 | SI2 | PE/GE, EIT or ETT | |
| b. Verify excavations are extended to proper depth and have reached proper material. | Y | P | IBC 1704.7 | SI2 | PE/GE, EIT or ETT | |
| c. Perform classification and testing of compacted fill materials. | Y | P | IBC 1704.7 | TA1 | PE/GE, EIT or ETT | |
| d. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill. | Y | C | IBC 1704.7 | TA1 | PE/GE, EIT or ETT | |
| e. Prior to placement of compacted fill, observe subgrade and verify that site has been prepared properly. | Y | P | IBC 1704.7 | SI2 | PE/GE, EIT or ETT | |
| 2. Required Verification and Inspection of Driven Deep Foundation Elements: | | | | | | |
| a. Verify element materials, sizes and lengths comply with the requirements. | N | C | IBC 1704.8 | TA1 | PE/GE, EIT or ETT | |
| b. Determine capacities of test elements and conduct additional load tests, as required. | N | C | IBC 1704.8 | SI2 | PE/GE, EIT or ETT | |
| c. Observe driving operations and maintain complete and accurate records for each element. | N | C | IBC 1704.8 | TA1 | PE/GE, EIT or ETT | |
| d. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element. | N | C | IBC 1704.8 | TA1 | PE/GE, EIT or ETT | |
| 3. Required Verification and Inspection of Cast-in-Place Deep Foundation Elements: | | | | | | |
| a. Observe drilling operations and maintain complete and accurate records for each element. | N | C | IBC 1704.9 | TA1 | PE/GE, EIT or ETT | |
| b. Verify placement locations and plumbness, confirm elelment diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end bearing strata capacity. Record concrete or grout volumes. | N | C | IBC 1704.9 | TA1 | PE/GE, EIT or ETT | |

See Concrete, Masonry, and/or Steel Schedules for additional material inspections for deep foundation elements as applicable.

**Project: Maine Eye-Retina & Surgery Center**
**Date Prepared: 4/11/16**

# Structural Schedule of Special Inspections

## CONCRETE CONSTRUCTION

| VERIFICATION AND INSPECTION<br><br>IBC Section 1704.4 | REQD Y/N | EXTENT: CONTINUOUS, PERIODIC, SUBMITTAL, OR NONE | COMMENTS | AGENT | AGENT QUALIFICATION | TASK COMPLETED |
|---|---|---|---|---|---|---|
| 1. Inspection of reinforcing steel, including prestressing tendons, and placement | Y | P | ACI 318: 3.5, 7.1-7.7 | SI1 | PE/SE or EIT | |
| 2. Inspection of reinforcing steel welding in accordance with Table 1704.3, Item 5B | N | - | Not applicable. Welding of Reinf Not Allowed | - | - | |
| 3. Inspect bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased or where strength design is used. | N | C | IBC 1911.5 | SI1 | PE/SE or EIT | |
| 4. Inspection of anchors installed in hardened concrete. | Y | P | IBC 1212.1 | SI1 | PE/SE or EIT | |
| 5. Verifying use of required design mix | Y | P | ACI 318: Ch 4, 5.2-5.4 | TA1 | ACI-CFTT or ACI-STT | |
| 6. At time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests and determine the temperature of the concrete. | Y | C | ASTM C 172<br>ASTM C 31<br>ACI 318: 5.6, 5.8 | TA1 | ACI-CFTT or ACI-STT | |
| 7. Inspection of concrete and shotcrete placement for proper application techniques | Y | C | ACI 318: 5.9, 5.10 | TA1 | ACI-CFTT or ACI-STT | |
| 8. Inspection for maintenance of specified curing temperature and techniques | Y | P | ACI 318: 5.11-5.13 | SI1 | PE/SE or EIT | |
| 9. Inspection of Prestressed Concrete | | | | | | |
| a. Application of prestressing force. | N | C | ACI 318: 18.20 | TA2 | PE/SE or EIT | |
| b. Grouting of bonded prestressing tendons in seismic force resisting system | N | C | ACI 318: 18.18.4 | TA1 | ACI-CFTT or ACI-STT | |
| 10. Erection of precast concrete members. | N | P | ACI 318: Ch 16 | SI1 | PE/SE or EIT | |
| 11. Verification of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beans and structural slabs. | N | P | ACI 318: 6.2 | TA1 | ACI-CFTT or ACI-STT | |
| 12. Inspect formwork for shape, location and dimensions of the concrete member being formed. | Y | P | Limitations apply. See below | SI1 | PE/SE or EIT | |

Limitations of item 12: Special inspection includes periodic review of formwork shape, general location, and formwork dimensions that can be readily measured with conventional tape measure. Verification of building layout, building location, foundation extents, column grids, and foundation elevations is excluded.

