Project Manual For

Iona College
New Rochelle, New York

NEW YORK PRESBYTERIAN
IONA SCHOOL OF HEALTH SCIENCES
IONA COLLEGE
BRONXVILLE, NY

S / L / A / M Architects, Landscape Architects & Engineers, P.C.

Project No.:	20287.10
Issued For:	Bid Package No. 2
Date:	April 7, 2022

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PROCUREMENT AND CONTRACTING REQUIREMENTS

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SECTION 01 1000 - 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. Contractor's use of site and premises.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and Drawing conventions.
7. Miscellaneous provisions.

B. Related Requirements:

1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 01 7300 "Execution" for coordination of Owner-installed products.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

A. Project Identification: New York Presbyterian Iona School of Health Sciences.

1. Project Location: Iona College Bronxville Campus

B. Owner: Iona College, 715 North Ave, New Rochelle, 10801

1. Owner's Representative: Rich Murray Director of Facilities Management

C. Architect: SLAM Architects & Engineers, P.C., 80 Glastonbury Boulevard, Glastonbury, CT

1. Architect's Representative: Scott Rich, project manager, (860) 657-8077.

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Langan – Civil Engineer: Chuck Utschig, PR; cutschig@langan.com; Tele: (914) 323.7410.
2. SLAM Architects & Engineers, P.C – Landscape Architect: Daniel Granniss; dgranniss@slamcoll.com; Tele: (860) 657.8077.
3. SLAM Architects & Engineers, P.C – Structural Engineer: Steve Murrayn (860) 657.8077.
4. Consulting Engineers Services – Mechanical, Electrical, Plumbing & Fire Protection Engineers: Michael Bouchard; mbouchard@cesct.com; Tele: (860) 632-1682
5. Consulting Engineers Services – Information technology/audio visual/security: Michael Bouchard; mbouchard@cesct.com; Tele: (860) 632-1682.

E. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.

1. See Section 01 3100 "Project Management and Coordination." for requirements for using web-based Project software.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. The project consists of renovation of existing construction, totaling approximately 31,750 total square feet, to fully renovate the existing Scheele Library building for a new School of Health Sciences facility.

2. Interior renovations within existing building to create new classrooms, medical simulation rooms, meeting rooms, offices, and open collaboration areas.

3. Within renovation area all existing architectural partitions and finishes plus mechanical, electrical and plumbing components will be removed and replaced with new.

4. There will be a minimal amount of roof work for new mechanical units and equipment.

5. Site and building demolition and exterior window replacement of the existing Scheele Library has been bid as Bid Package No. 1.

B. Type of Contract:

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

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

A. Unrestricted Use of Site: 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. Limits on 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 for 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 Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

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

1.8 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

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

B. On-Site Work Hours: Limit work to between 8:00 a.m. to 7:00 p.m., Monday through Friday, and 10:00 a.m. to 5:00 p.m. on Saturday and Sunday. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction. Work hours should be discussed in advance with the Owner to avoid interruption of special events on campus including but not limited to Parent’s Weekend. Noise levels from construction site shall not exceed and L10 of 70 dB(A) when measure at a distance of 400 feet from the construction site per City of New Rochelle code.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for 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, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, 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. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

G. Employee Screening:

1. Maintain list of approved screened personnel with Owner's representative.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications. Contract will be AIA form A134 and A201 General Conditions.

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

D. 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 scheduled on Drawings and published as part of the U.S. National CAD Standard.
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 01 1000

SECTION 012 300 - 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 the 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 alternates 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. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article 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: Vertical Folding Partition at Classrooms 038 and 039.

1. Base Bid: Wall Type 6A at south wall of Classrooms 038 and 039 with door openings 038A and 039A.
2. Add Alternate: Provide (2) motorized folding accordion overhead partitions, partition modifications, and steel supports at south wall of Classrooms 038 and 039. Alternate scope includes:
   a. Motorized vertical folding partitions at new openings 038B and 039B
   b. Power supply for motorized partitions at openings 038B and 039B
   c. Partition type change from Type 6A to a 1'-3 3/8" double stud partition to accommodate folding partition assembly and supporting steel.
   d. Structural steel supporting system for each opening (by BP-1).

B. Alternate No. 2: Wood Wall Paneling at Classrooms 038 and 039 with door opening.

1. Base Bid: Vinyl Wallcovering VWC2 at north wall of Main Street 037 and west wall of Stadium Stair 031.
2. Add Alternate: Replace VWC2 with Wood Wall Panel WWP1 including Wood Grilles and metal flex-backer and Paint P6. Note: extent / area of WWP1 is contingent on disposition of Add Alternate 1. Provide pricing as follows:
   a. Replacement of VWC2 consistent with Add Alternate 1 Base Bid condition (no vertical folding partitions).
   b. Replacement of VWC2 consistent with Add Alternate 1 condition (addition of vertical folding partitions).

END OF SECTION 01 2300

SECTION 01 2500 - 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. Document 00 2600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
2. Section 01 2100 "Allowances" for products selected under an allowance.
3. Section 01 2300 "Alternates" for products selected under an alternate.
4. Section 01 6000 "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.

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 to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form provided in Project Manual or that is part of web-based Project management software.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

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

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor 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.

1.6 PROCEDURES

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

1.7 SUBSTITUTIONS

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

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

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

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

C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after 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 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

Advancement of Construction Technology

SUBSTITUTION REQUEST

(After the Bidding Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

☐ Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

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SUBSTITUTION REQUEST
(Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

_____

_____

_____

_____

_____

_____

_____

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SECTION 01 2605 - 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 01 2500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 01 3100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on form included in Project Manual.

1.4 PROPOSAL REQUESTS

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

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 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 taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.

d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
e. Quotation Form: Use forms acceptable to Owner or form provided as part of web-based Project management software.

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 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 included in Project Manual or form provided as part of web-based Project management software.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on included in Project Manual or form provided as part of web-based Project management software.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on form included in Project Manual or form provided as part of web-based Project management

software. 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.

1.8 WORK CHANGE DIRECTIVE

A. Work Change Directive: **Architect** may issue a Work Change Directive on form included in Project Manual or form provided as part of web-based Project management software. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Work 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 Work 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 01 2605

Supplemental Instructions No.

To: **Date:**

Project No.:

Project:

Distribution:

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Prior to proceeding in accordance with these instructions, indicate your acceptance of these instructions for minor change to the Work as consistent with the Contract Documents and return a copy to the Architect.

Item: **Description of Revisions:**

Issued: **Accepted:**

By: **By:**

SLAM
CT | GA | MA | NY
80 Glastonbury Blvd
Glastonbury, CT 06033
860.657.8077
www.slamcoll.com

Proposal Request No.

To:

Date:

Project No.:

Project:

Distribution:

Please submit an itemized quotation for changes in the Contract Sum and/or Time incidental to proposed modifications to the Contract Documents described herein.

This is not a Change Order or a directive to proceed with the following work.

Item: **Description of Revisions:**

End of Proposal Request

SLAM
CT | GA | MA | NY
80 Glastonbury Blvd
Glastonbury, CT 06033
860.657.8077
www.slamcoll.com

Construction Change Directive No.

To: **Date:**

Contract For:

Project No.: **Contract Date:**

Project:

Distribution:

You are hereby directed to make the following change(s) in this Contract:

Proposed Adjustments

1. The Proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:
   - ☐ Lump Sum increase / decrease of $
   - ☐ Unit Price of $ per
   - ☐ as provided in Subparagraph 7.3.6 of AIA Document A201, 2007 edition.
   - ☐ as follows:
2. The Contract Time is proposed to be adjusted / remain unchanged. The proposed adjustment, if any, is an increase / a decrease of days.

When signed by the Owner and Architect and received by the Contractor, the document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change described above.

Signature by the Contractor indicates the Contractor's agreement with the proposed adjustments in the Contract Sum and Construction Contract Time set forth in this Change Directive.

Architect	**Owner**	**Contractor**
By	**By**	**By**
Date	**Date**	**Date**

SLAM
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SECTION 01 2900 - 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. Document 00 5213 "Owner-Contractor Agreement."
2. Section 01 2600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Section 01 3200 "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 items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Owner and 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 Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
4. 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. Owner's name.
    c. Owner's Project number.
    d. Name of Architect.
    e. Architect's Project number.
    f. Contractor's name and address.
    g. 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. Round dollar amounts to whole dollars, with total equal to Contract Sum.

        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. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.

6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.

9. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
11. Closeout Costs. 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.
12. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

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.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. 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.

1. Other Application for Payment forms proposed by the Contractor may be acceptable to Architect and Owner. Submit forms for approval with initial submittal of schedule of values.

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

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

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

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.

2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. 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 lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

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. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by 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. 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. Sustainable design action plans, including preliminary project materials cost data.
7. Schedule of unit prices.
8. Submittal schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
11. Copies of building permits.

12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
13. Initial progress report.
14. Report of preconstruction conference.
15. Certificates of insurance and insurance policies.
16. Performance and payment bonds.
17. Data needed to acquire Owner's insurance.

I. 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.

    a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. 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. Certification of completion of final punch list items.
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. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. 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.
10. Final liquidated damages settlement statement.
11. Proof that taxes, fees, and similar obligations are paid.
12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2900

SECTION 01 3100 - 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. RFIs.
3. Digital project management procedures.
4. Web-based Project management software package.
5. 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 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
2. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
3. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
5. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. 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, telephone number, and email address 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, 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, in web-based Project software directory, and in prominent location in each built facility. 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.

B. Coordination of Multiple Contracts: Each contractor shall cooperate with Project coordinator, who shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

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

C. 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.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.

1.6 REQUEST FOR INFORMATION (RFI)

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

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner 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. Owner name.
3. Owner's Project number.
4. Name of Architect.
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.

15. 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: Form bound in Project Manual or Software-generated form with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. 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 by Architect 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 01 2600 "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 5 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. Use software log that is part of web-based Project management software. Include the following:

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

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

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.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model and Sitework CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD 18 (Site) and Revit 2018 (building).
4. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.

    a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement included in this Project Manual.

B. Web-Based Project Management Software Package: Use Architect's web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project management software includes, at a minimum, the following features:

    a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    c. Document workflow planning, allowing customization of workflow between project entities.
    d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    e. Track status of each Project communication in real time, and log time and date when responses are provided.
    f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    g. Processing and tracking of payment applications.
    h. Processing and tracking of contract modifications.

i. Creating and distributing meeting minutes.
j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility, including smartphones and tablets.

2. Provide up to seven Project management software user licenses for use of Owner**,** Owner's Commissioning Authority, Architect, and Architect's consultants. Provide eight hours of software training at Architect's office for web-based Project software users.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
4. Provide one of the following Project management software packages under their current published licensing agreements:
   a. Procore Technologies, Inc.
   b. Architect’s project website.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare 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.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 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 a minimum of 10 working days prior to meeting.
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. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the

conference shall be familiar with Project and authorized to conclude matters relating to the Work.

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

    a. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Use of web-based Project software.
    h. Procedures for processing field decisions and Change Orders.
    i. Procedures for RFIs.
    j. Procedures for testing and inspecting.
    k. Procedures for processing Applications for Payment.
    l. Distribution of the Contract Documents.
    m. Submittal procedures.
    n. Sustainable design requirements.
    o. Preparation of Record Documents.
    p. Use of the premises.
    q. Work restrictions.
    r. Working hours.
    s. Owner's occupancy requirements.
    t. Responsibility for temporary facilities and controls.
    u. Procedures for moisture and mold control.
    v. Procedures for disruptions and shutdowns.
    w. Construction waste management and recycling.
    x. Parking availability.
    y. Office, work, and storage areas.
    z. Equipment deliveries and priorities.
    aa. First aid.
    bb. Security.
    cc. Progress cleaning.

3. 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 when required by other Sections and when required for 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, and Owner's Commissioning Authority 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. Sustainable design requirements.
i. Review of mockups.
j. Possible conflicts.
k. Compatibility requirements.
l. Time schedules.
m. Weather limitations.
n. Manufacturer's written instructions.
o. Warranty requirements.
p. Compatibility of materials.
q. Acceptability of substrates.
r. Temporary facilities and controls.
s. Space and access limitations.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. 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, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.

c. Procedures for completing and archiving web-based Project software site data files.
d. Submittal of written warranties.
e. Requirements for completing sustainable design documentation.
f. Requirements for preparing operations and maintenance data.
g. Requirements for delivery of material samples, attic stock, and spare parts.
h. Requirements for demonstration and training.
i. Preparation of Contractor's punch list.
j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
k. Submittal procedures.
l. Coordination of separate contracts.
m. Owner's partial occupancy requirements.
n. Installation of Owner's furniture, fixtures, and equipment.
o. 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 biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority 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. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Status of sustainable design documentation.
6) Deliveries.
7) Off-site fabrication.
8) Access.
9) Site use.

10) Temporary facilities and controls.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) Status of RFIs.
16) Status of Proposal Requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) 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 biweekly 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, Owner's Commissioning Authority 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) Resolution of BIM component conflicts.
        4) Status of submittals.
        5) Deliveries.

6) Off-site fabrication.
7) Access.
8) Site use.
9) Temporary facilities and controls.
10) Work hours.
11) Hazards and risks.
12) Progress cleaning.
13) Quality and work standards.
14) Status of RFIs.
15) Proposal Requests.
16) Change Orders.
17) Pending changes.

3. 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 01 3100

SECTION 01 3200 - 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. Unusual event reports.

B. Related Requirements:
1. Section 01 4000 "Quality Requirements" for schedule of tests and inspections.
2. Section 01 2900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

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. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

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

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

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

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

1. Float time belongs to Owner.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

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

1. Working electronic copy of schedule file.
2. PDF file.
3. Two paper copies, of sufficient size to display entire period or schedule, as required.

B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

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

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

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

4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

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

G. Daily Construction Reports: Submit at weekly intervals.

H. Material Location Reports: Submit at weekly intervals.

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

J. Unusual Event Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

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

1.6 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, 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.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Use scheduling component of Project management software package specified in Section 01 3100 "Project Management and Coordination," for current Windows operating system.

B. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting, using CPM scheduling.

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

C. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial 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.

D. Activities: Treat each floor 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. Temporary Facilities: Indicate start and completion dates for the following as applicable:

    a. Securing of approvals and permits required for performance of the Work.
    b. Temporary facilities.
    c. Construction of mock-ups, prototypes and samples.
    d. Owner interfaces and furnishing of items.
    e. Interfaces with Separate Contracts.
    f. Regulatory agency approvals.
    g. Punch list.

3. Procurement Activities: Include procurement process activities for long lead-time 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.

4. 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.

5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Commissioning Time: Include no fewer than 15 days for commissioning.
7. 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.
8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

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

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 1000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. 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.

7. 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.
    n. Commissioning.

8. 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.

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

G. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 01 2900 "Payment Procedures" for cost reporting and payment procedures.

H. 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 the Contract Time.

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

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

J. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

K. 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.

1.8 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-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 **90** days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.9 GANTT-CHART SCHEDULE REQUIREMENTS

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.

1. 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.

1.10 CPM SCHEDULE REQUIREMENTS

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

B. Startup Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

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

1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 60 days after date established for commencement of the Work.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.

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

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

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

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by Owner that may affect or be affected by Contractor's activities.
    i. Testing and inspection.
    j. Commissioning.
    k. Punch list and Final Completion.
    l. Activities occurring following Final Completion.

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

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

5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.

    a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
    b. Total cost assigned to activities shall equal the total Contract Sum.

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

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

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

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

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

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

1.11 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. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At weekly 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.

D. Unusual Event Reports: 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, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3200

SECTION 01 3305 - 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:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 01 2900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 3100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 01 3200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 01 3233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
5. Section 01 4000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
6. Section 01 7700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.

1.3 DEFINITIONS

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

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

1.4 SUBMITTAL SCHEDULE

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

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

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

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

1.5 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.

11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Paper Submittals:

1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
5. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
6. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using facsimile of sample form included in Project Manual transmittal form.

E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

F. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
3. Paper: Prepare submittals in paper form and deliver to Architect.

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 submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

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

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

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

D. 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.

E. 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.

F. 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.

1.7 SUBMITTAL REQUIREMENTS

A. 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 unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

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

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

    a. Wiring diagrams that show 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 Shop Drawings, and before or concurrently with Samples.

B. 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. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).

a. Two opaque (bond) copies of each submittal. Architect will return one copy(ies).
b. Three opaque copies of each submittal. Architect will retain two copies; remainder will be returned.

3. BIM Incorporation: Develop and incorporate Shop Drawing files into BIM established for Project.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

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

a. Project name and submittal number.
b. Generic description of Sample.
c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.
6. 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.

7. 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(s) 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.

8. 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 two sets of Samples. Architect will retain one. 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.

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

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

E. 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.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit 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. Provide a notarized signature where indicated.

2. 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.
3. 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.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. 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 substrate preparation and primers required.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.8 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 insufficient 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 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.

C. BIM Incorporation: Incorporate delegated-design drawing and data files into BIM established for Project.

1.9 CONTRACTOR'S REVIEW

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

B. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project management software. Include 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. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required**,** and return.

1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.

2. Paper Submittals: Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

3. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.

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. Architect will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3305

Dear *{Contractor name}*:

Re: CADD/Electronic File Transfer

At your request, **The S/L/A/M Collaborative** ("S/L/A/M") will provide electronic digital data files for your convenience and use in the preparation of shop drawings related to the Iona College School of Health Sciences Project, subject to the following terms and conditions:

S/L/A/M electronic digital data files are compatible with AutoCAD, Architectural Desktop Version 2010 Format. We make no representation as to the compatibility of these files with your hardware or your software beyond the specified release of the referenced specifications.

Data contained on these electronic digital data files are part of our instruments of service and shall not be used by you or anyone else receiving these data through or from you for any purpose other than as a convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to us. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents or consultants that may arise out of or in connection with your use of the electronic files.

Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from your use of the electronic digital data files.

These electronic digital data files are not construction documents. Differences may exist between these electronic digital data files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic digital data files you receive. In the event that a conflict arises between the signed or sealed hard-copy construction documents prepared by us and the electronic digital data files, the signed or sealed hard-copy construction documents shall govern. You are responsible for determining if any conflict exists. By your use of these electronic digital data files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitations, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of the contractors for the project.

Because information presented on the electronic digital data files can be modified, unintentionally or otherwise, we reserve the right to remove all indicia of ownership and / or involvement from each electronic digital data display.

We will furnish you electronic digital data files of the following drawing sheets:_____

UNDER NO CIRCUMSTANCES SHALL DELIVERY OF THE ELECTRONIC DIGITAL DATA FILES FOR USE BY YOU BE DEEMED A SALE BY US, AND WE MAKE NO WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE. IN NO EVENT SHALL WE BE LIABLE FOR ANY LOSS OR PROFIT OR ANY CONSEQUENTIAL DAMAGES AS A RESULT OF YOUR USE OR REUSE OF THESE ELECTRONIC DIGITAL DATA FILES.

AGREED TO BY:

_____
{Type Name and Title of Person Signing Agreement}
{Type Company Name of Contractor}
{Type Address of Contractor}

_____
Date

SECTION 013516 - ALTERATION PROJECT PROCEDURES

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 special procedures for alteration work.

1.3 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 COORDINATION

A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.

1. Schedule construction operations in sequence required to obtain best Work results.
2. Coordinate sequence of alteration work activities to accommodate the following:

    a. Owner's continuing occupancy of portions of existing building.
    b. Owner's partial occupancy of completed Work.
    c. Other known work in progress.
    d. Tests and inspections.

3. Detail sequence of alteration work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
5. Use of elevator and stairs.
6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

B. Pedestrian and Vehicular Circulation: Coordinate alteration work with circulation patterns within Project building(s) and site. Some work is near circulation patterns maintain all safety precautions recognizing that LaPenta Student Center, Doorley Hall and East Hall will all be occupied and operation for the duration of construction. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work**.** Plan and execute the Work accordingly.

1.5 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before starting alteration work, **conduct** conference at **Project site**.

1. Attendees: In addition to representatives of Owner, Architect, and Contractor, testing service representative, specialists, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:

    a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Fire-prevention plan.
    c. Governing regulations.

d. Areas where existing construction is to remain and the required protection.
e. Hauling routes.
f. Sequence of alteration work operations.
g. Storage, protection, and accounting for salvaged and specially fabricated items.
h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
i. Qualifications of personnel assigned to alteration work and assigned duties.
j. Requirements for extent and quality of work, tolerances, and required clearances.
k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.

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

B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at **weekly** intervals. 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**,** Architect, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.

a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:

1) Interface requirements of alteration work with other Project Work.
2) Status of submittals for alteration work.
3) Access to alteration work locations.
4) Effectiveness of fire-prevention plan.
5) Quality and work standards of alteration work.
6) Change Orders for alteration work.

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

1.6 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed **at Project site**.

1.7 INFORMATIONAL SUBMITTALS

A. Alteration Work Subschedule:

1. Submit alteration work subschedule within **seven** days of date established for **commencement of alteration work**.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.

C. Alteration Work Program: Submit **30 days** before work begins.

D. Fire-Prevention Plan: Submit **30 days** before work begins.

1.8 QUALITY ASSURANCE

A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of **five** recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.

1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.

a. Construct new mockups of required work whenever a supervisor is replaced.

B. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.

C. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.

1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

D. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

E. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.9 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area **designated by Owner**.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label 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 unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F (3 deg C) or more above the dew point.

E. Storage Space:

1. Owner will arrange for limited on-site location(s) for free storage of salvaged material. This storage space security **and climate control** for stored material.
2. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

1.10 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of **measured drawings, preconstruction photographs**.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicatedRemove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of **open-flame or** welding or other high-heat equipment. **Use of open-flame equipment is not permitted.**] Notify Owner **at least 72 hours** before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.

4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:

    a. Train each fire watch in the proper operation of fire-control equipment and alarms.
    b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
    c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
    d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than **30 minutes** after conclusion of work **in each area** to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
    e. Maintain fire-watch personnel at[**each area of** Project site until **60 minutes** after conclusion of daily work.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.

1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation **photographs**. Comply with requirements in Section 013233 "Photographic Documentation."

D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 013516

SECTION 01 4000 - 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 inspection 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 quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Requirements:

1. Section 01 2100 "Allowances" for testing and inspection allowances.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, 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.

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

C. 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, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Full-size physical assemblies that are constructed either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
   1. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements, consisting of multiple products, assemblies, and subassemblies, with cutaways enabling inspection of concealed portions of the Work.
      a. Include each system, assembly, component, and part of the exterior wall and roof to be constructed for the Project. Colors of components shall be those selected by the Architect for use in the Project.
   2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
   3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. 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. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."

I. 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.

J. 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. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.4 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 Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification 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.

1.6 ACTION SUBMITTALS

A. Mockup Shop Drawings: For integrated exterior mockups.

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

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

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

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

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

1. Specification Section number and title.
2. 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.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, 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 CONTRACTOR'S QUALITY-CONTROL PLAN

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

B. Quality-Control Personnel Qualifications: Engage qualified 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 shall not have other Project responsibilities.

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. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.

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 the 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.

1.9 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, telephone number, and email address 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 inspection.
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, telephone number, and email address 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 of 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, telephone number, and email address 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 of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

A. 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

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, applying, 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 is 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 in the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

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, demonstrate, repair, and perform service on installations 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 Contractor's responsibilities, including the following:

1. Provide test specimens representative of proposed products and construction.
2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
5. Build laboratory mockups at testing facility, using personnel, products, and methods of construction indicated for the completed Work.
6. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
7. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority 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.

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

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.

3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.

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

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

L. Required Mockups: Construct mockups according to approved Shop Drawings, incorporating required materials and assemblies, finished according to requirements. Comply with requirements in "Mockups" Paragraph.

1. Provide 6’-0”wide by 5’ -0” tall stone wall mock-up with railing to match elevation 1E/L502 and associated details.

2. Provide 6’-0” x 6’-0” walkway mock-up showing half brick pavers and half concrete walk.

1.11 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 inspection they are engaged to perform.
2. Payment for these services will be made from testing and inspection allowances specified in Section 012100 "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, whether specified or not, to verify and document that the Work complies with requirements.

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. Engage a qualified testing agency to perform 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 inspection 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 inspection 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. 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.

D. Testing Agency Responsibilities: Cooperate with Architect**,** Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations 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 duties of Contractor.

E. 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."

F. 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.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives 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 inspection. 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 inspection equipment at Project site.

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

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 and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in the Statement of Special Inspections attached to this Section, and as follows:

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. 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, Commissioning Authority's, and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, 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 01 7300 "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 01 4000

SECTION 01 4200 - 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.

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. Industry Organizations: 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. The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).

27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CE - Conformite Europeenne; http://ec.europa.eu/growth/single-market/ce-marking/.
51. CEA - Canadian Electricity Association; www.electricity.ca.
52. CEA - Consumer Electronics Association; www.ce.org.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.pbmdf.com.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csagroup.com.
65. CSA - CSA International; www.csa-international.org.
66. CSI - Construction Specifications Institute (The); www.csinet.org.
67. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.

71. DHI - Door and Hardware Institute; www.dhi.org.
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; www.eciaonline.org.
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; www.eima.com.
77. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
78. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); www.intertek.com.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.
82. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
85. FM Approvals - FM Approvals LLC; www.fmglobal.com.
86. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
88. FSA - Fluid Sealing Association; www.fluidsealing.com.
89. FSC - Forest Stewardship Council U.S.; www.fscus.org.
90. GA - Gypsum Association; www.gypsum.org.
91. GANA - Glass Association of North America; www.glasswebsite.com.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
97. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
98. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
99. IAS - International Accreditation Service; www.iasonline.org.
100. ICBO - International Conference of Building Officials; (See ICC).
101. ICC - International Code Council; www.iccsafe.org.
102. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
103. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
104. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
105. IEC - International Electrotechnical Commission; www.iec.ch.
106. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
107. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
108. IESNA - Illuminating Engineering Society of North America; (See IES).
109. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
110. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
111. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
112. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
113. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.

114. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
115. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
116. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
117. ISO - International Organization for Standardization; www.iso.org.
118. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
119. ITU - International Telecommunication Union; www.itu.int/home.
120. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
121. LMA - Laminating Materials Association; (See CPA).
122. LPI - Lightning Protection Institute; www.lightning.org.
123. MBMA - Metal Building Manufacturers Association; www.mbma.com.
124. MCA - Metal Construction Association; www.metalconstruction.org.
125. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
126. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
127. MHIA - Material Handling Industry of America; www.mhia.org.
128. MIA - Marble Institute of America; www.marble-institute.com.
129. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
130. MPI - Master Painters Institute; www.paintinfo.com.
131. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
132. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
133. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
134. NADCA - National Air Duct Cleaners Association; www.nadca.com.
135. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
136. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
137. NBI - New Buildings Institute; www.newbuildings.org.
138. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
139. NCMA - National Concrete Masonry Association; www.ncma.org.
140. NEBB - National Environmental Balancing Bureau; www.nebb.org.
141. NECA - National Electrical Contractors Association; www.necanet.org.
142. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
143. NEMA - National Electrical Manufacturers Association; www.nema.org.
144. NETA - InterNational Electrical Testing Association; www.netaworld.org.
145. NFHS - National Federation of State High School Associations; www.nfhs.org.
146. NFPA - National Fire Protection Association; www.nfpa.org.
147. NFPA - NFPA International; (See NFPA).
148. NFRC - National Fenestration Rating Council; www.nfrc.org.
149. NHLA - National Hardwood Lumber Association; www.nhla.com.
150. NLGA - National Lumber Grades Authority; www.nlga.org.
151. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
152. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
153. NRCA - National Roofing Contractors Association; www.nrca.net.
154. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
155. NSF - NSF International; www.nsf.org.
156. NSPE - National Society of Professional Engineers; www.nspe.org.
157. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
158. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.

159. NWFA - National Wood Flooring Association; www.nwfa.org.
160. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
161. PDI - Plumbing & Drainage Institute; www.pdionline.org.
162. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
163. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
164. RFCI - Resilient Floor Covering Institute; www.rfci.com.
165. RIS - Redwood Inspection Service; www.redwoodinspection.com.
166. SAE - SAE International; www.sae.org.
167. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
168. SDI - Steel Deck Institute; www.sdi.org.
169. SDI - Steel Door Institute; www.steeldoor.org.
170. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
171. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
172. SIA - Security Industry Association; www.siaonline.org.
173. SJI - Steel Joist Institute; www.steeljoist.org.
174. SMA - Screen Manufacturers Association; www.smainfo.org.
175. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
176. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
177. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
178. SPIB - Southern Pine Inspection Bureau; www.spib.org.
179. SPRI - Single Ply Roofing Industry; www.spri.org.
180. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
181. SSINA - Specialty Steel Industry of North America; www.ssina.com.
182. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
183. STI - Steel Tank Institute; www.steeltank.com.
184. SWI - Steel Window Institute; www.steelwindows.com.
185. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
186. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
187. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
188. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
189. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
190. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
191. TMS - The Masonry Society; www.masonrysociety.org.
192. TPI - Truss Plate Institute; www.tpinst.org.
193. TPI - Turfgrass Producers International; www.turfgrasssod.org.
194. TRI - Tile Roofing Institute; www.tileroofing.org.
195. UL - Underwriters Laboratories Inc.; www.ul.com.
196. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
197. USAV - USA Volleyball; www.usavolleyball.org.
198. USGBC - U.S. Green Building Council; www.usgbc.org.
199. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
200. WA - Wallcoverings Association; www.wallcoverings.org.
201. WASTEC - Waste Equipment Technology Association; www.wastec.org.
202. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.

203. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
204. WDMA - Window & Door Manufacturers Association; www.wdma.com.
205. WI - Woodwork Institute; www.wicnet.org.
206. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
207. WWPA - Western Wood Products Association; www.wwpa.org.

C. 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.

D. 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; www.quicksearch.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/fdsys.
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; www.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; The National Academies; 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. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. 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 DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.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.

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).

F. 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. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4200

SECTION 01 5000 - 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.

B. Related Requirements:

1. Section 01 1000 "Summary" for work restrictions and limitations on utility interruptions.

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 engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

E. 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.

F. 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.

G. Sewer, Water, and Electric Power Service: Use charges are specified in Section 01 1200 "Multiple Contract Summary."

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

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

F. 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. 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.

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 United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts**,** with 1-5/8-inch- (42-mm-) OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete bases for supporting posts.

C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

D. Wood Enclosure Fence: Plywood, 6 feet (1.8 m) high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.

E. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E84 and passing NFPA 701 Test Method 2.

F. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats minimum 36 by 60 inches (914 by 1524 mm).

G. 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. Field Offices, General: Owner will provide conditioned interior space for field offices for duration of Project.

C. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect**,** and 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, monitor, and 4-foot- (1.2-m-) square tack and marker boards.

3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

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

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a 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 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities 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.

3.2 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 01 1000 "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.

3.3 TEMPORARY UTILITY INSTALLATION

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

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

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

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

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

D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. 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.

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

F. Temporary Heating and Cooling: Provide temporary heating and cooling 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. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

G. 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**.**

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.

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

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

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

J. 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.

K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one land-based telephone line(s) for each field office.

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. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
3. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 1.0 Mbps upload and 15 Mbps download speeds at each computer.
4. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
5. Backup: External hard drive, minimum 2 terabyte, with automated backup software providing daily backups.

3.4 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 (9 m) of building lines that is noncombustible according to ASTM E136. 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. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

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

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 32 1216 "Asphalt Paving."

D. 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.

E. Parking: Provide temporary parking areas for construction personnel.

F. 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.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs. Submit shop drawing for approval.
2. 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.

3. Maintain and touch up signs so they are legible at all times.

H. Waste Disposal Facilities: Comply with requirements specified in Section 01 7419 "Construction Waste Management and Disposal."

I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 7300 "Execution."

J. 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.

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

L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 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.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

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: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 31 1000 "Site Clearing."

D. 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, according to erosion- and sedimentation-control Drawings, requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

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.

E. 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.

F. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."

G. 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.

H. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

I. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

J. 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 workday.

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

L. 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.

2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.

4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

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

3.6 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
2. 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.
3. Indicate methods to be used to avoid trapping water in finished work.

B. Exposed Construction Period: 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 Period: 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 and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: 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 temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
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 and require replacing.
    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 and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 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 01 7700 "Closeout Procedures."

END OF SECTION 01 5000

SECTION 01 6000 - 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 01 1000 "Summary" for Contractor requirements related to Owner-furnished products.
2. Section 01 2500 "Substitution Procedures" for requests for substitutions.
3. Section 01 4200 "References" for applicable industry standards for products specified.
4. Section 01 7700 "Closeout Procedures" for submitting warranties.

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. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 3300 "Submittal Procedures."

F. Substitution: Refer to Section 01 2500 "Substitution Procedures" for definition and limitations on substitutions.

1.4 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. Resolution of Compatibility Disputes between Multiple Contractors:

a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.5 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

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 that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

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

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to 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 in the Project Manual, 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 meeting 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: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

    a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."

2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered in very limited situations.

    a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

4. Non-Limited List of Products: 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.

    a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

6. Non-Limited List of Manufacturers: 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.

a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

7. 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 may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 2500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "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 01 2500 "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 a 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.

E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.

1. Select products for which sustainable design documentation submittals are available from manufacturer.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following

conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 3300 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Section 01 3300 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7300 - 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. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Coordination of Owner-installed products.
7. Progress cleaning.
8. Starting and adjusting.
9. Protection of installed construction.

B. Related Requirements:

1. Section 01 1000 "Summary" for coordination of Owner-furnished products, Owner-performed work, and limits on use of Project site.
2. Section 01 3300 "Submittal Procedures" for submitting surveys.
3. Section 01 7700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.3 DEFINITIONS

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

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 PREINSTALLATION MEETINGS

A. Layout Conference: Conduct conference at Project site.

1. Prior to establishing layout of new perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:

    a. Contractor's superintendent.
    b. Professional surveyor responsible for performing Project surveying and layout.
    c. Professional surveyor responsible for performing site survey serving as basis for Project design.

2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

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

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

D. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.6 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.7 QUALITY ASSURANCE

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

B. Professional Engineer Qualifications: Refer to Section 01 4000 "Quality Requirements."

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

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

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

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

PART 3 - EXECUTION

3.1 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, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, 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, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
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, submit a request for information to Architect in accordance with requirements in Section 01 3100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:

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

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

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

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

3.4 FIELD ENGINEERING

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

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

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

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

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

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

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

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

3.5 INSTALLATION

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

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of [**96 inches (2440 mm)**] <**Insert dimension**> in occupied spaces and [**90 inches (2300 mm)**] <**Insert dimension**> in unoccupied spaces, unless otherwise indicated on Drawings.

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 satisfactory results as judged by Architect. 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 of type expected for Project.

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: Select tools or equipment that minimize production of excessive 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 portions of the 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 with manufacturer.

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, as judged by Architect. Fit exposed connections together to form hairline joints.

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.6 CUTTING AND PATCHING

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

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

B. 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 in accordance with 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 minimize 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, as judged by Architect. 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 eliminate evidence of patching and refinishing.

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

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

a. Where patching occurs in a painted surface, 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, corner to corner of wall and edge to edge of ceiling. 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.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.
2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products

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

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

3.8 PROGRESS CLEANING

A. 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 (27 deg C).
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.

D. 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.

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

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

G. 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."

H. 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.

I. 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.

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

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 9113 "General Commissioning Requirements."

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

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

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

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION AND REPAIR 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. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

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

END OF SECTION 01 7300

SECTION 01 7419 - 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 other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

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

B. Related Requirements:

1. Section 01 1200 "Multiple Contract Summary" for coordination of responsibilities for waste management.

1.3 DEFINITIONS

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

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

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

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

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

1.4 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report.. Include the following information:

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

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

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

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

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

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

G. Qualification Data: For waste management.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may not serve as Waste Management Coordinator.

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

C. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

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

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

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

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

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

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50% percent by weight of total nonhazardous 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. Asphalt paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Brick.
e. Concrete masonry units.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.

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

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph 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) Wood pallets.
8) Plastic pails.

m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:

1) Paper.
2) Aluminum cans.

3) Glass containers.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

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

1. Comply with operation, termination, and removal requirements in Section 01 5000 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

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

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

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

E. Waste Management in Historic Zones or Areas: Transportation equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by [**12 inches (300 mm)**] <**Insert dimension**> or more.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

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

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

C. n of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

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

1. Provide appropriately marked containers or bins for controlling recyclable waste until 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 from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 RECYCLING DEMOLITION WASTE

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

1. Crush asphaltic concrete paving and screen to comply with requirements in Section 312000 "Earth Moving" for use as general fill.

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

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

1. Pulverize concrete to maximum **1-1/2-inch (38-mm)** size.
2. Crush concrete and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.

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

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

    a. Crush masonry and screen to comply with requirements in Section 31 2000 "Earth Moving" for use as satisfactory soil for fill or subbase.
    b. Crush masonry and screen to comply with requirements in Section 329300 "Plants" for use as mineral mulch.

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

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

F. Metals: Separate metals by type.

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

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

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

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

J. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry car pocket an in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

L. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

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

N. Conduit: Reduce conduit to straight lengths and store by material and size.

O. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.4 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. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.

2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

    a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.

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

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

    a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

D. Paint: Seal containers and store by type.

3.5 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, 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. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

END OF SECTION 01 7419

SECTION 01 7700 - 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.

B. Related Requirements:

1. Section 01 2900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.

1.3 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.
B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.
B. Certificate of Insurance: For continuing coverage.
C. Field Report: For pest-control inspection.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.7 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, 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.

    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 testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. 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. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 7900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint 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. 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.

1.8 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 in accordance with 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.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

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

1.9 LIST OF INCOMPLETE ITEMS

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, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, 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. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.10 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

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.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by uploading to web-based project software site.

E. Warranties in Paper Form:

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 (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

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

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

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: 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 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 not planted, mulched, or 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. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
i. Vacuum and mop concrete.
j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
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.
l. Remove labels that are not permanent.
m. Wipe surfaces of mechanical and electrical 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 ACR. Provide written report on completion of cleaning.

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

C. Pest Control: Comply with pest control requirements in Section 01 5000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 7419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 01 7300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 7700

SECTION 02 4100.02 - INTERIOR DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

B. Abandonment and removal of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 7300 - Execution: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.3 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Site Plan: Showing:
   1. Vegetation to be protected.
   2. Areas for temporary construction and field offices.
   3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.5 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of 5 years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Use of explosives is not permitted.
   3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   4. Provide, erect, and maintain temporary barriers and security devices.
   5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   7. Do not close or obstruct roadways or sidewalks without permit.
   8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

E. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Dismantle existing construction and separate materials.
   2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.2 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.3 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.4 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 4100.02

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Elevated concrete slabs.

B. Floors and slabs on grade.

C. Concrete reinforcement.

D. Joint devices associated with concrete work.

E. Concrete curing.

1.2 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 0516 - Underslab Vapor Barrier - Stego: For vapor barrier placed directly under slabs on grade.

C. Section 07 9200.02 - Interior Joint Sealants: Products and installation for sealants for saw cut joints and isolation joints in slabs.

1.3 REFERENCE STANDARDS

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete 1991 (Reapproved 2009).

C. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete 1998 (Reapproved 2004).

D. ACI 228.1R - In-Place Methods to Estimate Concrete Strength 2003.

E. ACI 301 - Specifications for Concrete Construction 2020.

F. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.

G. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

H. ACI 305R - Guide to Hot Weather Concreting 2020.

I. ACI 306R - Guide to Cold Weather Concreting 2016.

J. ACI 308R - Guide to External Curing of Concrete 2016.

K. ACI 318 - Building Code Requirements for Structural Concrete 2019, with Errata (2021).

L. ACI 347R - Guide to Formwork for Concrete 2014, with Errata (2017).

M. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

N. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.

O. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete 2017.

P. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method 2017.

Q. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field 2021a.

R. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

S. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

T. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.

U. ASTM C567/C567M - Standard Test Method for Determining Density of Structural Lightweight Concrete 2014.

V. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.

W. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2021b.

X. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

Y. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete 2020.

Z. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method 2016.

AA. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

BB. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete 2017a.

CC. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019.

DD. ASTM C597 - Standard Test Method for Pulse Velocity Through Concrete 2016.

EE. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2019.

FF. ASTM C803/C803M - Standard Test Method for Penetration Resistance of Hardened Concrete 2018.

GG. ASTM C805/C805M - Standard Test Method for Rebound Number of Hardened Concrete 2018.

HH. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.

II. ASTM C900 - Standard Test Method for Pullout Strength of Hardened Concrete 2019.

JJ. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

KK. ASTM C1866/C1866M - Standard Specification for Ground-Glass Pozzolan for Use in Concrete 2020.

LL. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars 2018a.

MM. ASTM D8139 - Standard Specification for Semi-Rigid, Closed-Cell Polypropylene Foam, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction 2017.

NN. ASTM D6817/D6817M - Standard Specification for Rigid Cellular Polystyrene Geofoam 2017 (Reapproved 2021).

OO. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings:
   1. Construction/Control Joint Layout Plan: Indicate proposed construction/control joints required to construct the structure.
      a) Layout of construction/control joints is subject to approval of the Architect.
      b) For slab on grade construction/control joint layout, include size and shape of boxouts for column/pier conditions.

C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

D. Mix Design: Submit proposed concrete mix design.
   1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.

2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
3. For structural lightweight concrete, submit test results and correlation between equilibrium density and the fresh bulk density of concrete for review. The fresh bulk density shall be used as the basis for acceptance during construction.
4. Design Mixtures: For each concrete mixture, include the following: mixture identification, minimum 28-day compressive strength, durability exposure class, maximum w/cm, calculated equilibrium unit weight for lightweight concrete, slump limit, air content, nominal maximum aggregate size, fiber reinforcement dosage, intended placement method, indicate amounts of mixing water to be withheld for later addition at Project site if any, and submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Test Reports: Submit report for each test or series of tests specified.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.
1. Maintain one copy of each document on site.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in 01 3000 - Administrative Requirements.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
a) Contractor's superintendent.
b) Independent testing agency responsible for concrete design mixtures.
c) Ready-mix concrete manufacturer.
d) Concrete subcontractor.
e) Special Inspector.
f) Architect
g) Structural Engineer of Record
2. Review the following:
a) Special inspection and testing and inspecting agency procedures for field quality control.
b) Construction, control and isolation joints, joint-filler strips and keyway forming.
c) Semirigid joint fillers.
d) Vapor-retarder installation and inspection.
e) Anchor rod and anchorage device installation tolerances.
f) Cold and hot weather concreting procedures.
g) Concrete finishes and finishing. Mockups if required.
h) Curing procedures.
i) Methods for achieving specified floor and slab flatness and levelness.

j) Floor and slab flatness and levelness measurements.
k) Concrete repair procedures.
l) Concrete protection.
m) Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
n) Protection of field cured field test cylinders.
o) Determine point at which samples are taken.
p) Distribution list for Test Reports.

E. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician .
1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

F. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

PART 2 PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 03 1000.

B. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

2.2 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
1. Type: Deformed billet-steel bars.
2. Finish: Unfinished, unless otherwise indicated.

B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.
1. Form: Flat Sheets.
2. WWR Style: 6 x 6-W4.0 x W4.0 (152 x 152-MW26 x MW26).

C. Reinforcement Accessories:
1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I/II Portland type.
1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C 33. Class 3S coarse aggregate or better, graded.
1. Acquire aggregates for entire project from same source.

C. Lightweight Aggregate: ASTM C330/C330M.

D. Fly Ash: ASTM C618, Class C or F. LOI shall not exceed 3%, specific gravity shall not be less than 2.2.

E. Ground Granulated Blast-Furnace Slag: ASTM C989/C989M, Grade 120.

F. Ground Glass Pozzolan: ASTM C1866/C1866M.

G. Water and Water Used to Make Ice: ASTM C94/C94M , potable or complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4.

2.4 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

D. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.

E. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

F. Accelerating Admixture: ASTM C494/C494M Type C.

G. Retarding Admixture: ASTM C494/C494M Type B.

2.5 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Comply with requirements of Section 03 0516 - Underslab Vapor Barrier - Stego.

B. Underslab Vapor Retarder:
   1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.
   2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   3. Products:
      a) Henry Company; Moistop Ultra 10: www.henry.com/#sle.
      b) ISI Building Products; Viper VaporCheck II 10-mil (Class A): www.isibp.com/#sle.
      c) W. R. Meadows, Inc; PERMINATOR Class A - 10 mils (0.25 mm): www.wrmeadows.com/#sle.

C. Structural Grade Rigid Filler Material: Complies with ASTM C578.
   1. Expanded Polystyrene (EPS)
   2. Type and Compressive Resistance: Type XIV, 40 psi (276 kPa) compressive resistance at 10% strain, minimum.

3. Type and Thermal Resistance, R-value (RSI-value): Type XIV, 4.2 (0.74), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature, when tested in accordance with ASTM C518 .
4. Board Size: 48 inch by 96 inch (1220 mm by 2440 mm).
5. Board Thickness: As Indicated on Drawings.
6. Board Edges: Square, at long edges.
7. Recycled Content: Minimum 20%, certified by independent third party such as Scientific Certification Systems.
8. Warranty: Limited lifetime warranty covering all ASTM C578 physical properties.
9. Manufacturers:
    a) DiversiFoam Products; RayLite® EPS Insulation, Type XIV: www.diversifoam.com
    b) Atlas Molded Products; ThermalStar Insulation Board 40 www.atlasmoldedproducts.com.
    c) Insulfoam, a Carlisle Company; InsulFoam XIV 40psi: www.Insulfoam.com
    d) ISOLOFOAM Group; ISOLOFOAM XHD 400/600: www.isolofoam.com
    e) Plymouth Foam Incorporated; Durafill 39: www.goplymouthfoam.com
    f) [____].
    g) Substitutions: See Section 01 6000 - Product Requirements.

2.6 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:
1. Complying with ASTM C881/C881M and of Type required for specific application. For use in structural bearing applications.

B. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.
1. Material: ASTM D8139, semi-rigid, closed-cell polypropylene foam.
2. Products:
    a) Nomaco, Inc; Fastflex Slab Isolation Joint Filler with Tear-Off Strip: www.nomaco.com/#sle.
    b) W. R. Meadows, Inc; Deck-O-Foam Joint Filler with pre-scored top strip: www.wrmeadows.com/#sle.
    c) Right / Pointe, LLC; Flex Foam Expansion Joint
    d) Substitutions: See Section 01 6000 - Product Requirements.

C. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches (150 mm) on center; ribbed steel stakes for setting.

2.7 CURING MATERIALS

A. Moisture-Retaining Sheet: ASTM C171.
1. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard (1.71 kg/sq m).
    a) 10 oz. burlap laminated onto 5 mil white coated polyethylene

B. Water and Water Used to Make Ice: Potable, not detrimental to concrete.

2.8 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Proportioning Structural Lightweight Concrete: Comply with ACI 211.2 recommendations.

C. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

D. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

E. Normal Weight Concrete: Interior stairs and housekeeping pads
   1. Exposure Class: ACI 318 F1
   2. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch (27.6 MPa).
   3. Fly Ash or Ground Glass Pozzolan Content: Between 15 and 25 percent of cementitious materials by weight.
   4. Ground Granulated Blast-Furnace Slag: Between 30 and 50 percent.
   5. Combined Fly Ash or Ground Glass Pozzolan and Ground Granulated Blast-Furnace Slag: Between 30 and 50 percent by mass, with fly ash or pozzolan not exceeding 25 percent.
   6. Total Air Content: 6 percent plus or minus 1.5 percent at point of placement, determined in accordance with ASTM C173/C173M.
   7. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

F. Structural Lightweight Concrete: Suspended Slabs and Slab on Deck Infills
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch (27.6 MPa).
   2. Fly Ash or Ground Glass Pozzolan Content: Between 10 and 15 percent of cementitious materials by weight.
   3. Ground Granulated Blast-Furnace Slag: Between 10 and 15 percent.
   4. Combined Fly Ash or Ground Glass Pozzolan and Ground Granulated Blast-Furnace Slag: Between 10 and 15 percent by mass, with fly ash or pozzolan not exceeding 15 percent.
   5. Total Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
   6. Maximum dry unit weight: 110 pounds per cubic foot (1762 kg/cu. m) plus or minus 3 lb/cu. ft. (48.1 kg/cu. m). The calculated value per ASTM C567/C567M shall be included in the submittal.
   7. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

2.9 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.
   1. Furnish batch ticket information.

2. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above **90 deg F (32 deg C) reduce mixing and delivery time to 60 minutes.**

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

B. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.

C. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas and that required inspections are completed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

3.3 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.4 PLACING CONCRETE

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
   1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
   2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Place concrete in accordance with ACI 304R.

C. Place concrete for floor slabs in accordance with ACI 302.1R.

D. Notify Architect not less than 24 hours prior to commencement of placement operations.

E. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

F. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

G. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

H. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
   1. Do not use vibrators to transport concrete inside forms.
   2. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
   3. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
   4. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

I. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
   1. If permitted, the contractor is required to clearly note on the delivery ticket the quantity of water withheld at the batching plant that can be added on site.
   2. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

J. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.5 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant specified in 07 9200.02 - Interior Joint Sealants, total height equal to thickness of slab, set flush with top of slab.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks; use 1/8 inch (3.2 mm) thick shatterproof abrasive or diamond-rimmed blade and cut at least 1 inch (25 mm) deep but not less than one quarter (1/4) the depth of the slab.
   1. For slabs on grade where fiber reinforcment is used in lieu of WWR, saw cut shall be at least one third (1/3) the depth of the slab.

E. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

F. Construction Joints in Slabs on Steel Deck: Where not otherwise indicated,
   1. Joints parallel to girder shall be located minimum 5'-0" off girder centerline.
   2. Joints parallel to infill beams shall be located half way between adjacent beam.
   3. Submit layout plan for A/E approval.

3.6 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
   2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
   3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.7 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include Resilient Flooring, Tile Carpeting, and [___].
   2. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.8 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Wet coverings should be laid over the concrete as soon as finishing operations are complete and surface marring can be avoided. Exposed concrete edges should be carefully covered. The coverings should be kept wet so that a film of moisture remains continuously in contact with the concrete throughout the curing period.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Curing Period: Not less than seven days.

D. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

E. Surfaces Not in Contact with Forms:
   1. Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist.
      a) Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.

3.9 TOLERANCES

A. Conform to ACI 117.

3.10 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

E. All field quality control tests shall be performed at point of concrete placement.

F. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cubic yards (38 cu m) or less of each class of concrete placed but not less than one per day. Test cylinders at 28 days.

G. Take three additional test cylinders during cold weather concreting, cured on job site under same conditions as concrete it represents. Test cylinders at 28 days.

H. During cold weather concreting, a number of techniques are available for estimating the in-place strength of concrete per ACI 228.1R. When these have been correlated to standard-cured cylinders, they can be used to determine the concrete strength. Tests are performed using simple handheld equipment. Use one of the following to estimate concrete strength.
   1. Pullout strength testing (ASTM C900) requires placing bolts in the concrete before casting. Individual bolts are then pulled out of the structure.
   2. Penetration resistance (ASTM C803/C803M) is a techniquethat involves placing pins in the concrete using a powder-actuated tool.
   3. Pulse velocity measurements (ASTM C597) determines the propagation velocity of a pulse of vibrational energy through a concrete member.
   4. Rebound hammer measurements (ASTM C805/C805M) are also .

I. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

J. Air Content: Perform one test for each set of test cylinders taken, following procedures of ASTM C231/C231M, pressure method, for normal-weight concrete; ASTM C173/C173M, volumetric method, for structural lightweight concrete.

K. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 degrees F (4.4 degrees C) and below or 80 degrees F (27 degrees C) and above, and one test for each set of test cylinders taken.

3.11 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

E. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete.
      a) Limit cut depth to 3/4 inch (19 mm).
      b) Make edges of cuts perpendicular to concrete surface.
      c) Clean, dampen with water, and brush-coat holes and voids with bonding agent.
      d) Fill and compact with patching mortar before bonding agent has dried.
      e) Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
      a) Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
      b) Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

3.12 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION 03 3000

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SECTION 03 5400 - CAST UNDERLAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Liquid-applied self-leveling floor underlayment.

1.2 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.

B. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

C. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars 2021.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.

C. Manufacturer's Instructions.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F (41 degrees C).

1.6 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F (10 degrees C) 24 hours before, during and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cementitious Underlayment:
   1. ARDEX Engineered Cements with ARDEX P51 Primer: www.ardexamericas.com/#sle.
   2. Koster American Corporation: www.kosterusa.com/#sle.
   3. Maxxon Corporation: www.maxxon.com/#sle.

2.2 MATERIALS

A. Cast Underlayments, General:
   1. Comply with applicable code for combustibility or flame spread requirements.

B. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
   1. Compressive Strength: Minimum 4000 pounds per square inch (27.6 MPa) after 28 days, tested per ASTM C109/C109M.
   2. Flexural Strength: Minimum 1000 psi (6.9 MPa) after 28 days, tested per ASTM C348.
   3. Density: 125 pounds per cubic foot (2002 kg/cu m), nominal.
   4. Final Set Time: 1-1/2 to 2 hours, maximum.
   5. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch (89 mm).
   6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

C. Reinforcement: Galvanized metal lath complying with recommendations of underlayment manufacturer for specific project circumstances.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

E. Primer: Manufacturer's recommended type.

F. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

2.3 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Add aggregate for areas where thickness will exceed 1-1/2 inch (38 mm). Mix underlayment and water for at least two minutes before adding aggregate, and continue mixing to assure that aggregate has been thoroughly coated.

C. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.2 PREPARATION

A. Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.

B. Wood: Install metal lath for reinforcement of underlayment.

C. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

D. Vacuum clean surfaces.

E. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

F. Close floor openings.

3.3 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Pump or pour material onto substrate. Do not retemper or add water.
   1. Pump, move, and screed while the material is still highly flowable.
   2. Be careful not to create cold joints.
   3. Wear spiked shoes while working in the wet material to avoid leaving marks.

C. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft (1:1000).

D. Place before partition installation.

E. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.4 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION 03 5400

SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete block.

B. Mortar and grout.

C. Reinforcement and anchorage.

D. Flashings.

E. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 1113 - Bituminous Dampproofing: Dampproofing parged masonry surfaces.

1.3 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

E. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016, with Editorial Revision (2018).

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.

G. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.

H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.

I. ASTM C150/C150M - Standard Specification for Portland Cement 2021.

J. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.

K. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.

L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.

M. ASTM C476 - Standard Specification for Grout for Masonry 2020.

N. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry 2019a.

O. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.

P. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls 2005.

Q. BIA Technical Notes No. 46 - Maintenance of Brick Masonry 2017.

R. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

1.5 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
   2. Nonloadbearing Units: ASTM C129.
      a) Hollow block.
      b) Lightweight.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404.

E. Water: Clean and potable.

F. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Type N.
   2. Color: Standard gray.

2.3 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa), deformed billet bars; galvanized.

B. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Ladder.
   2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
   3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

C. Strap Anchors: Bent steel shapes, 1-1/2 inch (38 mm) width, 0.105 inch (2.7 mm) thick, 24 inch (610 mm) length, with 1-1/2 inch (38 mm) long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.

D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face.

2.4 FLASHINGS

A. Metal Flashing Materials:
   1. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch (0.48 mm) thick; finish 2B to 2D.

B. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.

C. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

D. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.5 ACCESSORIES

A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.6 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Exterior, non-loadbearing masonry: Type N.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

3.2 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.3 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
   3. Mortar Joints: Flush.

3.4 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar and mortar smears as work progresses.

D. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

E. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

F. Cut mortar joints flush where bitumen dampproofing is applied.

3.5 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch (16 mm) mortar cover on each side.

E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches (900 mm) horizontally and 24 inches (600 mm) vertically.

3.6 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up flashing ends at least 1 inch (25.4 mm), minimum, to form watertight pan at nonmasonry construction.
   2. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

C. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.

D. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

3.7 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

3.8 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.

D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.9 PARGING

A. Dampen masonry walls prior to parging.

B. Scarify each parging coat to ensure full bond to subsequent coat.

C. Parge masonry walls in two uniform coats of mortar to a total thickness of 3/4 inch (19 mm).

D. Steel trowel surface smooth and flat with a maximum surface variation of 1/8 inch per foot (1 mm/m).

3.10 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

END OF SECTION 04 2000

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed steel stud interior wall and Stadium Seating and Stair framing.

1.2 RELATED REQUIREMENTS

A. Section 07 9200.02 - Interior Joint Sealants.

1.3 REFERENCE STANDARDS

A. AISI S200-12 - North American Standard for Cold-Formed Steel Framing – General Provisions, 2012 Edition 2012.

B. AISI S210-07 - North American Standard for Cold-Formed Steel Framing – Floor and Roof System Design, 2007 Edition (Reaffirmed 2012) 2012.

C. AISI S211-07 - North American Standard for Cold-Formed Steel Framing - Wall Stud Design, 2007 Edition (Reaffirmed 2012) 2012.

D. AISI S212-07 - AISI North American Standard For Cold-Formed Steel Framing - Header Design, 2007 Edition (Reaffirmed 2012) 2012.

E. AISI S213-07 w/ S1-09 - North American Standard for Cold-Formed Steel Framing – Lateral Design, 2007 Edition With Supplement 1 (Reaffirmed 2012) 2012.

F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

I. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections 2013.

J. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members 2018, with Editorial Revision.

K. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories 2020.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

M. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018.

N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Conduct meeting attended by Owner, Architect, manufacturer's technical representative, and other trade contractors at project site prior to beginning of installation to review requirements.
   1. Convene one week before starting work of this section.

B. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

D. Delegated Design Submittal: For cold-formed metal framing.

E. Shop Drawings: Indicate component details, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud layout.
   2. Describe method for securing studs to tracks and for bolted framing connections.
   3. Design Data:
      a) Shop drawings signed and sealed by a Professional Structural Engineer.
   4. Submittals that do not bear the Contractor's Professional Structural Engineer's seal and signature will be returned, without review.

F. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in New York.

B. Professional Structural Engineer Qualifications: A professional engineer who is legally qualified to practice in New York and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this project in material, design, and extent.

C. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum five years of documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

E. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Framing:
   1. ClarkDietrich: www.clarkdietrich.com/#sle.
   2. Marino: www.marinoware.com/#sle.
   3. The Steel Network, Inc: www.SteelNetwork.com/#sle.

2.2 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Requirements: Provide completed framing system having the following characteristics:
   1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
   2. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100-12, AISI S200-12, and the following:
      a) Floor and Roof Systems: AISI S210-07.
      b) Wall Studs: AISI S211-07.
      c) Headers: AISI S212-07.
      d) Lateral Design: AISI S213-07 w/ S1-09.
   3. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
   4. Design Loads: As indicated on the drawings.
      a) Wind Loads: Calculate wind loads in accordance with ASCE 7.
         1) Design Criteria: As indicated on Structural Drawing S001.
      b) Seismic Loads: Calculate seismic loads in accordance with ASCE 7.
         1) Design Criteria: As indicated on Structural Drawing S001.
   5. Stadium Stair Area (Seating and Stairs): Design, engineer, fabricate, and erect to comply with requirements of local, state, and federal regulations, and to withstand design loads for project conditions.
   6. Live load deflection meeting the following, unless otherwise indicated:

a) Floors: Maximum vertical deflection under live load of 1/480 of span.

7. Interior Non-Axial Load Bearing Walls: Maximum horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
8. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
9. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

C. Shop fabricate framing system to the greatest extent possible.

D. Deliver to project site in largest practical sections.

2.3 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
1. Gage and Depth: As required to meet specified performance levels.
2. Galvanized in accordance with ASTM A653/A653M, and coating indicated.

B. Load Bearing Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths as indicated on the Drawings, punched, with stiffened flanges, and as follows:
1. Minimum Uncoated-Steel Thickness: As required to comply with structural performance requirements, but not less than 0.0538 inch (1.37 mm) thickness.
2. Flange Width: 2 inches (51 mm) minimum.
3. Punched openings shall not be located within 12 inches (304.8 mm) from the ends of in-place wall framing.
4. Galvanized in accordance with ASTM A653/A653M, and coating indicated.
a) Coating for Exterior Framing: G90/Z275.
b) Coating for Interior Framing: G60/Z180.
5. Grade: As required by structural performance.

C. Non-Load Bearing Wall Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths as indicated on the Drawings, punched, with stiffened flanges, and as follows:
1. Minimum Uncoated-Steel Thickness: As required to comply with structural performance requirements, but not less than 0.0329 inch (0.84 mm) thickness.
2. Flange Width: 2 inches (51 mm) minimum.
3. Punched openings shall not be located within 12 inches (304.8 mm) from the ends of in-place wall framing.
4. Galvanized in accordance with ASTM A653/A653M, and coating indicated.
a) Coating for Exterior Framing: G90/Z275.
b) Coating for Interior Framing: G60/Z180.
5. Grade: As required by structural performance.

D. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flange, and as follows:
1. Minimum Uncoated-Steel Thickness: As required to comply with structural performance requirements, but not less than thickness of steel studs.
2. Flange Width: As required to comply with structural performance requirements, but not less than 1-1/4 inches (32 mm).

E. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, and as follows:
   1. Minimum Uncoated-Steel Thickness: As required to comply with structural performance requirements, but not less than 0.0538 inch (1.37 mm).
   2. Flange Width: A minimum of 3 inches (76.2 mm), and as required to comply with structural performance requirements, and to accommodate upward and downward deflection of 3/4 inch (19 mm).

2.4 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M to match coating level of framing member.

B. Mechanical Fasteners: Self-drilling, self-tapping screws, bolts, nuts and washers per ASTM C1513 corrosion-resistant-coated.
   1. Head Type: Low-profile head beneath sheathing and gypsum board, manufacturer's standard elsewhere.

C. Anchorage Devices: Powder actuated.

2.5 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.

C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

D. Touch-Up Primer for Galvanized Surfaces: ASTM A780/A780M, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

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

C. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistive rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

END OF SECTION 05 4000

SECTION 05 5000.02 - INTERIOR METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

1.2 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

C. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

I. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2014, with Amendment (2015).

J. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

K. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata (2020).

L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
   a) Include the following, as applicable:
      1) Design criteria.
      2) Engineering analysis depicting stresses and deflections.
      3) Member sizes and gauges.
      4) Details of connections.
      5) Support reactions.
      6) Bracing requirements.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Designer's Qualification Statement.

1.4 QUALITY ASSURANCE

A. Design slotted channel framing under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Slotted Channel Fittings: ASTM A1011/A1011M.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.2 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Bolts, Nuts, and Washers: Stainless steel.

D. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.3 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATED ITEMS

A. Sill Angles for Tempered Glass Railing Assemblies: ASTM A36/A36M steel angles with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish.

B. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

C. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.
   1. Manufacturers:
      a) Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/.
      b) Thomas & Betts Corporation: www.tnb.com/.
      c) Unistrut, a brand of Atkore International Inc: www.unistrut.com/.
      d) Source Limitations: Provide channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
   2. Applications:
      a) Pipe grid below ceiling for sensory swing attachment. As indicated on drawings.
      b) Support of items suspended below metal roof deck where direct attachment to deck is not permitted. See notes on drawings.
      c) Other locations as indicated on drawings.

2.5 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Prime Painting: One coat.

D. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

E. Stainless Steel Finish: No. 4 Bright Polished finish.

2.6 FINISHES - ALUMINUM

A. Interior Aluminum Surfaces: Class I natural anodized.

B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

E. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION 05 5000.02

SECTION 05 7000 - DECORATIVE METAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Railing and guardrail assemblies.

B. Wall-mounted handrails.

1.2 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

D. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

I. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing 2021.

J. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

K. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.

L. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.

M. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.

N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2021.

O. AWS C3.4M/C3.4 - Specification for Torch Brazing 2016.

P. AWS C3.5M/C3.5 - Specification for Induction Brazing 2016, with Amendment (2017).

Q. AWS C3.9M/C3.9 - Specification for Resistance Brazing 2020.

R. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

S. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017, with Amendment (2021).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Schedule and conduct a preinstallation meeting one week before starting work of this section. Attendees shall include, but not be limited to:
   1. Contractor.
   2. Manufacturer's representative.
   3. Architect.
   4. Owner's representative.
   5. Other subcontractors of adjacent work.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.

C. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

D. Samples: Submit one (1) of each item below for each type and condition shown.
   1. Glass: 12 inch by 12 inch (305 mm by 305 mm), illustrating color, thickness and edge condition.
   2. Railing: 12 inch (305 mm) long section of handrail illustrating color, finish and connection detail.

E. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.

F. Installer's qualification statement.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.6/D1.6M no more than 12 months before start of scheduled welding work.

C. Templates: Supply installation templates, reinforcing, and required anchorage devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory-provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.

D. Prior to installation, store materials and components under cover in a dry location.

1.7 FIELD CONDITIONS

A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F (18.3 degrees C) and maximum 95 degrees F (35 degrees C).

B. Maintain ambient temperature of space at minimum 65 degrees F (18.3 degrees C) and maximum 95 degrees F (35 degrees C) for 24 hours before, during, and after railing installation.

1.8 WARRANTY

A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 RAILING SYSTEMS

A. Railing Systems - General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.
   1. Performance Requirements: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.
      a) Lateral Force: 75 lb (333 N) minimum, at any point, when tested in accordance with ASTM E935.
      b) Distributed Load: 50 lb/ft (0.73 kN per m) minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E935.
      c) Concentrated Loads on Intermediate Rails: 50 psf (0.22 kgs per sq m), minimum.
      d) Concentrated Load: 200 lbs (888 N) minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.
   2. Assembly: Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.

3. Joints: Tightly fitted and secured, machined smooth with hairline seams.
4. Field Connections: Provide sleeves to accommodate site assembly and installation.
5. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
    a) Ease exposed edges to a small uniform radius.
    b) Welded Joints:
        1) Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
        2) Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.
    c) Brass/Bronze Brazed Joints:
        1) Perform torch brazing in accordance with AWS C3.4M/C3.4.
        2) Perform induction brazing in accordance with AWS C3.5M/C 3.5.
        3) Perform resistance brazing in accordance with AWS C3.9M/C3.9.

B. Metal Railing: Engineered, post-supported railing system with metal infill.
1. Configuration: As indicated on drawings.
2. Materials: Stainless Steel or Painted Steel, where occurring, as indicated on drawings.
3. Top Rail: 1-1/2 inch IPS / 1.9 inch OD (38.1 mm IPS / 48.26 mm OD) diameter pipe or tube, Schedule 40.
4. Handrail: 1-1/4 inch nominal pipe rail (1.66 inch OD) diameter pipe rail.
5. Wall Mounted Components: Components necessary to support railing with 1-1/2 inch (38 mm) clearance from wall, and as follows:
    a) Underslung support brackets: Supports at 60 inches (1524 mm), maximum.
6. Handrail Brackets: Same metal as railing.
7. Fasteners: Concealed.
8. Infill at Picket Railings: Vertical pickets.
    a) Horizontal Spacing: Maximum 4 inches (100 mm) on center.
    b) Material: Solid steel bar.
    c) Shape: Square.
    d) Size: As indicated on drawings .
    e) Top Mounting: Welded to underside of top rail.
    f) Bottom Mounting: Welded to top surface of stringer.
9. End and Intermediate Posts: As shown on drawings.
    a) Horizontal Spacing: As indicated on drawings.
    b) Mounting: Welded.

C. Structural Glass Railing System, Base-Mounted: Engineered, base-shoe supported railing system with structural glass.
1. Configuration: As indicated on drawings.
2. Top Cap: Stainless steel "U" cap.
3. Grip Rail (where occurring): Round, stainless steel, 1-1/4 inch (19 mm) diameter, nominal.
4. Base Cladding:
    a) Material: 18 gauge, 0.0500 inch (1.27 mm) stainless steel; No. 4 satin finish.
5. Glass: As specified in this section.
6. Handrail Brackets (where occurring): Same metal as railing.
7. Stainless Steel Finish, Exposed Surfaces: No. 4 satin finish.
8. Fasteners:
    a) As indicated on drawings.

D. Wall-Mounted Handrail:
   1. Materials: Stainless Steel or Painted Steel, where occurring, as indicated on drawings.
   2. 1-1/4 inch (19 mm) diameter nominal (1.66 inch OD) stainless steel; No. 4 satin finish.
   3. 1-1/4 inch (19 mm) diameter nominal (1.66 inch OD) steel, painted.
   4. Handrail Brackets: Same metal and finish as railing, as indicated on drawings.
      a) Mounting: Wall.
   5. Comply with ADA Standards.

2.2 MATERIALS

A. Steel Components:
   1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
   2. Tubing: ASTM A501/A501M structural tubing, round and shapes as indicated.
   3. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
   4. Iron Castings: ASTM A47/A47M, malleable.
   5. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
   6. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

B. Stainless Steel Components:
   1. ASTM A666, Type 304.
   2. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch (1.59 mm) minimum metal thickness, 1-1/2 inch (38 mm) diameter.
   3. Stainless Steel Finish: No. 4 satin finish.