**Project: Maine Eye-Retina & Surgery Center**
**Date Prepared: 4/11/16**

# Structural Schedule of Special Inspections - STEEL CONSTRUCTION

| VERIFICATION AND INSPECTION<br>IBC Section 1704.3 | REQD Y/N | EXTENT: CONTINUOUS, PERIODIC, SUBMITTAL, OR NONE | COMMENTS | AGENT | AGENT QUALIFICATION | TASK COMPLETED |
|---|---|---|---|---|---|---|
| 1. Material verification of high-strength bolts, nuts and washers: | | | | | | |
| a. Identification markings to conform to ASTM standards specified in the approved construction documents. | Y | P | Applicable ASTM material standards, AISC 360, A3.3 | TA1 | AWS/AISC-SSI | |
| b. Manufacturer's certificate of compliance required. | Y | S | | SI1 | PE/SE or EIT | |
| 2. Inspection of high-strength bolting | | | | | | |
| a. Snug-tight joints. | Y | P | | TA1 | AWS/AISC-SSI | |
| b. Pretensioned and slip-critical joints using turn-of-nut with matchmaking, twist-off bolt or direct tension indicator methods of installation. | Y | P | AISC LRFD Section M2.5 IBC Sect 1704.3.3 | TA1 | AWS/AISC-SSI | |
| c. Pretensioned and slip-critical joints using turn-of-nut without matchmaking or calibrated wrench methods of installation. | Y | C | | TA1 | AWS/AISC-SSI | |
| 3. Material verification of structural steel and cold-formed steel deck: | | | | | | |
| a. For structural steel, identification markings to conform to AISC 360. | Y | P | AISC 360, M5.5 | SI1 | PE/SE or EIT | |
| b. For other steel, identification markings to conform to ASTM standards specified in the approved construction documents. | Y | P | Applicable ASTM material standards | SI1 | PE/SE or EIT | |
| c. Manufacturer's certified test reports. | Y | S | | SI1 | PE/SE or EIT | |
| 4. Material verification of weld filler materials: | | | | | | |
| a. Identification markings to conform to AWS specification in the approved construction documents. | Y | P | AISC 360, M5.5 | TA1 | AWS/AISC-SSI | |
| b. Manufacturer's certificate of compliance required. | Y | S | | SI1 | PE/SE or EIT | |
| 5. Submit current AWS D1.1 welder certificate for all field welders who will be welding on this project. | Y | S | AWS D1.1 | SI1 | PE/SE or EIT | |
| 6. Inspection of welding (IBC 1704.3.1): | | | | | | |
| a. Structural steel and cold-formed deck: | | | | | | |
| 1) Complete and partial joint penetration groove welds. | N | C | AWS D1.1 | TA1 | AWS-CWI | |
| 2) Multipass fillet welds. | N | C | | TA1 | AWS-CWI | |
| 3) Single-pass fillet welds> 5/16" | N | C | | TA1 | AWS-CWI | |
| 4) Plug and slot welds | N | C | | TA1 | AWS-CWI | |
| 5) Single-pass fillet welds≤ 5/16" | Y | P | | TA1 | AWS-CWI | |
| 6) Floor and deck welds. | Y | P | AWS D1.3 | TA1 | AWS-CWI | |
| b. Reinforcing steel: | | | | | | |
| 1) Verification of weldability of reinforcing steel other than ASTM A706. | N | - | Not applicable. | - | - | |
| 2) Reinforcing steel-resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement. | N | C | AWS D1.4 ACI 318: 3.5.2 | TA1 | AWS-CWI | |
| 3) Shear reinforcement. | N | C | | TA1 | AWS-CWI | |
| 4) Other reinforcing steel. | N | P | | TA1 | AWS-CWI | |
| 7. Inspection of steel frame joint details for compliance (IBC Sect 1704.3.2) with approved construction documents: | | | | | | |
| a. Details such as bracing and stiffening. | Y | P | IBC 1704.3.2 | SI1 | PE/SE or EIT | |
| b. Member locations. | Y | P | | SI1 | PE/SE or EIT | |
| c. Application of joint details at each connection. | Y | P | | SI1 | PE/SE or EIT | |

**Project: Maine Eye-Retina & Surgery Center**
**Date Prepared: 4/11/16**

# Structural Schedule of Special Inspection Services

## FABRICATION AND IMPLEMENTATION PROCEDURES – STRUCTURAL STEEL

| VERIFICATION AND INSPECTION<br><br>IBC Section 1704.2 | REQD<br>Y/N | EXTENT:<br>CONTINUOUS, PERIODIC, SUBMITTAL, OR NONE | COMMENTS | AGENT | AGENT QUALIFICATION | TASK COMPLETED |
|---|---|---|---|---|---|---|
| 1. Fabrications Procedures: Review of fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved special inspection agency. At the completion of fabrication, the approved fabricator shall submit a certificate of compliance to the building code official stating that the work was performed in accordance with the approved construction documents.<br>-OR-<br>2. AISC Certification | Y | S | Fabricator shall submit one of the two qualifications | SI1 | PE/SE or EIT | |
| 3. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the building code official stating that the work was performed in accordance with the approved construction documents. | Y | S | IBC 1704.2.2 | SI1 | PE/SE or EIT | |

# Fabricator's Certificate of Compliance

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2 of the International Building Code must submit a *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project:

Fabricator's Name:

Address:

Certification or Approval Agency:

Certification Number:

Date of Last Audit or Approval:

Description of structural members and assemblies that have been fabricated:

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

_____ _____
Signature Date

_____
Title

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual

## End of Structural Statement of Special Inspections