C. Glass (LS2): Laminated safety glass; ASTM C1172, unless otherwise indicated.
   1. Plastic Interlayer: Minimum 0.060 inch (1.52 mm) thick.
   2. Impact Strength: Category II, tested in accordance with 16 CFR 1201.
   3. Thickness: 9/16 inch (14.3 mm).
   4. Configuration: As indicated on drawings.
   5. Edges: Ground smooth and polished.
   6. Color: Clear, no tint.

2.3 ACCESSORIES

A. Non-Weld Mechanical Fittings for Stainless Steel Railings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

C. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete for bolt anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry for bolt anchors.
   3. For anchorage to stud walls, provide backing plates for bolt anchors.
   4. Exposed Fasteners: No exposed bolts or screws.

D. Carbon Steel Bolts and Nuts: ASTM A307.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates, and supports for attachment of anchors.

3.2 PREPARATION

A. Protect existing work.

B. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.

C. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.3 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections, and abraded areas.
   4. Touch up shop primer and factory-applied finishes.
   5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

3.5 CLEANING

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

C. Glass and Glazing: Clean glazing surfaces; remove excess glazing sealant compounds, dirt, and other substances.

3.6 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
   1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION 05 7000

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SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire retardant treated wood materials.

B. Concealed wood blocking, nailers, and supports.

1.2 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

B. AWPA U1 - Use Category System: User Specification for Treated Wood 2021.

C. PS 1 - Structural Plywood 2009 (Revised 2019).

D. PS 20 - American Softwood Lumber Standard 2021.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.3 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
   3. Other Locations: PS 1, C-D Plugged or better.

2.4 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:
   1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a) Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b) Treat rough carpentry items as indicated .
      c) Do not use treated wood in applications exposed to weather or where the wood may become wet.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.4 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.5 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

END OF SECTION 06 1000

SECTION 06 2000 - FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finish carpentry items.

1.2 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard 2016.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

F. PS 1 - Structural Plywood 2009 (Revised 2019).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data:
   1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
   2. Provide data on fire retardant treatment materials and application instructions.
   3. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
   2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of finish plywood, 12 x 12 inch (305 x 305 mm) in size illustrating wood grain and specified finish.

E. Samples: Submit two samples of wood trim 12 inch (305 mm) long.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Protect from moisture damage.

D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.1 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:
1. As indicated on drawings.

2.2 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1 Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

C. Particleboard: ANSI A208.1 Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.

2.3 FASTENINGS

A. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.

B. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and stainless steel finish in exposed locations.

C. Concealed Joint Fasteners: Threaded steel.

2.4 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Lumber for Shimming and Blocking: Softwood lumber of indicated species.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.5 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

C. Provide identification on fire retardant treated material.

D. Redry wood after pressure treatment to maximum 19 percent moisture content.

2.6 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.7 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a) System - 11, Polyurethane, Catalyzed.
      b) Stain: As selected by Architect.
      c) Sheen: Satin.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Install factory-fabricated units in accordance with manufacturer's printed installation instructions.

C. Set and secure materials and components in place, plumb and level.

D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

3.3 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION 06 2000

SECTION 06 4100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

1.2 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 12 3600 - Countertops.

1.3 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

C. BHMA A156.9 - Cabinet Hardware 2020.

D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
   2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet and countertop substrate and finish.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
   2. Single Source Responsibility: Provide and install this work from single fabricator.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.8 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.1 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Wood Veneer Faced Cabinet:

C. Plastic Laminate Faced Cabinets: Custom grade.

2.2 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.3 LAMINATE MATERIALS (PL1)

A. Manufacturers:
   1. Basis of Design: As indicated in the Finish Product List on drawings.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

2.4 COUNTERTOPS

A. Countertops: See Section 12 3600.

2.5 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.

C. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.6 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

2.7 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.8 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a) System - 11, Polyurethane, Catalyzed.
      b) Stain: As selected by Architect.
      c) Sheen: As indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

3.3 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 06 4100

SECTION 06 8316 - FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.2 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).

B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor 2013a.

C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2017.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Samples: Submit two samples 12 by 12 inch (305 x 305 mm) in size illustrating material and surface design of panels.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:
   1. Basis of Design: As indicated in the Finish Product List on drawings.

2.2 PANEL SYSTEMS

A. Wall Panels (FRL1):
   1. Panel Size: As indicated in the Finish Product List on drawings.
   2. Panel Thickness: As indicated in the Finish Product List on drawings.
   3. Surface Design: As indicated in the Finish Product List on drawings.
   4. Color: As indicated in the Finish Product List on drawings.
   5. Attachment Method: As indicated in the Finish Product List on drawings.

2.3 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
   4. Impact Strength: Greater than 6 ft lb force per inch (320 J per m), when tested in accordance with ASTM D256.

B. Trim: Vinyl; color coordinating with panel.

C. Adhesive: Type recommended by panel manufacturer.

D. Sealant: Type recommended by panel manufacturer; color matching panel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.2 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION 06 8316

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SECTION 07 0553 - FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.2 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Paint finish.

1.3 REFERENCE STANDARDS

A. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.

C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

D. Samples: Submit two samples of each type of marking proposed for use, of size similar to that required for project, illustrating font, wording, and method of application.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.6 FIELD CONDITIONS

A. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).

B. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 09 9123 for products.

C. Languages: Provide sign markings in English and Spanish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 PREPARATION

A. See Section 09 9123 for substrate preparation for painted markings.

3.3 INSTALLATION

A. Locate markings as required by ICC (IBC).

B. Install applied markings in accordance with Section 09 9123.

C. Install neatly, with horizontal edges level.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION 07 0553

SECTION 07 1113 - BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Bituminous dampproofing.

B. Protection boards.

1.2 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing 2011 (Reapproved 2016).

B. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing 2013, with Editorial Revision (2019).

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, and mastics.

C. Installer's qualification statement.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.1 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. VOC Content: Not more than permitted by local, State, and federal regulations.
   2. Applied Thickness: 1/16 inch (1.5 mm), minimum, wet film.
   3. Products:
      a) Karnak Corporation; 220 Fibered Emulsion Dampproofing: www.karnakcorp.com/#sle.
      b) W. R. Meadows, Inc; Sealmastic Emulsion Type I (spray-grade): www.wrmeadows.com/#sle.

c) Mar-Flex Systems, Inc; ArmorBlock 361 WB.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.2 BITUMEN MATERIALS

A. Cold Asphaltic Type:
1. Emulsified Asphalt: ASTM D1227/D1227M, with fiber reinforcement other than asbestos, Type II, Class 1 or 2.
2. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

2.3 ACCESSORIES

A. Protection Board: 1/8-inch (3 mm) thick asphalt wood fiberboard.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.3 APPLICATION

A. Foundation Walls: Apply two coats of asphalt dampproofing.

B. Perform this work in accordance with manufacturer's instructions.

C. Apply bitumen by spray application.

D. Apply bitumen in two coats, continuous and uniform, at a rate of 25 sq ft/gal (0.6 sq m/L) per coat.

E. Seal items watertight with mastic, that project through dampproofing surface.

F. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.

G. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION 07 1113

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SECTION 07 8400 - FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.2 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

B. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems 2020a.

C. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers 2020a.

D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

E. ITS (DIR) - Directory of Listed Products current edition.

F. FM (AG) - FM Approval Guide current edition.

G. UL (DIR) - Online Certifications Directory Current Edition.

H. UL (FRD) - Fire Resistance Directory Current Edition.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installer's qualification statement.

1.4 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Installer Qualifications: Company specializing in performing the work of this section and:
1. Verification of minimum three years documented experience installing work of this type.

1.5 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to drawings for required systems and ratings.

2.2 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.3 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
1. Fire Ratings: See drawings for required systems and ratings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.3 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.

C. Do not cover installed firestopping until inspected by authorities having jurisdiction.

D. Install labeling required by code.

3.4 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.5 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 8400

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SECTION 07 9200.02 - INTERIOR JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping: Firestopping sealants.

B. Section 08 8000.02 - Interior Glazing: Glazing sealants and accessories.

1.3 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants 2018.

B. ASTM C834 - Standard Specification for Latex Sealants 2017.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

D. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2016.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2018.

G. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints 2019 (Reapproved 2020).

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

F. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

G. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

H. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

I. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

B. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Allow sufficient time for testing to avoid delaying the work.
   4. Deliver to manufacturer sufficient samples for testing.
   5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
   6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

C. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a) Test date.
      b) Copy of test method documents.
      c) Age of sealant upon date of testing.
      d) Test results, modeled after the sample form in the test method document.
      e) Indicate use of photographic record of test.

D. Field Quality Control Plan:
   1. Visual inspection of entire length of sealant joints.

2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
   a) For each different sealant and substrate combination, allow for one test every 12 inches (305 mm) in the first 10 linear feet (3 linear m) of joint and one test every 24 inches (610 mm) thereafter.
   b) If any failures occur in the first 10 linear feet (3 linear m), continue testing at 12 inches (305 mm) intervals at no extra cost to Owner.
3. Field testing agency's qualifications.
4. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

E. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

F. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.

G. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inches (457 mm) long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch (25.4 mm) by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

1.6 WARRANTY

A. See Section 01 7700 - Closeout Procedures for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.

2.2 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a) Joints between door, window, and other frames and adjacent construction.
      b) Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a) Joints between door, window, and other frames and adjacent construction.
      b) Other joints indicated below.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.

D. Interior Wet Areas: restrooms; fixtures in wet areas include plumbing fixtures, countertops, and other similar items.

2.3 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Non-Staining to Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
   1. Color: TBD.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.

D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: To be selected by Architect from manufacturer's full range.

2.4 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
   3. Record each test on Preinstallation Adhesion Test Log as indicated.
   4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
   5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.3 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Install bond breaker backing tape where backer rod cannot be used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.4 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet (30 linear m), notify Architect immediately.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION 07 9200.02

SECTION 080671 – DOOR HARDWARE SCHEDULE

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 references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 01 Section “Summary”.
2. Division 08 Section “Hollow Metal Doors and Frames”
3. Division 08 Section “Wood Doors”
4. Division 08 Section “Door Hardware”.
5. Division 26 Section “Electrical”.
6. Division 28 Section “Access Control”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of

other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.5 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.6 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

1. Section 08 71 00 – Door Hardware.

C. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. RU - Corbin Russwin
6. HS - HES
7. RF - Rixson
8. NO - Norton
9. SA - SARGENT
10. HD - HID

Hardware Sets

Set: 1.0

Doors: 101B

1	Continuous Hinge	CFMxxSLF-HD1 PT Cut to ___"		PE	087100	
1	Electric Power Transfer	EL-CEPT		SU	087100	⚡
1	Electrified Rim Exit, Fail Secure	ED5200 N9905ET M92 MELR M51 CT7SB	630	RU	087100	⚡
1	Small Format Inter Core	Final Core	626		087100	
1	Conc Overhead Stop	1-x36	630	RF	087100	
1	Automatic Opener	6331	689	NO	087100	⚡
1	Threshold	278x224AFGT FHSL14SS-2		PE	087100	
1	ElectroLynx Frame Harness	QC-C2500P		MK	087100	⚡
2	ElectroLynx Door Harness	QC-Cxxx LAR		MK	087100	⚡
1	Wire Harness	52-2946		MK	087100	⚡
1	Wiring Diagram	WD-SYSPK		SA	087100	
1	Position Switch	DPS-x-xx		SU	087100	⚡
1	Card / FOB Reader	Provided by Security Vendor		HD	281300	
1	Door Switch	504		NO	087100	⚡
1	Door Switch	501		NO	087100	⚡
1	Power Supply	AQL4-R8E1		SU	087100	⚡

Notes: •DOORS NORMALLY LOCKED AND CLOSED.
•PRESENTING VALID CREDENTIAL ENERGIZES OUTSIDE LEVER AND ENERGIZES OUTSIDE ACTUATOR.
•DEPRESSING ENERGIZED ACTUATOR INITIATES AUTO OPERATION.
•ENTRY BY MANUAL KEY...
•EGRESS BY PUSHING ACTUATOR BEGINS AUTO OPERATION OR BY EXIT DEVICE PUSH PAD.
•FREE EGRESS PERMITTED AT ALL TIMES.

Set: 2.0

Doors: 101A

1	Continuous Hinge	CFMxxSLF-HD1 PT Cut to ___"		PE	087100	
1	Electric Power Transfer	EL-CEPT		SU	087100	⚡
1	Electrified Rim Exit, Fail Secure	ED5200 N9905ET M92 M51 CT7SB	630	RU	087100	⚡
1	Small Format Inter Core	Final Core	626		087100	
1	Surface Closer	DC6210 W33 A11	689	RU	087100	
1	Threshold	278x224AFGT FHSL14SS-2		PE	087100	
1	ElectroLynx Frame Harness	QC-C2500P		MK	087100	⚡
1	ElectroLynx Door Harness	QC-Cxxx LAR		MK	087100	⚡
1	Wiring Diagram	WD-SYSPK		SA	087100	
1	Position Switch	DPS-x-xx		SU	087100	⚡
1	Power Supply	AQL4-R8E1		SU	087100	⚡

Notes:

•DOOR NORMALLY CLOSED AND LOCKED.
• LOCK IS FAIL SECURE.
•UNLOCKING OF DOOR BY KEY SIGNALS SECURITY SYSTEM OF ENTRY W/ OUT AUDIT TRAIL.
•PRESENTING PROPER CREDENTIALS UNLOCKS OUTSIDE LEVER AND SHUNTS DOOR POSITION SWITCH.
•EGRESS PERMITTED AT ALL TIMES.
•RX SWITCH ON INSIDE LEVER SHUNTS DOOR POSITION SWITCH.

•LOCK IS FAIL SECURE.
•FREE EGRESS AT ALL TIMES

Set: 3.0

Doors: 101D

1 Continuous Hinge	CFMxxSLF-HD1 Cut to ___"		PE	087100	
1 Push Bar & Pull	BF15747 T4HD	US32D-MS	RO	087100	
1 Conc Overhead Stop	1-x36	630	RF	087100	
1 Automatic Opener	6311	689	NO	087100	
1 Door Switch	504		NO	087100	

Notes: Permiter/meeting stile gasketing by Alum Door / Frame Manufacturer.

•Door normally closed and unlocked.
•Triggering actuator initiates Auto Operation.
•Manual operation during outage.

Set: 4.0

Doors: 101C

1 Continuous Hinge	CFMxxSLF-HD1 Cut to ___"		PE	087100	
1 Push Bar & Pull	BF15747 T4HD	US32D-MS	RO	087100	
1 Conc Overhead Stop	1-x36	630	RF	087100	
1 Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100	

Notes: Permiter/meeting stile gasketing by Alum Door / Frame Manufacturer.

Set: 5.0

Doors: 036

1	Continuous Hinge	CFMxxSLF-HD1 Cut to ___"		PE	087100	
1	Rim Exit Device, Exit Only	ED5200 EO M61 CT7SB	630	RU	087100	⚡
1	Surface Closer	DC6210 W33 A11	689	RU	087100	
1	Threshold	278x224AFGT FHSL14SS-2		PE	087100	
1	Gasketing	2891CPK X 290CPK TKSP		PE	087100	
1	Rain Guard	346C TKSP		PE	087100	
1	Door Bottom	216SNFG TKSP		PE	087100	

Notes: Signage required and provide w/ alarmed exit device.

Set: 6.0

Doors: 002

3	Hinge, Full Mortise	TA2714	US26D	MK	087100	
1	Electric Power Transfer	EL-CEPT		SU	087100	⚡
1	Fail Secure Lock	ML20906-SEC NSA M91xM92 CT7SB	626	RU	087100	⚡
1	Small Format Inter Core	Final Core	626		087100	
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100	
1	ElectroLynx Frame Harness	QC-C2500P		MK	087100	⚡
1	ElectroLynx Door Harness	QC-Cxxx LAR		MK	087100	⚡
1	Wiring Diagram	WD-SYSPK		SA	087100	
1	Card / FOB Reader	Provided by Security Vendor		HD	281300	
1	Power Supply	AQL4-R8E1		SU	087100	⚡

Notes: Perimeter gasketing by frame manufacturer.

•DOOR NORMALLY CLOSED AND LOCKED.
• LOCK IS FAIL SECURE.
•UNLOCKING OF DOOR BY KEY SIGNALS SECURITY SYSTEM OF ENTRY W/ OUT AUDIT TRAIL.
•PRESENTING PROPER CREDENTIALS UNLOCKS OUTSIDE LEVER AND SHUNTS DOOR POSITION SWITCH.
•EGRESS PERMITTED AT ALL TIMES.
•RX SWITCH ON INSIDE LEVER SHUNTS DOOR POSITION SWITCH.
•LOCK IS FAIL SECURE.
•FREE EGRESS AT ALL TIMES

Set: 7.0

Doors: 038, 039

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Rim Exit Device, Classroom	ED5200 N955ET M51 CT7SB	630	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Conc Overhead Stop	1-x36	630	RF	087100
1	Surface Closer	DC6210 A14	689	RU	087100
1	Kick Plate	K1050 8" CSK BEV	US32D	RO	087100

Notes: Perimeter gasketing by frame manufacturer.

Set: 8.0

Doors: 217, 222, 224A, 224B, 227, 230, 231

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Classroom Lock	CLX3355 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100
1	Gasketing	S88		PE	087100

Set: 9.0

Doors: 120

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Classroom Lock	CLX3355 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6210 A4	689	RU	087100
1	Kick Plate	K1050 8" CSK BEV	US32D	RO	087100

Notes: Perimeter gasketing by frame manufacturer.

Set: 10.0

Doors: 033, 034, 035

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Classroom Lock	CLX3355 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Conc Overhead Friction Stay	1-x16	630	RF	087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Kick Plate	K1050 8" CSK BEV	US32D	RO	087100

Notes: Perimeter gasketing by frame manufacturer.

Set: 11.0

Doors: 104, 105, 115, 203, 204, 208, 212, 213, 229, 232, 233

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Classroom Lock	CLX3355 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6200 A1	689	RU	087100
1	Kick Plate	K1050 8" CSK BEV	US32D	RO	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100

Notes: Perimeter gasketing by frame manufacturer.

Set: 12.0

Doors: 216, 220

6	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Dust Proof Strike	570	US26D	RO	087100
2	Flush Bolt	555	US26D	RO	087100
1	Classroom Lock	CLX3355 NZD CT7SB	626	RU	087100

1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6200 A1	689	RU	087100
2	Armor Plate	K1050 37" high CSK BEV	US32D	RO	087100
2	Door Stop	441CU / 400 as req'd	US26D	RO	087100

Notes: Perimeter gasketing by frame manufacturer.

Set: 13.0

Doors: 214

6	Hinge, Full Mortise	TA2714	US26D	MK	087100	
1	Magnetic Lock	DM62BD		SU	087100	⚡
2	Push Pull	BF 111x73C/73CL	US32D-MS	RO	087100	
2	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100	
2	Kick Plate	K1050 8" CSK BEV	US32D	RO	087100	
2	Door Stop	441CU / 400 as req'd	US26D	RO	087100	
1	Gasketing	S88		PE	087100	
2	Astragal	S772		PE	087100	
1	ElectroLynx Frame Harness	QC-C2500P		MK	087100	⚡
1	Wiring Diagram	WD-SYSPK		SA	087100	
1	Card / FOB Reader	Provided by Security Vendor		HD	281300	
1	Motion Sensor	XMS		SU	087100	⚡
1	Push Button	EEB2		SU	087100	⚡
1	Power Supply	AQL4-R8E1		SU	087100	⚡

Notes: PROVIDE WIRING DIAGRAM.
CARD READERS PROVIDED BY OTHERS.
DOORS NORMALLY CLOSED AND LOCKED BY MAG LOCKS.
PRESENTING VALID CREDETIALS RELEASE MAGLOCKS.
EGRESS BY DOOR PUSH BUTTOM EEB2 OR MOTION SENSOR.

Set: 14.0

Doors: 003, 004, 207

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Deadbolt	DL4122 CT7SB	626	RU	087100
2	Small Format Inter Core	Final Core	626		087100
1	Push Pull	BF 111x73C/73CL	US32D-MS	RO	087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Kick Plate	K1050 8" CSK BEV	US32D	RO	087100
1	Mop Plate	K1050 4" CSK BEV	US32D	RO	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100

Set: 15.0

Doors: 110, 111

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Privacy Lock	ML2060 NSA V21	626	RU	087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Kick Plate	K1050 8" CSK BEV	US32D	RO	087100
1	Mop Plate	K1050 4" CSK BEV	US32D	RO	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100
1	Gasketing	S88		PE	087100

Set: 16.0

Doors: 008, 012, 108

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Storeroom Lock	CLX3357 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100

Set: 17.0

Doors: 206B

3	Hinge, Full Mortise	TA2714	US26D	MK	087100

1	Storeroom Lock	CLX3357 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Armor Plate	K1050 37" high CSK BEV	US32D	RO	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100

Set: 18.0

Doors: 030, 112, 209

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Electric Power Transfer	EL-CEPT		SU	087100
1	Fail Secure Lock	ML20906-SEC NSA M91 CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100
1	ElectroLynx Frame Harness	QC-C2500P		MK	087100
1	ElectroLynx Door Harness	QC-Cxxx LAR		MK	087100
1	Wiring Diagram	WD-SYSPK		SA	087100
1	Position Switch	DPS-x-xx		SU	087100
1	Power Supply	AQL4-R8E1		SU	087100

Notes:
•DOOR NORMALLY CLOSED AND LOCKED.
• LOCK IS FAIL SECURE.
•UNLOCKING OF DOOR BY KEY SIGNALS SECURITY SYSTEM OF ENTRY W/ OUT AUDIT TRAIL.
•PRESENTING PROPER CREDENTIALS UNLOCKS OUTSIDE LEVER AND SHUNTS DOOR POSITION SWITCH.
•EGRESS PERMITTED AT ALL TIMES.
•RX SWITCH ON INSIDE LEVER SHUNTS DOOR POSITION SWITCH. •LOCK IS FAIL SECURE.
•FREE EGRESS AT ALL TIMES

Set: 19.0

Doors: 114, 202, 210

6	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Dust Proof Strike	570	US26D	RO	087100
2	Flush Bolt	555	US26D	RO	087100
1	Storeroom Lock	CLX3357 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
2	Door Stop	441CU / 400 as req'd	US26D	RO	087100

Set: 20.0

Doors: 206A

6	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Dust Proof Strike	570	US26D	RO	087100
2	Flush Bolt	555	US26D	RO	087100
1	Storeroom Lock	CLX3357 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
2	Armor Plate	K1050 37" high CSK BEV	US32D	RO	087100
2	Door Stop	441CU / 400 as req'd	US26D	RO	087100

Set: 21.0

Doors: 009, 109, 211

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Classroom Lock	CLX3355 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100

Set: 22.0

Doors: 113, 116, 117

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Passage Latch	CLX3310 NZD	626	RU	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100
1	Gasketing	S88		PE	087100

Set: 23.0

Doors: 118

3 Hinge, Full Mortise	TA2714	US26D	MK	087100
1 Privacy Lock	ML2060 NSA V21	626	RU	087100
1 Door Stop	441CU / 400 as req'd	US26D	RO	087100
1 Threshold	151A		PE	087100
2 Gasketing	S88		PE	087100
1 Door Bottom	STC411APK 36"		PE	087100

Set: 24.0

Doors: 225, 228

3 Hinge, Full Mortise	TA2714	US26D	MK	087100
1 Passage Latch	CLX3310 NZD	626	RU	087100
1 Door Stop	441CU / 400 as req'd	US26D	RO	087100
1 Gasketing	S88		PE	087100

Set: 26.0

Doors: 205

3 Hinge, Full Mortise	TA2714	US26D	MK	087100
1 Hotel Lock	ML2029 NSA V21 CT7SB	626	RU	087100
1 Small Format Inter Core	Final Core	626		087100
1 Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1 Kick Plate	K1050 8" CSK BEV	US32D	RO	087100
1 Mop Plate	K1050 4" CSK BEV	US32D	RO	087100
1 Door Stop	441CU / 400 as req'd	US26D	RO	087100
1 Gasketing	S88		PE	087100

Set: 27.0

Doors: 010A, 0ST2B

3 Hinge, Full Mortise, Hvy Wt	VIF match Height & Weight of ETR	US26D	MK	087100

		prep			
1	Storeroom Lock	CLX3357 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100
1	Gasketing	S88		PE	087100

Notes: VIF existing preps...provide hardware to use ETR frame.

Set: 28.0

Doors: 010B, 011A, 011B

3	Hinge, Full Mortise, Hvy Wt	VIF match Height & Weight of ETR prep	US32D	MK	087100
1	Storeroom Lock	CLX3357 NZD CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100
1	Threshold	172A		PE	087100
1	Gasketing	312CR TKSP		PE	087100
1	Sweep	3452APK TKSP		PE	087100

Notes: VIF existing preps...provide hardware to use ETR frame.

Set: 29.0

Doors: 007

3	Hinge, Full Mortise, Hvy Wt	VIF match Height & Weight of ETR prep	US26D	MK	087100
1	Fail Secure Lock	ML20906-SEC NSA M91xM92 CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100

1	Gasketing	S88		PE	087100
1	ElectroLynx Frame Harness	QC-C2500P		MK	087100
1	ElectroLynx Door Harness	QC-Cxxx LAR		MK	087100
1	Wiring Diagram	WD-SYSPK		SA	087100
1	Card / FOB Reader	Provided by Security Vendor		HD	281300
1	Power Supply	AQL4-R8E1		SU	087100
1	Power Transfer	as dirtected by architect		SU	087100

Notes: VIF existing preps...provide hardware to use ETR frame.

Architect to confirm type of power transfer through ETR Frame to hardware

Set: 30.0

Doors: 0ST2A, 2ST2, 2ST4

3	Hinge, Full Mortise, Hvy Wt	VIF match Height & Weight of ETR prep	US26D	MK	087100
1	Passage Latch	ML2010 NSA	626	RU	087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100
1	Gasketing	S88		PE	087100

Notes: VIF existing preps...provide hardware to use ETR frame.

Set: 31.0

Doors: 1ST2

3	Hinge, Full Mortise, Hvy Wt	VIF match Height & Weight of ETR prep	US26D	MK	087100
1	Storeroom Lock	ML2057 NSA CT7SB	626	RU	087100
1	Small Format Inter Core	Final Core	626		087100
1	Surface Closer	DC6210 A3 / DC6200 A10	689	RU	087100
1	Door Stop	441CU / 400 as req'd	US26D	RO	087100
1	Gasketing	S88		PE	087100
1	Sweep	315CN		PE	087100

Notes: VIF existing preps...provide hardware to use ETR frame.

Set: 32.0

Doors: 2ST1

6	Hinge, Full Mortise, Hvy Wt	VIF match Height & Weight of ETR prep	US26D	MK 087100	
2	Fire Rated Surf Vert Rod, Passage	ED5470B N910ET M55 M110	630	RU 087100	
2	Surface Closer	DC6210 A3 / DC6200 A10	689	RU 087100	
2	Electromagnetic Holder	998M 24VDC	689	RF 087100	⚡
1	Gasketing	S88		PE 087100	
2	Astragal	S772		PE 087100	

Notes: VIF existing preps...provide hardware to use ETR frame.

Set: 99.0

Doors: 221, 223A, 223B, 226

1	Small Format Inter Core	Final Core	626	087100

Notes: Coordinate keying requirements w/ Assembly supplier. Provide cylinder and keyed core as required.

END OF SECTION 080671

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated exterior hollow metal doors with frames.

1.2 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

1.3 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2018.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames 2020.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

J. ASTM C476 - Standard Specification for Grout for Masonry 2020.

K. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames 2016.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

M. ITS (DIR) - Directory of Listed Products current edition.

N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.

O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

P. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.

Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.

R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

T. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2019.

U. UL (DIR) - Online Certifications Directory Current Edition.

V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Samples: Submit two samples of metal, 2 by 2 inches (51 by 51 mm) in size, showing factory finishes, colors, and surface texture.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Basis of Design: Steelcraft, an Allegion brand; : www.allegion.com/#sle.
   2. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   4. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   5. Steelcraft, an Allegion brand: www.allegion.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Door Edge Profile: Manufacturers standard for application indicated.
   4. Typical Door Face Sheets: Flush.
   5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   6. Zinc Coating for Typical Interior (where indicated) and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
      a) Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.
   a) Level 3 - Extra Heavy-duty.
   2. Door Thermal Resistance: R-Value of 8.7, minimum, for installed thickness of polyurethane.
   3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
   4. Weatherstripping: Refer to Section 08 7100.

C. Interior Doors, Non-Fire-Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a) Level 3 - Extra Heavy-duty.
      b) Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
      c) Model 1 - Full Flush.
      d) Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
         1) Doors over 48" shall be minimum thickness of 0.0598 inch (16 ga).
   2. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

D. Fire-Rated Doors:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a) Level 3 - Extra Heavy-duty.
      b) Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
      c) Model 1 - Full Flush.
      d) Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
   2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
   3. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
   4. Provide units listed and labeled by UL (DIR) or ITS (DIR).
      a) Attach fire rating label to each fire rated unit.
   5. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
   6. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

2.4 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Frame Metal Thickness: 14 gage, 0.067 inch (1.7 mm), minimum.

D. Door Frames, Fire-Rated: Full profile/continuously welded type.
   1. Fire Rating: Same as door, labeled.
   2. Frame Metal Thickness: 14 gage, 0.067 inch (1.7 mm), minimum.

E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

F. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

G. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (102 mm) high to fill opening without cutting masonry units.

H. Frames Wider than 48 inches (1219 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.

2.5 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch (0.4 mm) dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
   1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.6 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap and stirrup or T-shaped anchors to suit frame size, not less than 0.042 inches thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inches thick.
   2. Stud Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inches thick.
   3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
   4. Postinstalled Expansion Type for In-place Concrete or Masonry: Minimum 3/8 inch diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inches thick, and as follows:
   1. Monolithic Concrete Slabs: Clip type anchors, with two holes to receive fasteners.
   2. Separate Topping Concrete Slabs: Adjustable type anchors with extension clips, allowing not less than 2 inch height adjustment. Terminate bottom of frames at finish floor surface.

2.7 ACCESSORIES

A. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

B. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

B. Examine rough-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Verify that opening sizes and tolerances are acceptable.

D. Verify that finished walls are in plane to ensure proper door alignment.

E. Prepare written report, endorsed by the Installer, listing conditions detrimental to performance of the work.

F. 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 area smooth, flush and invisible on exposed faces.

B. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

C. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16", measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16" measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16" measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16" measured at jambs on a perpendicular line from head to floor.

D. Drill and tap doors and frames to receive nontemplated, mortised and surface mounted door hardware.

3.3 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.
   1. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post installed expansion anchors.
      a) Floor anchors may be set with power actuated fasteners instead of post installed expansion anchors if so indicated and approved on shop drawings.
   2. Metal Stud Partitions: Solidly pack mineral fiber insulation behind frames.
   3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
   4. Concrete Walls: Solidly fill space between frame and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
   5. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush and invisible on exposed faces.
   6. In-Place Gypsum Board partitions: Secure frames in place with post installed expansion anchors through floor anchors at each jamb. Countersink anchors and fill and make smooth, flush and invisible on exposed faces.
   7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural supports at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
   8. Installation Tolerances: Adjust hollow metal frames for squareness, alignment, twist and plumbness.

D. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire Rated Standard Steel Doors:
      a) Jambs and Head: 1/8" plus or minus 1/16".
      b) Between Edges of Pairs of Doors: 1/8" plus or minus 1/16".
      c) Between Bottom of Door and Top of Threshold: Maximum 3/8"
      d) Between Bottom of Door and Top of Finish Floor (no Threshold): Maximum 3/4"
   2. Fire Rated Doors: Install doors with clearances according to NFPA 80.
   3. Smoke Control Doors: Install doors according to NFPA 105.

E. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

F. Install door silencers in frames before grouting.

1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

G. Install door hardware as specified in Section 08 7100.
   1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

H. Coordinate installation of electrical connections to electrical hardware items.

I. Touch up damaged factory finishes.

3.4 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime Coat Touch-up: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust inhibitive primer.

D. Metallic Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 1113

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.2 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 7100 - Door Hardware.

C. Section 08 8000.02 - Interior Glazing.

1.3 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

D. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

F. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of door veneer, 6 by 6 inch (152 by 152 mm) in size illustrating wood grain, stain color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special installation instructions.

F. Warranty, executed in Owner's name.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.7 WARRANTY

A. See Section 01 7700 - Closeout Procedures for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Basis of Design: Masonite Architectural (formerly Algoma Hardwoods); Aspiro Select Wood Veneer.

2.2 DOORS AND PANELS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

3. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft (0.01524 cu m/s/sq m) of door opening at 0.10 inch wg (24.9 Pa) pressure at both ambient and elevated temperatures for "S" label; if necessary, provide additional gasketing or edge sealing.

2.3 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.4 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Same species as face veneer.

B. Veneer Facing for Opaque Finish: Closed grain hardwood veneer, in compliance with indicated quality standard.

C. Facing Adhesive: Type I - waterproof.

2.5 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other throughbolted hardware.

C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
   1. Exception: Doors to be field finished.

F. Provide edge clearances in accordance with the quality standard specified.

2.6 FINISHES - WOOD VENEER DOORS

A. Factory finish doors in accordance with approved sample.

B. Seal door top edge with color sealer to match door facing.

2.7 ACCESSORIES

A. Hollow Metal Door Frames: As specified in Section 08 1113.

B. Glazing: As specified in Section 08 8000.

C. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

D. Door Hardware: See Section 08 7100.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.
   2. Install smoke and draft control doors in accordance with NFPA 105 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.3 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.5 SCHEDULE

A. Refer to door schedule on the drawings

END OF SECTION 08 1416

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SECTION 08 3100 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.2 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Mortise cylinder and core hardware.

B. Section 09 9123 - Interior Painting: Field paint finish.

1.3 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products current edition.

B. UL (FRD) - Fire Resistance Directory Current Edition.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Project Record Documents: Record actual locations of each access unit.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units:
   1. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
   2. Size: As required
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
   5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

6. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.

B. Wall-Mounted Units in Wet Areas:
1. Material: Stainless steel.
2. Size: As required
3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
6. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.

C. Fire-Rated Wall-Mounted Units:
1. Wall Fire-Rating: As indicated on drawings.
2. Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
3. Size: As required
4. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

D. Ceiling-Mounted Units:
1. Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
2. Size: As required
3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.2 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Manufacturers:
1. ACUDOR Products Inc: www.acudor.com/#sle.
2. Babcock-Davis: www.babcockdavis.com/sle.
3. Bauco Access Panel Solutions Inc
4. Karp Associates, Inc: www.karpinc.com/#sle.
5. Milcor, Inc: www.milcorinc.com/#sle.
6. Nystrom, Inc: www.nystrom.com/#sle.

B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Style: Frame concealed by door panel.
a) Gypsum Board Mounting Criteria: Use drywall bead type frame.
2. Door Style: Single thickness with rolled or turned in edges.
3. Frames: 16 gauge, 0.0598 inch (1.52 mm), minimum thickness.
4. Single Steel Sheet Door Panels: 1/16 inch (1.6 mm), minimum thickness.
5. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
a) Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
6. Primed and Factory Finish: Polyester powder coat; color to match surrinding area.
7. Hardware:
a) Hardware for Fire-Rated Units: As required for listing.
b) Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.

c) Latch/Lock: Screw driver slot for quarter turn cam latch.
d) Number of Locks/Latches Required: As recommended by manufacturer for size of unit.

C. Perimeter Gasket Flush Access Doors for gypsum board install
1. Basis of Design: Bauco Plus II by Bauco Access Panel Solutions Inc
2. Assembly Description: Aluminum frame and gypsum door with lift out and safety cables
3. Door Size: As required.
4. Hardware: Standard Touch Latch release

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

3.4 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 3100

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SECTION 08 4243 - INTENSIVE CARE UNIT / CRITICAL CARE UNIT ENTRANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged units consisting of doors, sidelights, frames, and hardware; manual operation.

1.2 RELATED REQUIREMENTS

A. Section 08 8000.02 - Interior Glazing.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. NAAMM AMP 500-06 - Metal Finishes Manual 2006.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene one week before starting work of this section.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer's catalog data, detail sheets, and specifications, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Specimen warranty.

C. Shop Drawings: Prepared specifically for this project; show dimensions of doors, sidelights, details of construction, and interface with other products.

D. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Operating and Maintenance Data: Operating and maintenance instructions, and parts lists.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in factory packaging, protected from damage.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store products under cover and elevated above grade.

1.8 WARRANTY

A. See Section 01 7700 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Intensive Care Unit (ICU)/Critical Care Unit (CCU) Entrances:
   1. Basis of Design: ASSA ABLOY Entrance Solutions; Versamax ICU, Model No. VMS2FBO-7.
   2. Horton Automatics, a division of Overhead Door Corporation: www.hortondoors.com/#sle.
   3. NABCO Entrances, Inc: www.nabcoentrances.com/#sle.
   4. Stanley Access Technologies: www.stanleyaccess.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.2 ENTRANCE ASSEMBLIES

A. Entrance Assemblies: Factory assembled, manually operated, extruded aluminum door and frame with normally-closed but operable sidelights, complete with hardware and operating components.
   1. Door and Sidelight Construction: Heavy duty interlocked extruded aluminum tubular stile and rail sections, through-rod bolted construction with steel corner support at hinge stile of carrier-suspended swinging panels or mechanically fastened corners with welded reinforcing brackets to reduce sag in sliding or breakout mode.
      a) Door Thickness: 1-3/4 inch (44.5 mm), nominal.
   2. Accessible Door Opening Force: Maximum of 5 pound-force (22.2 N) to fully open door in compliance with ADA Standards and requirements of local authorities having jurisdiction.
   3. Panel Breakout Force: Maximum of 50 pound-force (222 N).
   4. Finish: Clear anodized, AAMA 611 Class I; in compliance with NAAMM AMP 500-06.
      a) Color: As selected by Architect.

B. Dimensions:

1. Rough Opening Width: As indicated on drawings.
2. Overall Frame Width (Outside): 84 inches (2133.6 mm).
3. Clear Opening Width: 73-1/4 inches (1860.5 mm), when swinging panels are fully open.
4. Normal Operation Opening Width: 35-9/16 inches (903.3 mm).
5. Maximum Panel Width: 41-7/16 inches (1052.1 mm).
6. Rough Opening Height: 90 inches (2286.0 mm).
7. Overall Frame Height: 89-3/4 inches (2279.7 mm).
8. Clear Door Opening Height: 84-3/16 inches (2138.4 mm).
9. Framing Members: Provide manufacturer's standard extruded aluminum framing, reinforced as required to support imposed loads.
   a) Nominal Sizes: 1-3/4 inch (44.5 mm) wide by 4-1/2 inch (114.3 mm) deep.
10. Panel Thickness: 1-3/4 inch (45 mm).
11. Stile Design:
    a) Narrow stile, 2 inch (51 mm), nominal width.
12. Top Rail Height: 4 inch (102 mm), nominal.
13. Bottom Rail Height: 4 inch (102 mm), nominal.
14. Glazing Stop Width: Manufacturers standard.
15. Glazing Thickness: See Glass Type LS1 in Section 08 8000..

C. Swing-Aside Type Sliding Entrances: Normal operation consisting of side-sliding panel; 90 degree swing function only when sliding panels are in full open position; sliding panels passing on non-swinging side of sidelight.
   1. Panels: Two; swinging sidelight and sliding panel.
   2. Swing Direction: Panels to swing into patient room.
   3. Track: No floor track in either sliding or sidelight width.

2.3 COMPONENTS

A. Aluminum Extrusions for Doors, Sidelights, Headers, and Trim: Alloy as recommended by manufacturer for construction and specified finish; nominal 1/8 inch (3.2 mm) wall thickness.

B. Sliding Door Header: Track and suspension system concealed with removable cover.
   1. Track: Extruded aluminum, with anti-rising, anti-derailing design.
   2. Door Suspension System: Two wheeled carriers per panel, with steel ball bearings; wheel diameter minimum 1-1/4 inch (32 mm).
   3. Door Hanger Brackets: Nylon wheels with hardened steel bearings.

C. Glazing Stops: Manufacturer's standard snap-on extruded aluminum square stops with preformed resilient glazing gaskets.

D. Door Hardware: Provide door handles, recessed door pulls, and other hardware as required for normal and swing-open operation; factory install hardware to greatest extent possible.

E. Glazing: Refer to Section 08 8000, Type LS1.

F. Sealant for Within Door/Frame Assembly: As recommended or required by door manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings are plumb, square, and ready for installation of entrances.

B. Verify that overhead support is properly located and securely anchored.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Where aluminum components will contact different metals, prior to installation paint contact surfaces with primer or apply sealant or tape recommended by manufacturer for protection against galvanic action.

D. Where aluminum components will contact concrete or masonry, prior to installation paint contact surfaces with bituminous paint.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, except where more stringent requirements are specified.

B. Install entrances securely anchored in place, plumb, level, and true to location, in alignment with established lines and grades, without warp, bow, or racking of members.

C. Where frames are assembled in field, fit frame joints hairline tight without burrs or distortion; rigidly secure nonmoving joints and seal watertight.

D. Install field-installed hardware using concealed fasteners to greatest extent possible.

E. Install glazing in accordance with requirements of Section 08 8000.

F. Adjust for proper operation, without binding or scraping and without excessive noise; lubricate operating hardware and other moving parts.

G. After operation of the completed installation for minimum of 300 cycles, readjust and re-lubricate.

3.4 CLEANING

A. Clean installed work to like-new condition.

3.5 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 08 4243

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SECTION 08 4313.02 - INTERIOR ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Door hardware.

1.2 RELATED REQUIREMENTS

A. Section 08 8000.02 - Interior Glazing: Glass and glazing accessories.

1.3 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems 2015.

C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems 2014.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.

G. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

H. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

K. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.

L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).

M. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors 2002 (Reapproved 2018).

N. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
   1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

D. Samples: Submit two samples 12 inches (305 mm) square in size illustrating finished aluminum surface, glass, glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

G. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

H. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

I. Designer's Qualification Statement.

J. Manufacturer's Qualification Statement.

K. Installer's Qualification Statement.

L. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.8 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.9 WARRANTY

A. See Section 01 7700 - Closeout Procedures for additional warranty requirements.

B. Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide 10 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Center-Set Style, Thermally-Broken:
   1. Basis of Design: EFCO Corporation; 403 Series: www.efcocorp.com.
   2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (51 mm wide by 114 mm deep).

2.2 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING

A. Center-Set Style:
   1. Basis of Design: EFCO Corporation; 402 Series: www.efcocorp.com.

2. Vertical Mullion Dimensions: As indicated on drawings.

2.3 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Insulating Glazing, Thermally-Broken:
   1. Basis of Design: EFCO Corporation; Series D502 ThermaStile.

B. Wide Stile, Monolithic Glazing:
   1. Basis of Design: EFCO Corporation; Series D500.
   2. Thickness: 1-3/4 inches (43 mm).

2.4 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing.
   2. Glazing Rabbet: For 1/4 inch (6 mm) monolithic glazing.
   3. Finish: Superior performing organic coatings.
      a) Factory finish all surfaces that will be exposed in completed assemblies.
   4. Finish Color: Black, to match existing to remain.
   5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   11. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.

B. Performance Requirements
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a) Design Wind Loads: Comply with requirements of ASCE 7.
      b) Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.

3. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.5 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
   1. Glazing Stops: Flush.
   2. Cross-Section: As indicated on drawings.

B. Glazing: See Section 08 8000.

C. Swing Doors: Glazed aluminum.
   1. Top Rail: 5 inches (127 mm) wide.
   2. Vertical Stiles: 5 inches (127 mm) wide.
   3. Bottom Rail: 7-1/2 inches (191 mm) wide.
   4. Glazing Stops: Square.
   5. Finish: Same as storefront.

2.6 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209/B209M.

C. Fasteners: Stainless steel.

D. Concealed Flashings: Stainless steel, 26 gauge, 0.0187 inch (0.48 mm) minimum thickness.

E. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.

F. Sealant for Setting Thresholds: Non-curing butyl type.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.7 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Color: Black, to match existing to remain.

2.8 HARDWARE

A. For each exterior door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: Storefront manufacturer's standard type to suit application.
   1. Finish on Hand-Contacted Items: Polished stainless steel.
   2. For each door, include butt hinges, push handle, pull handle, exit device, and closer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.2 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install hardware using templates provided.
   1. See Section 08 7100 for hardware installation requirements.

K. Install glass using glazing method required to achieve performance criteria; see Section 08 8000.

L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.4 FIELD QUALITY CONTROL

A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.

B. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

C. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
   3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).
      a) Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
   4. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf (75 Pa).
      a) Maximum allowable rate of air leakage is 0.09 cfm/sq ft (0.5 L/s sq m).

D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.5 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.6 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.7 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 4313.02

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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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Automatic operators.
4. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 01 Section "Summary"
2. Division 06 Section "Rough Carpentry".
3. Division 08 Section "Door Schedule".
4. Division 08 Section "Door Hardware Sets"
5. Division 08 Section "Hollow Metal Doors and Frames".
6. Division 08 Section "Flush Wood Doors".
7. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
8. Divioson 26 Section "Electrical"

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.

6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of

other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
   c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified 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.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.

2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual overhead door closer bodies.
4. Five years for motorized electric latch retraction exit devices.
5. Two years for electromechanical door hardware, unless noted otherwise.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. 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.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. Hager Companies (HA).
b. Ives (IV).
c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

a. Bommer Industries (BO).
b. Hager Companies (HA).

c. Pemko (PE).

2.3 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko (PE) - EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.
c. Stanley Hardware (ST) EPT-12C Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. Hager Companies (HA) - Quick Connect.
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC-C Series.
c. Stanley Hardware (ST) - WH Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.

2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

    a. Burns Manufacturing (BU).
    b. Door Controls International (DC).
    c. Rockwood (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

4. Manufacturers:

    a. Burns Manufacturing (BU).
    b. Hiawatha, Inc. (HI).
    c. Rockwood (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway:

C. Interchangeable Cores: Provide small format interchangeable cores as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

E. Construction Keying: Provide temporary keyed construction cores.

2.6 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.7 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Where specified, provide status indicators with highly reflective color and wording for “locked/unlocked” or “vacant/occupied” with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1” x 0.6” with a curved design allowing a 180 degree viewing angle with protective covering to prevent tampering.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) - ML2000 Series.
b. Sargent Manufacturing (SA) - 8200 Series.
c. Schlage (SC) - L9000 Series.

B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.

1. Vertical Impact: Exceed 100 vertical impacts (20 times ANSI/BHMA A156.2 requirements).

2. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.

3. Locks are to be non-handed and fully field reversible.

4. Locksets to incorporate a free-wheeling lever design.

5. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 12 million cycles.

6. Manufacturers:

    a. Corbin Russwin Hardware (RU) - CLX3300 Series.
    b. Sargent Manufacturing (SA) - 10X Line.
    c. Schlage (SC) - ND Series.

2.8 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed, subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below and in the hardware sets.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
2. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ML20900 Series.
    b. Sargent Manufacturing (SA) - 8200 Series.
    c. Schlage (SC) - L9000 EL/EU/RX Series.

2.9 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - DL4000 Series.
b. Sargent Manufacturing (SA) - 4870 Series.
c. Schlage (SC) - L460 Series.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

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: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 ELECTROMAGNETIC LOCKING DEVICES

A. Surface Electromagnetic Locks (Heavy Duty): Electromagnetic locks to be surface mounted type tested to ANSI A156.23, Grade 2 with minimum holding force strength of 1,200 pounds. Locks to be capable of either 12 or 24 voltage and be UL listed for use on fire rated door assemblies. Electronics are to be fully sealed against tampering and allow exterior weatherproof applications. As indicated in Hardware Sets, provide specified mounting brackets and housings. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.

1. Manufacturers:

a. Security Door Controls (SD) - EMLock 1500 Series.
b. Securitron (SU) - M62 Series.
c. Securitron (SU) - M82 Series.

2.12 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.

9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

    1. Manufacturers:

a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
b. Sargent Manufacturing (SA) - 80 Series.
c. Von Duprin (VD) - 35A/98 XP Series.

2.13 ELECTROMECHANICAL EXIT DEVICES

A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.

1. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.

2. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.

3. Manufacturers:

a. Corbin Russwin Hardware (RU) - ED5000 Series.
b. Sargent Manufacturing (SA) - 80 Series.
c. Von Duprin (VD) - 35A/98 XP Series.

2.14 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - DC6000 Series.
b. Norton Rixson (NO) - 7500 Series.
c. Sargent Manufacturing (SA) - 351 Series.

2.15 ELECTROMECHANICAL DOOR OPERATORS

A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Standard: Certified ANSI/BHMA A156.19.

C. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.

E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19.

F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

I. Wireless Interface: Operator units shall have a wireless interface via a mobile device for ease of installation and setup.

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

1. Norton Rixson (NO) - 6300 Series.

2.16 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:

a. LCN Door Closers (LC) - SEM7800 Series.
b. Norton Rixson (RF) - 980/990 Series.
c. Sargent Manufacturing (SA) - 1560 Series.

2.17 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

    a. Burns Manufacturing (BU).
    b. Hiawatha, Inc. (HI).
    c. Rockwood (RO).

2.18 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. Burns Manufacturing (BU).
    b. Hiawatha, Inc. (HI).
    c. Rockwood (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

    a. Norton Rixson (RF).
    b. Rockwood (RO).
    c. Sargent Manufacturing (SA).

2.19 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. 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 perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko (PE).
3. Reese Enterprises, Inc. (RE).

2.20 ELECTRONIC ACCESSORIES

A. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.

1. Manufacturers:

a. Alarm Controls (AK) - SREX Series.
b. Securitron (SU) - XMS Series.

B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 3280 Series.
b. Security Door Controls (SD) - DPS Series.
c. Securitron (SU) - DPS Series.

C. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Manufacturers:

a. Securitron (SU) - AQL Series.

2.21 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.22 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

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.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Refer to Section 080671, Door Hardware Sets, for hardware sets.

END OF SECTION 087100

SECTION 08 8000.02 - INTERIOR GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glazing units.

B. Plastic films.

C. Laminated glass interlayers.

D. Glazing compounds.

1.2 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

1.3 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

E. ASTM C1036 - Standard Specification for Flat Glass 2021.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.

J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

K. ASTM E413 - Classification for Rating Sound Insulation 2016.

L. GANA (GM) - GANA Glazing Manual 2008.

M. GANA (SM) - GANA Sealant Manual 2008.

N. GANA (LGRM) - Laminated Glazing Reference Manual 2009.

O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data on Glazing Unit and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch (305 by 305 mm) in size of glass units.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.7 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

A. See Section 01 7700 - Closeout Procedures for additional warranty requirements.

B. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

C. Heat Soaked Tempered Glass: Provide a five (5) year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Glass Fabricators:
   1. GGI - General Glass International: www.generalglass.com/#sle.
   2. Thompson I.G., LLC: www.thompsonig.com/#sle.
   3. Viracon, Inc: www.viracon.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Float Glass Manufacturers:
   1. AGC Glass North America, Inc: www.agcglass.com/#sle.
   2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   3. Guardian Glass, LLC: www.guardianglass.com/#sle.
   4. Pilkington North America Inc: www.pilkington.com/na/#sle.
   5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

C. Laminated Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   2. Thompson I.G., LLC; Laminated Glass: www.thompsonig.com/#sle.
   3. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

D. Mirrored Glass Manufacturers:
   1. Pilkington North America Inc; Pilkington Mirropane Transparent Mirror: www.pilkington.com/na/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

E. Plastic Films Manufacturers:
   1. Basis of Design: As indicated in the Finish Product List on drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.2 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.

3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
5. Heat-Soak Testing (HST): Provide HST of fully tempered glass used on point-supported, high-risk, or other demanding applications of project, to reduce risks of spontaneous breakage due to nickel sulfide (NiS) induced fractures in accordance with industry established testing requirements.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.3 GLAZING UNITS

A. Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Annealed float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.

B. Type TS1 - Monolithic Safety Glazing: Non-fire-rated.
1. Applications:
a) Glazed lites in doors, except fire doors.
b) Glazed sidelights to doors, except in fire-rated walls and partitions.
c) Other locations required by applicable federal, state, and local codes and regulations.
d) Other locations indicated on drawings.
2. Glass Type: Fully tempered safety glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.
5. Provide safety glazing labeling.

C. Type LS1 - Sound Control Glazing: Laminated monolithic glass.
1. Applications: Locations as indicated on drawings.
2. Tint: Clear.
3. Sound Transmission Class (STC) Rating: Provide at least STC 34 rating, complying with ASTM E90 and ASTM E413.
4. Overall Thickness: 7/16 inch (11 mm) nominal.
5. Laminated Monolithic Glass:
a) Outer Layer: Tempered glass.
1) Thickness: 3/16 inch (4.8 mm).
b) Interlayer: Acoustic polyvinyl butyral (PVB), thickness as required to meet performance criteria.
c) Inner Layer: Tempered glass.
1) Thickness: 3/16 inch (4.8 mm).

D. Type LS2 - Structural Glass Railing: Laminated monolithic glass.
1. See Section 05 7000 - Decorative Metal.

E. Type M-1 - Transparent One-Way Mirror: Mirror quality laminated float glass with pyrolytic (hard coat) type coating located on high light level surface of glass; ASTM C1376. Lamiinated with acoustic interlayer.

1. Applications: Locations as indicated on drawings.
2. Thickness: 9/16 inch (14.3 mm).
3. Glass Tint: Grey.
4. Glass Type: Laminated annealed.
5. Lighting Ratio: Maintain at least 8:1 lighting level ratio between coated side (bright-observed side) and uncoated side (dim-observer side).
6. Glazing Method: Gasket glazing.
7. Manufacturers:
   a) Pilkington North America Inc; Pilkington Mirropane Transparent Mirror: www.pilkington.com/na/#sle.

2.4 PLASTIC FILMS

A. Type DF1, DF2 - Decorative Plastic Film: Polyester type.
   1. Application: Locations as indicated on drawings.
   2. Color: As indicated in the Finish Product List on drawings.
   3. Thickness Without Liner: 0.002 inch (0.051 mm).
   4. Width: As indicated on drawings.
   5. Manufacturers:
      a) Basis of Design: As indicated in the Finish Product List on drawings.

2.5 LAMINATED GLASS INTERLAYERS

A. Type LS1 - Sound Control Polyvinyl Butyral (PVB) Interlayer for Laminated Glazing:
   1. Functionality: Post-breakage safety, security, and sound control.
   2. Applications:
      a) Single pane, laminated glass unit, Type LS1.
   3. Color: Clear.
   4. Thickness: As required for indicated performance of laminated glass application.
   5. Improvement in Sound Transmission: Up to 3 dB.

2.6 GLAZING COMPOUNDS

A. Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.7 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.4 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5 INSTALLATION - PLASTIC FILM

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

B. Place without air bubbles, creases or visible distortion.

C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.6 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.7 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.8 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION 08 8000.02

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SECTION 08 8813 - FIRE-RATED GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire-rated glazing units.

B. Glazing compounds.

1.2 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

H. GANA (GM) - GANA Glazing Manual 2008.

I. GANA (SM) - GANA Sealant Manual 2008.

J. GANA (LGRM) - Laminated Glazing Reference Manual 2009.

K. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).

M. ITS (DIR) - Directory of Listed Products current edition.

N. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

O. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies 2022.

P. UL (DIR) - Online Certifications Directory Current Edition.

Q. UL 9 - Standard for Fire Tests of Window Assemblies Current Edition, Including All Revisions.

R. UL 10B - Standard for Fire Tests of Door Assemblies Current Edition, Including All Revisions.

S. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene preinstallation meeting one week before starting work of this section; require attendance by each of affected installers.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data on Glazing Unit Glazing Types: Provide structural, physical, and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.6 FIELD CONDITIONS

A. Ambient Conditions: Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during, and 24 hours after installation of glazing compounds.

1.7 WARRANTY

A. See Section 01 7700 - Closeout Procedures for additional warranty requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire-Resistance-Rated Glass:
   1. Manufacturers:
      a) SAFTIFIRST, a division of O'Keeffe's Inc: www.safti.com/#sle.
      b) Technical Glass Products: www.fireglass.com/#sle.
      c) Vetrotech North America: www.vetrotechusa.com/#sle.

2.2 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Kind FT - Fully Tempered Type: Comply with ASTM C1048.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Comply with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
   2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch (0.762 mm) thick, minimum.

2.3 GLAZING UNITS

A. Type FR - Fire-Protection-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve indicated fire rating period of 60 minutes or less.
   1. Applications:
      a) Glazing in fire-resistance-rated door assembly.
      b) Other locations as indicated on drawings.
   2. Glass Type: Specialty tempered float glass.
   3. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
   4. Safety Glazing Certification: 16 CFR 1201 Category II.
   5. Fire-Rating Period: 60 minutes.
   6. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction
      a) "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
      b) "OH" - meets fire window assembly criteria, including hose stream test of NFPA 257 or UL 9 fire test standards.
      c) "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.
      d) "XXX" - placeholder that represents fire-rating period, in minutes.
   7. Products:
      a) SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite X-45: www.safti.com/#sle.
      b) Technical Glass Products; Firelite Plus: www.fireglass.com/#sle.
      c) Vetrotech North America; Keralite/Select Laminated: www.vetrotechusa.com/#sle.

2.4 GLAZING COMPOUNDS

A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.5 ACCESSORIES

A. Setting Blocks: Aluminum silicate, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Continuous by one half the height of glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.2 INSTALLATION - GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers unless more stringent requirements are indicated, including those in referenced glazing standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with contaminating substances that may result from construction operations including, but not limited to weld spatter, fire-safing, plastering, mortar droppings, etc.

END OF SECTION 08 8813

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SECTION 09 0561 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.
   3. Thin-set ceramic tile and stone tile.

B. Removal of existing floor coverings.

C. Preparation of new and existing concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

F. Patching compound.

G. Remedial floor coatings.

1.2 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 2020.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.4 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement.
   2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
   3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
   4. Manufacturer's installation instructions.
   5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

D. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.
   6. Submit report to Architect.
   7. Submit report not more than two business days after conclusion of testing.

E. Adhesive Bond and Compatibility Test Report.

F. Copy of RFCI (RWP).

1.5 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.

2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.

B. Deliver materials in manufacturer's packaging; include installation instructions.

C. Keep materials from freezing.

1.7 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.1 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
   3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

PART 3 EXECUTION

3.1 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:

a) Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
b) Removal of existing floor covering.

2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
   a) Do not attempt to remove coating or penetrating material.
   b) Do not abrade surface.
3. Preliminary cleaning.
4. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
7. Specified remediation, if required.
8. Patching, smoothing, and leveling, as required.
9. Other preparation specified.
10. Adhesive bond and compatibility test.
11. Protection.

B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.2 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.3 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.4 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.

F. Report: Report the information required by the test method.

3.5 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.6 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
   1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.7 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.8 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.9 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

END OF SECTION 09 0561

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Acoustic insulation.

C. Gypsum wallboard.

D. Joint treatment and accessories.

E. Extruded aluminum partition gap closure.

1.2 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

C. Section 07 9200.02 - Interior Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

D. Section 09 2216 - Non-Structural Metal Framing.

1.3 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

G. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2018.

H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.

I. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

J. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2019.

K. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019, with Editorial Revision (2020).

L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

N. ASTM E413 - Classification for Rating Sound Insulation 2016.

O. GA-216 - Application and Finishing of Gypsum Panel Products 2016, with Errata.

P. GA-226 - Application of Gypsum Board to Form Curved Surfaces 2008.

Q. GA-600 - Fire Resistance Design Manual Sound Control 2021.

R. UL (FRD) - Fire Resistance Directory Current Edition.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on gypsum board, accessories, and joint finishing system.

D. Installer's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Fire-Resistance-Rated Assemblies: Provide completed assemblies as indicated on drawings
   1. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
   2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.2 METAL FRAMING MATERIALS

A. Non-structural Steel Framing for Application of Gypsum Board: See Section 09 2216.

2.3 BOARD MATERIALS

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a) Mold resistant board is required at all locations.
   4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   5. Thickness:
      a) Vertical Surfaces: 5/8 inch (16 mm).
      b) Ceilings: 1/2 inch (13 mm).
      c) Multi-Layer Assemblies: Thicknesses as indicated on drawings.

B. Abuse Resistant Wallboard:
   1. Application: High-traffic areas indicated.
   2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   6. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
   7. Glass Mat-Faced Type: Gypsum wallboard, as defined in ASTM C1658/C1658M.
   8. Type: Fire-resistance-rated Type X, UL or WH listed.
   9. Thickness: 5/8 inch (16 mm).
   10. Edges: Tapered.

C. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Type: Regular and Type X, in locations indicated.
5. Type X Thickness: 5/8 inch (16 mm).
6. Regular Board Thickness: 5/8 inch (16 mm).
7. Edges: Tapered.

D. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
2. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.4 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool. Thickness: As indicated on the drawings.
1. Basis-of-Design Products: Subject to compliance with requirements, provide one of the following:
a) Rockwool North America (ROXUL); ROXUL AFB: www.rockwool.com.
b) Thermafiber, Inc.; Thermafiber SAFB: www.thermafiber.com.
2. Substitutions: See 01 6000 - Product Requirements.

B. Acoustical Sealant: As specified in Section 07 9200.02 - Interior Joint Sealants.

C. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
1. Corner Beads: Low profile, for 90 degree outside corners.
2. Expansion Joints:
a) Type: V-shaped PVC with tear away fins.

D. Extruded Aluminum Acoustic Barrier System: Adjustable acoustic divider to provide closure between partition wall and window mullions or windows.
1. Basis-of-Design: Gordon, Inc; Mullion Mate - Series 40.
a) Subject to compliance with requirements, provide either the named product or a comparable product as approved by the Architect.
2. Sizes: As indicated on drawings.
3. Materials:
a) Aluminum Extrusions: 6063-T5 or T6 temper, tensile strength 31 KSI (ASTM B221, ASTM B221M).
b) Interior of extrusions to contain acoustic insulation and compressed springs.
c) Assembly to include factory-applied gaskets with adhesive on both sides on both ends of extrusions.
d) Factory-supplied caulk to seal edges at gaskets for acoustical performance purposes.
1) ASTM C920 Type S, Grade NS, Class 35, Use NT, G, A.
4. Sound Attenuation (Composite STC):
a) Installed against the window mullion = 38 STC.
b) Installed against the window = 56 STC.

5. Aluminum Finish: Custom finish to match color and finish of existing adjacent aluminum curtain wall framing, as approved by the Architect.
6. End Caps:
   a) Extruded or brake formed.
   b) Match width of partition.
   c) Provide where indicated on drawings.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
2. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
3. Joint Compound: Setting type, field-mixed.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

G. Abuse Resistant Finishes:
1. Acrylic, water-based, non-textured, high build, tintable primer and surfacer.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 SHAFT WALL INSTALLATION

A. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.3 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
1. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.
   1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12 inch (300 mm) 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 (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Extruded Aluminum Acoustic Barrier System: Install in locations indicated on Drawings in accordance with manufacturer's written installation instructions.
   1. Measure and cut acoustic barrier wall end cap to proper lengths.
   2. Notch around horizontal mullions, sills, or other obstructions leaving appropriate gap for differential movement between the sound barrier wall end cap and the obstruction.
   3. Apply continuous bead of acoustical sealant to the acoustical foam surface that will be in contact with the gypsum wall board edge.
   4. Place acoustic barrier wall end cap on the vertical surface of the gypsum board partition and loosely install fasteners in the top and bottom slotted holes of the wall end cap.
   5. Plumb the wall end cap leaving recommended gap spacing of a minimum 5/16-inch between the interior glass surface and the aluminum return leg of the wall end cap. The closed cell foam gasket material shall be in contact with the glass surface to allow for differential movement between the mullion cap and the curtain wall framing system. Increase the gap spacing if directed by the Architect.
   6. Tighten the top and bottom fasteners to secure the wall end cap.
   7. Install additional fasteners at 12-inches on center, minimum.
   8. Install snap covers to conceal fasteners.
   9. Apply acoustical sealant at joints of dissimilar materials, as directed by the Architect.

3.5 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.6 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.7 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 09 2116

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SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.2 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Structural load bearing metal stud framing and Exterior wall stud framing.

B. Section 05 5000.02 - Interior Metal Fabrications: Metal fabrications attached to stud framing.

C. Section 06 1000 - Rough Carpentry: Wood blocking within stud framing.

D. Section 07 8400 - Firestopping: Sealing top-of-wall assemblies at fire rated walls.

E. Section 07 9200.02 - Interior Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

F. Section 08 3100 - Access Doors and Panels.

G. Section 09 2116 - Gypsum Board Assemblies: Acoustic Insulation

H. Section 09 2116 - Gypsum Board Assemblies: Execution requirements for anchors for attaching work of this section.

1.3 REFERENCE STANDARDS

A. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.

B. ASTM A645/A645M - Standard Specification for Pressure Vessel Plates, 5% and 512% Nickel Alloy Steels, Specially Heat Treated 2010 (Reapproved 2016).

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.

E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

G. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017.

H. ASTM E1190 - Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members 2011.

I. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements 2022.

J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

K. ASTM E413 - Classification for Rating Sound Insulation 2016.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Sustainable Design Submittal: Documentation of recycled content and location of manufacture.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packaging or bundles bearing brand name and identification of manufacturer.

B. Store all materials inside, under cover, in a manner to keep them dry, protected from weather, surface contamination, corrosion and damage from construction traffic and other causes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich: www.clarkdietrich.com/#sle.
   2. Marino: www.marinoware.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.2 FRAMING MATERIALS

A. Fire Rated Assemblies: Comply with applicable code and as indicated on drawings.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
   1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G60 (Z180), hot-dip galvanized, unless otherwise indicated
   2. Deflection at tile walls L/360 at 5 psf (L/360 at 240 Pa).
   3. Studs: C shaped with flat or formed webs.
      a) Minimum Base-Metal Thickness: 0.0329 inch (0.836 mm).
   4. Embossed Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally equivalent to conventional ASTM C645 steel studs and tracks.
      a) Minimum Base-Metal Thickness: As required by horizontal deflection performance requirements and 0.0190 inch (0.483 mm).
      b) Minimum Yield Stress: 65 ksi.
   5. Runners: U shaped, sized to match studs.
   6. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
      a) Minimum Base-Metal Thickness: 0.0329 inch (0.836 mm).

C. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with continuous bridging on both sides.

D. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
   1. Products:
      a) ClarkDietrich; BlazeFrame Firestop Deflection Track: www.clarkdietrich.com/#sle.

2.3 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625 inch (1.59 mm) diameter wire, or double strand of 0.0475 inch (1.21 mm) diameter wire.

B. Hanger Attachments to Concrete:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488/E488M by an independent testing agency.
      a) Type: Postinstalled, expansion anchor.
   2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E1190 by an independent testing agency.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.162 inch inch (4.12 mm) diameter.

D. Grid Suspension System for Ceilings: ASTM A645/A645M, 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; Armstrong Drywall Grid: www.armstrongceilings.com/#sle.
      b) CertainTeed Corporation; 1-1/2" Drywall System: www.certainteed.com/#sle.
      c) Rockfon; Chicago Metallic 640-C Heavy Duty Double Web Suspension System: www.rockfon.com/#sle.
      d) USG Corporation; Drywall Suspension System: www.usg.com/#sle.

2.4 AUXILIARY MATERIALS

A. Isolation Strip at Exterior Walls: Provide one of the following:
   1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
   2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.2 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C754.

B. Extend partition framing to structure where indicated and to ceiling in other locations.

C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

E. Align and secure top and bottom runners at 24 inches (600 mm) on center.

F. Where partition framing is subject to water on the floors during construction, provide a heavy coating of rust preventive paint, suitable for galvanized steel, on all surfaces of bottom runner tracks and the lower 3 inches (76.2 mm) of studs.
   1. Repair damaged and rusted areas of hot-dip galvanized coatings in accordance with ASTM A780/A780M.

G. At partitions indicated with an acoustic rating:

1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
2. Place one bead of acoustic sealant between runners and substrate , studs and adjacent construction.
3. Place one bead of acoustic sealant between studs and adjacent vertical surfaces.

H. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

I. Install studs vertically at spacing indicated on drawings.

J. Align stud web openings horizontally.

K. Secure studs to tracks using crimping method. Do not weld.

L. Stud splicing is not permissible.

M. Fabricate corners using a minimum of three studs.

N. Install double studs at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

O. Coordinate erection of studs with requirements of door frames; install supports and attachments.

P. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

Q. Furring: Coordinate with sound isolation clip spacing and locations. Lap splices a minimum of 6 inches (150 mm).

3.3 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

E. Space main carrying channels at maximum 72 inch (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

3.4 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION 09 2216

SECTION 09 2700 - PLASTER FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glass-fiber-reinforced gypsum fabrications as indicated on drawings.
   1. Interior column covers.

1.2 REFERENCE STANDARDS

A. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.

B. ASTM C1355/C1355M - Standard Specification for Glass Fiber Reinforced Gypsum Composites 1996 (Reapproved 2020).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including dimensions, finishes, storage and handling requirements and recommendations, and installation recommendations.

C. Shop Drawings: For custom items, provide drawings showing dimensions, layout, joints, details, fastening, and interface with adjacent work; include field measured dimensions of the spaces where items are to be installed, if critical to proper installation.

D. Samples: For each custom finish specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Transport, lift, and handle units with care, avoiding excessive stress and preventing damage; use appropriate equipment.

B. Store products in manufacturer's unopened packaging until ready for installation, in a clean dry area protected from weather, moisture and damage; store units upright and not stacked unless permitted by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Glass-Fiber-Reinforced Gypsum Fabrications:
   1. Basis of Design: Custom Castings Northeast Inc.: www.customcastings.net.
   2. Melton Classics, Inc.

3. Formglas Products

2.2 GYPSUM FABRICATIONS (INTERIOR USE ONLY)

A. Glass-Fiber-Reinforced Gypsum Fabrications: Molded glass fiber reinforced gypsum with structural reinforcing as required.
   1. Surface Burning Characteristics: Flame spread index of 0 (zero), smoke developed index of 10, maximum, when tested in accordance with ASTM E84.
   2. Surface Finish: Suitable for flat paint finish, without pinholes , voids, or roughness..
   3. Material Characteristics: Complying with ASTM C1355/C1355M.
   4. Glass Content: Minimum 5 percent by weight.
   5. Method of Construction: Hand or spray lay-up process in molds.
   6. Shell Thickness: 3/16 inch (5 mm), minimum.
   7. Shell Thickness at Part Edges and at Fastening Points: 5/16 inch (8 mm), minimum.
   8. Outside Corner Radius: 1/8 inch (3 mm), maximum.
   9. Draft Angle: 3 degrees, minimum, on returns, setbacks, reveals, and grooves.
   10. Dimensional Tolerances of Molded Surfaces:
      a) Straightness: Maximum of 1/8 inch in 8 linear feet (1 mm in 750 mm) variation from straight at any point along any plane, edge, or surface.
      b) Overall Width and Length: Plus/minus 1/8 inch (3 mm).
      c) Dimensions Within Overall Width and Length: Plus/minus 1/16 inch (2 mm).

B. Joint Cement: Type recommended by fabrication manufacturer.

C. Joint Tape and Compound: Types recommended for gypsum wallboard work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly constructed; verify that substrates are plumb and true.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Architect and wait for instructions before beginning installation.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Install supplementary temporary and permanent supports as required for proper installation.

3.3 INSTALLATION

A. Install in accordance with applicable code and manufacturer's recommendations, plumb and true to line; shim where necessary.

B. Coordinate work with installation of substrates.

C. Join pieces with cemented butt joints except at control and expansion joints.

D. Provide control joints at not more than 35 feet (10.5 m) on center if not indicated on drawings.

E. Finish joints and surfaces as required for Level 5 in ASTM C840.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 09 2700

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SECTION 09 3000 - TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Stone thresholds.

D. Non-ceramic trim.

1.2 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.

C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.

D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).

E. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.

F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.

G. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2021.

H. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).

I. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).

J. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).

K. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.

L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).

M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).

N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2020.

O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2019.

P. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014 (Reaffirmed 2019).

Q. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014 (Reaffirmed 2019).

R. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2019.

S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2021.

T. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018.

U. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2021.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Installer's Qualification Statement:
   1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.5 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.
      a) Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).

1.6 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for general requirements for mock-up.

B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
   1. Minimum size of mock-up is indicated on drawings or as directed by Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

PART 2 PRODUCTS

2.1 TILE

A. Manufacturers: All products by the same manufacturer.
   1. Basis of Design: As indicated in the Finish Product List on drawings.

B. Porcelain Tile, Type PTF1, PTF2, PST1, PTW1, PTW2: ANSI A137.1 standard grade.
   1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
   2. Size: As indicated in the Finish Product List on drawings.
   3. Color(s): As indicated in the Finish Product List on drawings.
   4. Pattern: As indicated in the Finish Product List on drawings.

2.2 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a) Transition between floor finishes of different heights.
      b) Borders and other trim as indicated on drawings.
   2. Manufacturers:
      a) Schluter-Systems: www.schluter.com/#sle.
      b) Genesis APS International: www.genesis-aps.com/#sle.

B. Thresholds: 2 inches (51 mm) wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
   1. Thickness: 1/2 inch (12.7 mm).
   2. Material: Marble, honed finish.
   3. Color and Pattern: As indicated on drawings.
   4. Applications:
      a) At doorways where tile terminates.

2.3 SETTING MATERIALS

A. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
   2. Bostik Inc: www.bostik-us.com/#sle.
   3. Custom Building Products: www.custombuildingproducts.com/#sle.
   4. H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
   5. LATICRETE International, Inc: www.laticrete.com/#sle.

B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
   1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.

C. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.
   1. Products:
      a) ARDEX Engineered Cements; A 38: www.ardexamericas.com/#sle.

b) LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar Bed: www.laticrete.com/#sle.
c) Merkrete, by Parex USA, Inc; Merkrete Underlay C: www.merkrete.com/#sle.

2.4 GROUTS

A. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
2. Bostik Inc: www.bostik-us.com/#sle.
3. Custom Building Products: www.custombuildingproducts.com/#sle.
4. H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
5. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
3. Color(s): As indicated in the Finish Product List on drawings.

2.5 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Crack Resistance: No failure at 1/8 inch (3.2 mm) gap, minimum.
2. Fluid or Trowel Applied Type:
a) Thickness: 20 mils (0.5 mm), maximum.

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
2. Fluid or Trowel Applied Type:
a) Thickness: 25 mils (0.6 mm), minimum, dry film thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
1. Test in accordance with Section 09 0561.

2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
3. Follow moisture and alkalinity remediation procedures in Section 09 0561.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.3 INSTALLATION - GENERAL

A. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

B. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

C. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

D. Form internal angles square and external angles bullnosed.

E. Install non-ceramic trim in accordance with manufacturer's instructions.

F. Install thresholds where indicated.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

3.5 INSTALLATION - WALL TILE

A. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
   1. Where mortar bed is indicated, install in accordance with TCNA (HB) Method W222, one coat method.

3.6 CLEANING

A. Clean tile and grout surfaces.

3.7 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION 09 3000

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SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Suspended acoustical ceiling system (SAC).

D. Extruded-Aluminum Edge Moldings and Trim.

1.2 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels: Access panels.

B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

C. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.

D. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.

E. Section 28 4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.3 REFERENCE STANDARDS

A. ASTM A645/A645M - Standard Specification for Pressure Vessel Plates, 5% and 512% Nickel Alloy Steels, Specially Heat Treated 2010 (Reapproved 2016).

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2020.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2019.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on suspension system components.

D. Samples: Submit two samples 6 by 6 inch (152 by 152 mm) in size illustrating material and finish of acoustical units.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 1 percent of total installed.

1.6 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Basis of Design: As indicated in the Finish Product List on drawings or as approved by the Architect from the following:
      a) Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
      b) USG Corporation: www.usg.com/ceilings/#sle.
      c) Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:
   1. Basis of Design: As indicated in the Finish Product List on drawings or as approved by the Architect from the following:

2.2 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels, Type APC1, APC2: Mineral fiber with membrane-faced overlay, with the following characteristics:
   1. Basis of Design: As indicated in the Finish Product List on drawings.
   2. Classification: ASTM E1264 Type IV.
   3. Size: As indicated in the Finish Product List on drawings.
   4. Thickness: As indicated in the Finish Product List on drawings.
   5. Light Reflectance: 85 to 87 percent, determined in accordance with ASTM E1264.
   6. NRC Range: As indicated in the Finish Product List on drawings.
   7. Ceiling Attenuation Class (CAC): As indicated in the Finish Product List on drawings.
   8. Panel Edge: As indicated in the Finish Product List on drawings.
   9. Tile Edge: As indicated in the Finish Product List on drawings.
   10. Color: As indicated in the Finish Product List on drawings.
   11. Suspension System: Exposed grid.

C. Seamless Acoustical Ceiling Panels, Type SAC1: Mineral fiber with spray-applied finish, with the following characteristics:
   1. Basis of Design: As indicated in the Finish Product List on drawings.
   2. Application(s): As indicated in the Finish Product List on drawings.
   3. Classification: ASTM E1264 Type IV.
      a) Form: 2, water felted.
      b) Pattern: "G" - smooth.
   4. Size: As indicated in the Finish Product List on drawings.
   5. Thickness: As indicated in the Finish Product List on drawings.
   6. NRC: As indicated in the Finish Product List on drawings
   7. Ceiling Attenuation Class (CAC): As indicated in the Finish Product List on drawings
   8. Panel Edge: Tapered.
   9. Tile Edge: Square.
   10. Color: As indicated in the Finish Product List on drawings.
   11. Suspension System: Drywall grid.

D. Acoustical Panels, Type APC3: Glass fiber with membrane-faced overlay, with the following characteristics:
   1. Basis of Design: As indicated in the Finish Product List on drawings.
   2. Classification: ASTM E1264 Type XII.
      a) Form: 2, cloth.
      b) Pattern: "E" - lightly textured.
   3. Size: As indicated in the Finish Product List on drawings.
   4. Thickness: As indicated in the Finish Product List on drawings.
   5. Light Reflectance: 88 percent, determined in accordance with ASTM E1264.
   6. NRC Range: As indicated in the Finish Product List on drawings
   7. Ceiling Attenuation Class (CAC): As indicated in the Finish Product List on drawings
   8. Panel Edge: As indicated in the Finish Product List on drawings.
   9. Color: As indicated in the Finish Product List on drawings.
   10. Suspension System: Exposed.

2.3 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Suspension System for Type APC Ceiling, typical : Hot-dipped galvanized steel grid and cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 9/16 inch (14 mm) face width.
   3. Finish: Baked enamel.
   4. Color: As indicated in the Finish Product List on drawings.

C. Grid Suspension System for Suspended Acoustical Ceilings (SAC1): ASTM A645/A645M, direct-hung system composed of main beams and cross-furring members that interlock. Steel grid system of main tees and support bars connected to structure using hanging wire.
   1. Products:
      a) Armstrong World Industries, Inc; Armstrong Drywall Grid: www.armstrongceilings.com/#sle.
      b) CertainTeed Corporation; 1-1/2" Drywall System: www.certainteed.com/#sle.
      c) Rockfon; Chicago Metallic 640-C Heavy Duty Double Web Suspension System: www.rockfon.com/#sle.
      d) USG Corporation; Drywall Suspension System: www.usg.com/#sle.

2.4 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.

C. Perimeter Moldings: Same material and finish as grid.
   1. Size: As required for installation conditions.
   2. Shadow Molding: Shaped to create a perimeter reveal.

D. Metal Edge Trim for "Cloud" Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
   1. Trim Height: As indicated on drawings.
   2. Finish: Baked enamel.
   3. Color: As indicated in the Finish Product List on drawings.

E. Extruded-Aluminum Edge Moldings and Trim:
   1. Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
      a) Height: 4 inch (102 mm).
      b) Color: White.

F. Touch-up Paint: Type and color to match acoustical and grid units.

G. Finish for Suspended Acoustical Ceiling System:
   1. Joint Compound:
      a) Setting Compound: Lightweight setting-type drywall joint compound, Ultra lightweight drying-type drywall joint compound, as recommended by manufacturer.
      b) Joint Tape: Self-adhesive mesh drywall joint tape (Panel to Panel).
         1) Use Setting Type Compound for initial coats and use Drying Type Compound for final coats per the installation instructions. DO NOT use any other type of drywall compound such as All-Purpose Compound.
         2) Use paper tape at wall intersections.
   2. Spray Applied Finish: Manufacturer's fine texture finish product for suspended acoustical ceiling system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.3 INSTALLATION - SUSPENSION SYSTEM

A. Suspend ceiling hangers from building's structural members.
   1. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
   2. 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.
   3. Do not attach hangers to steel deck tabs.
   4. Do not attach hangers to steel roof deck. Attach hangers to structural members.

B. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

C. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

D. Locate system on room axis according to reflected plan.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

J. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch (25 mm) movement. Maintain visual closure.

3.4 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

F. Where round obstructions occur, provide preformed closures to match perimeter molding.

3.5 INSTALLATION - SEAMLESS ACOUSTICAL CEILING SYSTEM (SAC)

A. Install seamless acoustical units in accordance with manufacturer's instructions.

B. Finish panel joints and fasteners with tape and compound to create a flat surface.
   1. Finish joint seams and field to a level 4 finish with required joint compound.
   2. Spray with 4-5 coats of Fine Texture Finish.

3.6 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.7 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

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5100

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SECTION 09 6500 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Resilient stair accessories.

E. Installation accessories.

1.2 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.3 REFERENCE STANDARDS

A. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers 1998 (Reapproved 2015).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

C. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading 2017.

D. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing 2004 (Reapproved 2021).

E. ASTM F1344 - Standard Specification for Rubber Floor Tile 2021a.

F. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2020.

G. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.

H. ASTM F2169 - Standard Specification for Resilient Stair Treads 2015 (Reapproved 2020).

I. ASTM F2195 - Standard Specification for Linoleum Floor Tile 2018.

J. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

K. UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance From Various Sources Using Static Environmental Chambers Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

D. Verification Samples: Submit two samples, 12 by 12 inch (305 by 305 mm) in size illustrating color and pattern for each resilient flooring product specified.

E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

G. Installer's Qualification Statement.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 100 square feet (9.3 square meters) of each type and color.
   3. Extra Wall Base: 100 linear feet (30.5 linear meters) of each type and color.
   4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.7 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.1 SHEET FLOORING

A. Rubber-Backed Sheet Vinyl Flooring - Type RSF1: Vulcanized composition rubber backing fusion bonded to heterogeneous vinyl sheet, color and pattern through total thickness.
   1. Manufacturers:
      a) Basis of Design: As indicated in the Finish Product List on drawings.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   3. Thickness: As indicated in the Finish Product List on drawings.
   4. Sheet Width: As indicated in the Finish Product List on drawings.
   5. Seams: Heat welded.
   6. Surface Texture: Smooth.
   7. Pattern: As indicated in the Finish Product List on drawings.
   8. Color: As indicated in the Finish Product List on drawings.

B. Vinyl Sheet Flooring - Type RSF2: Transparent or translucent vinyl wear layer over interlayer and backing.
   1. Manufacturers:
      a) Basis of Design: As indicated in the Finish Product List on drawings.
   2. Minimum Requirements: Comply with ASTM F1303, Type I, with Class B plastic backing.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. Wear Layer Thickness: 0.020 inch (0.50 mm) minimum.
   5. Total Thickness: 0.080 inch (2.0 mm) minimum.
   6. Static Load Resistance: 75 psi (517 kPa) minimum, when tested as specified in ASTM F970.
   7. Seams: Heat welded.
   8. Pattern: As indicated in the Finish Product List on drawings.
   9. Color: As indicated in the Finish Product List on drawings.

C. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

2.2 TILE FLOORING

A. Vinyl Tile - Type RFT3: Solid vinyl with color and pattern throughout thickness.
   1. Manufacturers:
      a) Basis of Design: As indicated in the Finish Product List on drawings.

2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Mold and Microbial Resistance: Highly resistant when tested in accordance with ASTM D6329; certified in accordance with UL 2824.
5. Plank Tile Size: As indicated in the Finish Product List on drawings.
6. Total Thickness: As indicated in the Finish Product List on drawings.
7. Pattern: As indicated in the Finish Product List on drawings.
8. Color: As indicated in the Finish Product List on drawings.

B. Rubber Tile - Type RFT1: Homogeneous, color and pattern throughout thickness.
1. Manufacturers:
   a) Basis of Design: As indicated in the Finish Product List on drawings
2. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Size: As indicated on drawings nominal.
5. Total Thickness: 0.125 inch (3.2 mm).
6. Texture: As indicated in the Finish Product List on drawings.
7. Pattern: As indicated in the Finish Product List on drawings.
8. Color: As indicated in the Finish Product List on drawings.

C. Linoleum Tile: - Type RFT2 Homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness.
1. Manufacturers:
   a) Basis of Design: As indicated in the Finish Product List on drawings.
2. Minimum Requirements: Comply with ASTM F2195, Type corresponding to type specified.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Backing: Synthetic fabric.
5. Thickness: As indicated in the Finish Product List on drawings.
6. Tile Size: As indicated in the Finish Product List on drawings.
7. Pattern: As indicated in the Finish Product List on drawings.
8. Color: As indicated in the Finish Product List on drawings.

2.3 STAIR COVERING

A. Stair Treads with Integral Risers: Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.
1. Manufacturers:
   a) Basis of Design: As indicated in the Finish Product List on drawings.
2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Nosing: Square.
5. Tread Texture: As indicated in the Finish Product List on drawings.

6. Tread Pattern: As indicated in the Finish Product List on drawings.
7. Color: As indicated in the Finish Product List on drawings.

2.4 RESILIENT BASE

A. Resilient Base - Type RB1: ASTM F1861, Type TP, rubber, thermoplastic; style as scheduled.
   1. Manufacturers:
      a) Basis of Design: As indicated in the Finish Product List on drawings.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   3. Height: As indicated in the Finish Product List on drawings.
   4. Thickness: As indicated in the Finish Product List on drawings.
   5. Finish: As indicated in the Finish Product List on drawings.
   6. Color: As indicated in the Finish Product List on drawings.
   7. Accessories: Premolded external corners and internal corners.

B. Resilient Base - Type RB2: ASTM F1861, Type TP, rubber, thermoplastic; Style B, Cove.
   1. Manufacturers:
      a) Basis of Design: As indicated in the Finish Product List on drawings.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   3. Height: As indicated in the Finish Product List on drawings.
   4. Thickness: As indicated in the Finish Product List on drawings.
   5. Finish: As indicated in the Finish Product List on drawings.
   6. Color: As indicated in the Finish Product List on drawings.
   7. Accessories: Premolded external corners and internal corners.

2.5 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 0561.

2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
3. Follow moisture and alkalinity remediation procedures in Section 09 0561.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

3.3 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
1. Spread only enough adhesive to permit installation of materials before initial set.
2. Fit joints and butt seams tightly.
3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
2. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 INSTALLATION - SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.

B. Cut sheet at seams in accordance with manufacturer's instructions.

C. Seal seams by heat welding where indicated.

D. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated.

3.5 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams as indicated on drawingsn.

C. Install plank tile with a random offset of at least 6 inches (152 mm) from adjacent rows.

3.6 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.7 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.8 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.9 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 6500

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SECTION 09 6813 - TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.2 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.3 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

C. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

F. Installer's Qualification Statement.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.6 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Tile Carpeting, Type CPT1-CPT6, ECT1: Tufted, manufactured in one color dye lot.
   1. Basis of Design: As indicated in the Finish Product List on drawings
   2. Tile Size: As indicated in the Finish Product List on drawings.
   3. Color: As indicated in the Finish Product List on drawings.
   4. Pattern: As indicated in the Finish Product List on drawings.
   5. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   6. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
   7. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity.
   8. Other Properties: As indicated in the Finish Product List on drawings.

2.2 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Embossed aluminum.

C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 0561.

2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
3. Follow moisture and alkalinity remediation procedures in Section 09 0561.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Fully adhere carpet tile to substrate.

G. Trim carpet tile neatly at walls and around interruptions.

H. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION 09 6813

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SECTION 09 6816 - SHEET CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Carpet, direct-glued.

1.2 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

B. Section 09 6813 - Tile Carpeting.

1.3 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

C. CRI 104 - Standard for Installation of Commercial Carpet 2015.

D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings.

D. Samples: Submit two samples 24 by 24 inch (610 by 610 mm) in size illustrating color and pattern for each carpet and cushion material specified.

E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

F. Installer's Qualification Statement.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional requirements.
   2. Extra Carpet: 100 sq ft (9.3 sq m) of each type, color, and pattern installed.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

1.6 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F (21 degrees C) ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.1 CARPET

A. Carpet, Type CP1:
   1. Basis of Design: As indicated in the Finish Product List on drawings.
   2. Roll Width: As indicated in the Finish Product List on drawings
   3. Color: As indicated in the Finish Product List on drawings.
   4. Pattern: As indicated in the Finish Product List on drawings.
   5. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   6. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").

2.2 ACCESSORIES

A. Subfloor Filler: Type recommended by carpet manufacturer.

B. Moldings and Edge Strips: Embossed aluminum.

C. Seam Adhesive: Recommended by carpet manufacturer.

D. Carpet Adhesive: Recommended by carpet manufacturer; releasable type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 0561.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Clean substrate.

3.3 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.4 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

F. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

3.5 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

END OF SECTION 09 6816

SECTION 09 7200 - WALL COVERINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall covering.

1.2 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics 2020.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit two samples of wall covering, 8 by 10 inch (203 by 254 mm) in size illustrating color, finish, and texture.

E. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Wall Covering Materials: 25 linear feet (8 linear m) of each color and pattern of wall covering; store where directed.
   3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.5 MOCK-UP

A. Provide panel, 8 feet (2.4 m) wide, full height, illustrating installed wall covering and joint seaming technique.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.7 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surfaces.

PART 2 PRODUCTS

2.1 WALL COVERINGS

A. General Requirements:
   1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

B. Wall Covering - Type VWC1: Fabric-backed vinyl roll stock.
   1. Comply with ASTM F793/F793M, Category V, Type II.
   2. Backing: Woven, osnaburg fabric.
   3. Color: As indicated in the Finish Product List on drawings.
   4. Pattern: As indicated in the Finish Product List on drawings.

C. Wall Covering - Type VWC2:
   1. Descrition:
      a) Flexiible architectural film backed by a pressure sensitive adhesive with an integrated air removal system, for application to hard, non-porous surfaces. vinyl roll stock.
      b) Precision manufactured from blend of synthetic, engineered plastics, produced using calendaring process. and printed using high-definition presses.
   2. Fire hazard classification: Class A, tested to ASTM E84 and UL 723.
   3. Total Thickness: 8.5 mil (0.0085 inch) (0.2 mm).
   4. Roll Width: 48 inches (1220 mm).
   5. Color: As indicated in the Finish Product List on drawings.
   6. Pattern: As indicated in the Finish Product List on drawings.

D. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

E. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

F. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) nor vary at a rate greater than 1/16 inch/ft (1.5 mm/300 mm).

3.2 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces that affect work of this section.

E. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

F. Vacuum clean surfaces free of loose particles.

3.3 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

D. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

E. Butt edges tightly.

F. Overlap adjacent panels as recommended by manufacturer.

G. Horizontal seams are not acceptable.

H. Do not seam within 2 inches (50 mm) of internal corners or within 6 inches (150 mm) of external corners.

I. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

J. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.

K. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches (150 mm) of wall covering termination. Ensure full contact bond.

L. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.4 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.5 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION 09 7200

SECTION 09 7750 - WOOD WALL PANELING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wood wall panel system.

1.2 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Submit manufacturer's descriptive literature for each specified product. Include anchorage devices specific to project substrate types.

C. Shop Drawings: Submit elevations for each application and location. Indicate details of joints and attachments.
   1. Scale of Drawing Elevations: 1/4 inch to 1 foot (1:50), minimum.
   2. Scale of Drawing Details: 1-1/2 inches to 1 foot (1:8), minimum.

D. Samples: Submit two samples 12 by 12 inches (300 by 300 mm) in size, indicating finish and color for each type of panels.

E. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for fire performance.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Wood Wall Paneling Components: Provide a quantity equal to 2 percent of total product installed.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.5 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood wall panel components to project site in original, unopened packages.

B. Store in fully enclosed space, flat, level and off the floor.

1.7 FIELD CONDITIONS

A. Do not install wood wall panel system until wet construction work is complete and permanent heat and air conditioning is installed and operating.

B. Maintain room temperature between 60 degrees F (16 degrees C) and 75 degrees F (24 degrees C) and relative humidity between 35 to 55 percent before, during, and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wood Wall Panels (WWP1):
   1. Basis of Design: As indicated in the Finish Product List on drawings.

2.2 WOOD WALL SYSTEM

A. Performance Requirements:
   1. Comply with applicable codes for fire-retardant requirements.
   2. Surface Burning Characteristics: Flame spread index of 25, smoke developed index of 450, when tested in accordance with ASTM E84.

B. Wood-Based Materials:
   1. Solid Wood: Clear, dry, sound, plain sawn, selected for well-matched species, grain and color, no defects.

C. Wood Grilles: Pre-assembled module of solid wood grilles with metal backer frame.
   1. Size: As indicated in the Finish Product List on drawings.
   2. Solid Wood Species: As indicated in the Finish Product List on drawings.
      a) Factory Finish: As indicated in the Finish Product List on drawings.

2.3 FABRICATION

A. Shop fabricate wood wall panel components to the greatest extent possible.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not install wall panels until after interior wet work is dry.

3.2 PREPARATION

A. Acclimate wood wall panel materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

3.3 INSTALLATION

A. Wood Wall Panels:
   1. Install wood wall panels in accordance with manufacturer's instructions.
   2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
   3. Install components in uniform plane, and free from twist, warp, and dents.
   4. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.

3.4 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

3.5 CLEANING

A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION 09 7750

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SECTION 09 8430 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sound-absorbing panels.

1.2 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests 2016.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout and fabric orientation.

D. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch (305 by 305 mm), showing construction, edge details, and fabric covering.

E. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with at least three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

PART 2 PRODUCTS

2.1 FABRIC-COVERED SOUND-ABSORBING UNITS (AWP2)

A. Manufacturers:
   1. Basis of Design: As indicated in the Finish Product List on drawings.

B. General:
   1. Prefinished, factory assembled fabric-covered panels.
   2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Fabric-Covered Acoustical Panels for Walls:
   1. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
   2. Core Density: 6 to 7 lb/cu ft (96 to 112 kg/cu m).
   3. Sound Absorption: Noise Reduction Coefficient (NRC) of 0.80 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
   4. Panel Size: 24 inches by 48 inches (610 mm by 1220 mm) As indicated in the Finish Product List on drawings.
   5. Panel Thickness: As indicated in the Finish Product List on drawings.
   6. Edges: Perimeter edges reinforced by a formulated resin hardener.
   7. Corners: Square.
   8. Fabric: As indicated in the Finish Product List on drawings.
   9. Color: As indicated in the Finish Product List on drawings.
   10. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.
   11. Mounting Method: Direct applied with adhesive.

2.2 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
   1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.

2.3 ACCESSORIES

A. Panel Adhesive: Acceptable to acoustical panel manufacturer for application as indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Install mounting accessories and supports in accordance with shop drawings.

C. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

D. Install acoustical units to construction tolerances of plus or minus 1/16 inch (1.6 mm) for the following:
   1. Plumb and level.
   2. Flatness.

3.3 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.4 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION 09 8430

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SECTION 09 9123 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
5. Floors, unless specifically indicated.
6. Glass.
7. Concealed pipes, ducts, and conduits.

1.2 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

D. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).

E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

F. SSPC-SP 2 - Hand Tool Cleaning 2018.

G. SSPC-SP 6 - Commercial Blast Cleaning 2007.

H. SSPC-SP 13 - Surface Preparation of Concrete 2018.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
2. MPI product number (e.g., MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
3. Allow 30 days for approval process, after receipt of complete samples by Architect.
4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.5 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide door and frame assembly illustrating paint color, texture, and finish.

C. Locate where directed by Architect.

D. Mock-up may remain as part of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.7 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F (3 degrees C) above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Base Manufacturer: PPG Paints.

C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each paint material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

a) 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b) SCAQMD 1113 Rule.
c) Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
1) Opaque, Flat: 50 g/L, maximum.
2) Opaque, Nonflat: 150 g/L, maximum.
3) Opaque, High Gloss: 250 g/L, maximum.
d) Architectural coatings VOC limits of the State in which the Project is located.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated in the Finish Product List on drawings.

2.3 PAINT SYSTEMS - INTERIOR

A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, aluminum, and acoustical ceilings.
1. Two top coats and one coat primer.
2. Top Coat(s): Interior Latex; MPI #43, 44, 52, 53, 54, or 114.
a) Products:
1) PPG Paints Speedhide Interior Latex, 6-411 Series, Eggshell. (MPI #44)
3. Top Coat Sheen:
a) Eggshell: MPI gloss level 3; use this sheen at all locations unless noted otherwise.
4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
2. Two top coats and one coat primer.
3. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
a) Products:
1) PPG Paints Advantage 900 Styrene Acrylic, 919-10 Series, Semi-Gloss. (MPI #141)
4. Top Coat Sheen:
a) Semi-Gloss: MPI gloss level 5; use this sheen at trim and door frames.
5. Primer: As recommended by top coat manufacturer for specific substrate.

C. Medium Duty Vertical and Overhead: Including gypsum board, plaster, concrete, concrete masonry units, uncoated steel, shop primed steel, galvanized steel, and aluminum.
1. Two top coats and one coat primer.
2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.

a) Products:
1) PPG Paints Speedhide Zero Interior Latex, 6-4110XI Series, Flat. (MPI #143)

3. Top Coat Sheen:
a) Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
4. Primer: As recommended by top coat manufacturer for specific substrate.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Concrete:
1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

F. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

H. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

J. Galvanized Surfaces:
1. Prepare surface according to SSPC-SP 2.

K. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

L. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

M. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 9123

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SECTION 09 9300 - STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of stains and transparent finishes.

1.2 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category.

C. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, 12 x 12 inch (305 x 305 mm) in size.

D. Certification: By manufacturer that stains and transparent finishes comply with VOC limits specified.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Stain and Transparent Finish Materials: 1 gallon (4 L) of each color and type; from the same product run, store where directed.
   3. Label each container with color and type in addition to the manufacturer's label.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.6 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperature: 50 degrees F (10 degrees C) unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide finishes used in any individual system from the same manufacturer; no exceptions.

2.2 STAINS AND TRANSPARENT FINISHES - GENERAL

A. Finishes:
   1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each finish material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Flammability: Comply with applicable code for surface burning characteristics.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: Match Architect's samples.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of stains and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall items removed prior to finishing.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 9300

SECTION 10 1100 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Porcelain enamel steel markerboards.

B. Linoleum bulletin boards.

1.2 REFERENCE STANDARDS

A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling 2018.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

C. ASTM F2034 - Standard Specification for Sheet Linoleum Floor Covering 2018.

D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturer's data on porcelain enamel steel markerboard and tackboard.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.

D. Samples: Two, 2 by 2 inches (50 by 50 mm) in size illustrating materials and finish, color and texture of porcelain enamel steel markerboard and tackboard.

E. Test Reports: Show compliance to specified surface burning characteristics requirements.

F. Maintenance Data: Include data on regular cleaning, stain removal .

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.5 WARRANTY

A. See Section 01 7700 - Closeout Procedures, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.1 VISUAL DISPLAY UNITS

A. Porcelain Enamel Steel Markerboards (VD1):
   1. Basis of Design: As indicated in the Finish Product List on drawings.
   2. Color: As indicated in the Finish Product List on drawings.
   3. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch (0.61 mm).
   4. Size: As indicated on drawings.
   5. Accessories: As indicated in the Finish Product List on drawings.

B. Bulletin Boards (VD2):
   1. Basis of Design: As indicated in the Finish Product List on drawings.
   2. Composition: Homogeneous tackable surface material made of primary natural materials consisting of linseed oil, cork, rosin binders and dry pigments mixed and calendared onto a natural jute backing.
   3. Minimum Requirements: Comply with ASTM F2034, Type 1.
   4. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   5. VOC Content Limits: As specified in Section 01 6116.
   6. Backing: Jute fabric.
   7. Thickness: 1/4 inch (6 mm), minimum, excluding backing.
   8. Sheet Width: 79 inch (2000 mm), minimum.
   9. Color: To be selected by Architect from manufacturer's full range.
   10. Mounting: Adhesive.

2.2 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Adhesives: Type used by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify flat wall surface for frameless adhesive-applied boards.

3.2 PREPARATION

A. Acclimatize tackable wall panels by removing from packaging in installation area not less than 24 hours before application.

B. Remove switchplates, wall plates, and surface-mounted fixtures where tackable wall paneling is applied. Reinstall items on completion of installation.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

C. Butt Joints: Install with tight hairline joints.

D. Install bulletin boards in accordance with manufacturer's recommendations for direct wall application.
   1. Use manufacturer's required adhesive.

3.4 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION 10 1100

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SECTION 10 1400 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Room and door signs.

B. Interior directional and informational signs.

1.2 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Verification Samples: Submit samples showing colors specified.

G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

H. Manufacturer's Qualification Statement.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.6 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
   3. Character Height: 1 inch (25 mm).
   4. Sign Height: 2 inches (50 mm), unless otherwise indicated.
   5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
   6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
   7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
   8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

C. Interior Directional and Informational Signs:
   1. Sign Type: Same as room and door signs.
   2. Sizes: As indicated on drawings.
   3. Wording of signs is scheduled on Drawings.

4. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.

2.2 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.
   4. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
   5. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: Clear.
   4. Character Color: Contrasting color.

2.3 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/16 inch (1.6 mm).

2.4 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Exposed Screws: Stainless steel.

C. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 10 1400

SECTION 10 2113.17 - PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Phenolic toilet compartments.

B. Urinal screens.

1.2 RELATED REQUIREMENTS

A. Section 05 5000.02 - Interior Metal Fabrications: Concealed steel support members.

B. Section 06 1000 - Rough Carpentry: Blocking and supports.

C. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.3 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.
   1. Show anchorage locations and accessory items.
   2. Verify dimensions with field measurements prior to final production of toilet compartments.

D. Samples: Submit two samples of partition panels, 6 inch (152 mm) square, in size illustrating panel finish, color, and sheen.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Phenolic Toilet Compartments:
   1. Basis of Design: Bobrick Washroom Equipment, Inc: www.bobrick.com.

2.2 PHENOLIC TOILET COMPARTMENTS - TYPE 1 - WOMEN AND MEN'S TOILET ROOMS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.
   1. Color: As indicated in the Finish Product List on drawings.
   2. Basis of Design: Bobrick DuraLine Series; Model No. 1080G/1180G, Standard Height, with gap-free doors and stiles.

B. Doors:
   1. Thickness: 3/4 inch (19 mm).
   2. Width: 24 inch (610 mm).
   3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
   4. Height: 58 inch (1473 mm).

C. Panels:
   1. Thickness: 1/2 inch (13 mm).
   2. Height: 58 inch (1473 mm).
   3. Depth: As indicated on drawings.

D. Pilasters:
   1. Thickness: 3/4 inch (19 mm).
   2. Width: As required to fit space; minimum 3 inch (76 mm).

E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

F. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches (7.6 mm) from the edge to allow for 0.175 inch (4.4 mm) overlap to prevent line-of-sight into the toilet compartment. Privacy strips fastened or adhered onto the partition material are not acceptable.

2.3 PHENOLIC TOILET COMPARTMENTS - TYPE 2 - GENDER-NEUTRAL TOILET ROOM

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-to-ceiling.
   1. Color: As indicated in the Finish Product List on drawings.
   2. Basis of Design: Bobrick DuraLine Series; Model No. 3080/3180, Extended Height, with gap-free doors and stiles.

B. Doors:
   1. Thickness: 3/4 inch (19 mm).
   2. Width: 24 inch (610 mm).
   3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
   4. Height: 96 inch (244 mm), with transom closure to ceiling. 1-inch nominal floor clearance.

C. Panels:
   1. Thickness: 1/2 inch (13 mm).
   2. Height: Floor-to-ceiling, with 1-inch nominal gap at top and bottom.

3. Depth: As indicated on drawings.

D. Pilasters:
1. Thickness: 3/4 inch (19 mm).
2. Width: As required to fit space; minimum 3 inch (76 mm).
3. Height: Floor-to-ceiling.

E. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches (7.6 mm) from the edge to allow for 0.175 inch (4.4 mm) overlap to prevent line-of-sight into the toilet compartment. Privacy strips fastened or adhered onto the partition material are not acceptable.

2.4 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch (76 mm) high, concealing floor fastenings.
1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Hollow stainless steel, 1 inch by 1-1/2 inch (25 mm by 38 mm) size, with anti-grip profile and cast socket wall brackets.

C. Wall and Pilaster Brackets: Polished stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
1. Fastening: Hardware is secured to door and stile with pin-in-head Torx stainless steel machine screws. Hinges, latch and door stops secured to door with pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners for hinges, latch and optional door stops secured directly into core not acceptable.
a) Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb (680 kg) per insert.
2. Mounting Brackets:
a) Standard Concealed.
1) Mounting Brackets: Mounted inside compartment; exposed brackets on exterior of compartment not acceptable with the exception of outswing doors.
b) Full-Height:
1) Mounting Brackets: 18 gauge (1.2 mm) stainless steel and extend full height of panel.
2) U-Channels: Secure panels to stiles.
3) Angle Brackets: Secure stiles-to-walls and panels to walls.

E. Hardware: Polished stainless steel:
1. Hinge Type for Standard Height Partitions: Pivot hinges, gravity type, adjustable for door close positioning; two per door.
2. Hinge Type for Extended Height Partitions: Full-height institutional hinge; 16 gauge (1.6 mm) stainless steel, self-closing, 3 section hinges.
3. Door Latch: Slide type with exterior emergency access feature. Provide occupancy indicator on extended height partions.
4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.

5. Coat hook with rubber bumper; one per compartment, mounted on door.
6. Provide door pull for outswinging doors.

F. Toilet Partition Suspension Members: As specified in Section 05 5000.02.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Attach panel brackets securely to walls using anchor devices.

C. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.3 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.4 ADJUSTING

A. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

B. Adjust adjacent components for consistency of line or plane.

END OF SECTION 10 2113.17

SECTION 10 2123 - CUBICLE CURTAINS AND TRACK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface mounted overhead curtain track and guides.

B. Cubicle curtains.

1.2 RELATED REQUIREMENTS

A. Section 05 5000.02 - Interior Metal Fabrications: Track supports above ceiling.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2019.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data for curtain fabric characteristics.

C. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.

D. Samples: Submit 12 by 12 inch (300 by 300 mm) sample patch of curtain cloth with representative top, bottom, and edge hem stitch detail, heading with reinforcement and carrier attachment to curtain header.

E. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Curtains: Two of each type and size.
   3. Extra Carriers: Ten.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept curtain materials on site and inspect for damage.

B. Store curtain materials on site and deliver to Owner for installation when requested.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cubicle Track and Curtains:
   1. Basis of Design: As indicated in the Finish Product List on drawings.

2.2 TRACKS AND TRACK COMPONENTS

A. Tracks: Extruded aluminum sections; one piece per track run.
   1. Profile: Channel.
   2. Mounting: Surface.
   3. Structural Performance: Capable of supporting vertical test load of 50 lbs (23 kg) without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
   4. Track End Stop: To fit track section.
   5. Track Bends: Minimum 12 inch (300 mm) radius; fabricated without deformation of track section or impeding movement of carriers.
   6. Finish on Exposed Surfaces: Clear anodized.

B. Curtain Carriers: Nylon rollers, size and type compatible with track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal.

C. Wand: Plastic, attached to lead carrier, for pull-to-close action.

D. Installation Accessories: Types required for specified mounting method and substrate conditions.

2.3 CURTAINS

A. Cubicle Curtains:
   1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   2. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
   3. Material: Close weave polyester; anti-bacterial, self deodorizing, sanitized, and preshrunk.
   4. Color/Pattern: As indicated in the Finish Product List on drawings.
   5. Open Mesh Cloth: Open weave to permit air circulation; flameproof material, manufacturer's standard color.
   6. Attachment of Curtain Fabric to Open Mesh Cloth: Manufacturer's standard sewn seam.

B. Curtain Fabrication:
   1. Width of curtain to be 10 percent wider than track length.
   2. Length of curtain to end 15 inches (380 mm) above finished floor.
   3. Railroad fabric without vertical seams.
   4. Include open mesh cloth at top 20 inches (508 mm) of curtain for room air circulation, attached to curtain as specified above.
   5. Curtain Heading: Fabric band matching curtain panel with metal grommet holes for carriers spaced 6 inches (150 mm) on center.

6. Seams and Hems: Manufacturer's standard fabrication method for securely sewn and finished seams and hems.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.

B. Verify that field measurements are as indicated on shop drawings.

3.2 INSTALLATION

A. Install curtain track to be secure, rigid, and true to ceiling line.

B. See Section 05 5000.02 for track supports above ceiling.

C. Secure track to ceiling system.

D. Install end cap and stop device.

E. Install curtains on carriers ensuring smooth operation.

END OF SECTION 10 2123

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SECTION 10 2239 - FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Top-supported folding panel partitions, horizontal opening.

B. Top-supported operable panel partitions, vertical opening, electrical operation.

1.2 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking and track support shimming.

B. Section 09 7200 - Wall Coverings: Product requirements for vinyl fabric finish for installation by this section.

C. Section 09 7750 - Wood Wall Paneling: Product requirements for wood veneer finish for installation by this section.

D. Section 10 1100 - Visual Display Units: Product requirements for markerboard finish for installation by this section.

E. Division 26 Sections: Empty conduit from partition motor controller to disconnect and from motor controller to control buttons.

F. Division 26 Sections: Electrical characteristics and wiring connections; control buttons .

1.3 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

D. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

E. ASTM E413 - Classification for Rating Sound Insulation 2016.

F. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions 2012 (Reapproved 2020).

G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.
   1. Require attendance by representatives of installer.
   2. Notify Architect four calendar days in advance of scheduled meeting date.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on partition materials, operation, hardware and accessories, electric operating components, and colors and finishes available.

C. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in the State in which the Project is located, showing loads at points of attachment to the building structure.

D. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, location and details of pass door and frame, adjacent construction and finish trim, and stacking depth.

E. Samples for Review: Submit two samples of surface finish, 12 by 12 inches (300 by 300 mm) size, illustrating quality, colors selected, texture, and weight.

F. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

1.8 WARRANTY

A. See Section 01 7700 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Folding Panel Partitions - Horizontal Opening:
   1. Basis of Design: Modernfold, a DORMA Group Company.
   2. Hufcor, Inc: www.hufcor.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Operable Panel Partitions - Vertical Opening:
   1. Basis of Design: Skyfold Inc.
   2. Hufcor, Inc: www.hufcor.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.2 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING - MOTORIZED

A. Folding Panel Partitions: Side opening; continuous hinged panels; side stacking; motor operated.

B. Panel Construction:
   1. Frame: 16 gauge, 0.0598 inch (1.52 mm) thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction.
   2. Panel Substrate Facing: Steel sheet, manufacturer's standard thickness.
   3. Hinges: Continuous piano type, stainless steel.
   4. Panel Properties:
      a) Thickness Without Finish: 4-1/4 inches (108 mm).
      b) Width: Standard width.
      c) Weight: 9.5 lb/sq ft (46.4 kg/sq m).

C. Panel Finishes:
   1. Facing: 48-inch high markerboard, mounted 33-inches AFF, with vinyl-coated fabric above and below.
   2. Exposed Metal Trim: Custom powder coated paint finish.

D. Panel Seals:
   1. Panel to Panel Seals: Grooved and gasketed astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
   2. Acoustic Seals: Flexible acoustic seals at jambs, meeting mullions, ceilings, retractable floor and ceiling seals, and above track to structure acoustic seal.

E. Suspension System:
   1. Track: Formed steel; 1-1/4 by 1-1/4 inch (32 by 32 mm) size; thickness and profile designed to support loads, steel sub-channel and track connectors.
   2. Carriers: Nylon wheels on trolley carrier at top of every second panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.

F. Performance:
   1. Acoustic Performance:

a) Sound Transmission Class (STC): 54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft (9.3 sq m).

2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

G. Operation:
1. Electric Operator: 5.6 inches (142 mm) per second traveling speed; adjustable friction clutch brake actuated by solenoid controlled motor starter; enclosed limit switch; enclosed magnetic reversing starter.
2. Control Station: One standard keyed, three button OPEN-STOP-CLOSE type; 24 volt circuit; recess mounted.
   a) Key switch prepared for mortise lock cylinder.
   b) Key switches alike.
3. Safety Features:
   a) Limit Switches: Automatic type, at both extremes of travel, to prevent over-travel.
   b) Emergency Release: Mechanism to disengage motor drive system and permit manual operation.
   c) Pocket Door Interlock: Mechanism to prevent operation of panels unless storage pocket doors are fully open.
   d) Optical beam detection of obstructions in path of partition during operation.
4. Electrical Requirements:
   a) 1 hp (746 W), 4.5 rated load amperes.
   b) 208/230 volts, three phase, 60 Hz.
   c) Conduit and Outlet Boxes: Concealed type in accordance with Electrical Sections.
   d) Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
   e) Disconnect Switch: Factory mount disconnect switch in control panel.

H. Accessories:
1. Ceiling Closure: White enameled ceiling closure; aluminum jamb and head molding, fittings and attachments.
2. Pocket Enclosures: Door, frame, and trim to match adjacent walls.
3. Acoustic Sealant: As recommended by partition manufacturer.

2.3 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING - MANUAL

A. Folding Panel Partitions: Side opening; paired panels; side stacking; manually operated.

B. Panel Construction:
1. Frame: 16 gauge, 0.0598 inch (1.52 mm) thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction.
2. Panel Substrate Facing: Steel sheet, manufacturer's standard thickness.
3. Hinges: Continuous piano type, stainless steel.
4. Panel Properties:
   a) Thickness Without Finish: 4-1/4 inches (108 mm) nominal.
   b) Width: Standard width.
   c) Weight: 9.5 lb/sq ft (46.4 kg/sq m).

C. Panel Finishes:
   1. Facing: Markerboard.

D. Panel Seals:
   1. Panel to Panel Seals: Grooved and gasketed astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
   2. Acoustic Seals: Flexible acoustic seals at jambs, meeting mullions, ceilings, retractable floor and ceiling seals, and above track to structure acoustic seal.

E. Suspension System:
   1. Track: Formed steel; 1-1/4 by 1-1/4 inch (32 by 32 mm) size; thickness and profile designed to support loads, steel sub-channel and track connectors.
   2. Carriers: Nylon wheels on trolley carrier at top of every second panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.

F. Performance:
   1. Acoustic Performance:
      a) Sound Transmission Class (STC): 54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft (9.3 sq m).
   2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
   3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

G. Accessories:
   1. Acoustic Sealant: As recommended by partition manufacturer.

2.4 OPERABLE PANEL PARTITIONS - VERTICAL OPENING

A. Operable Panel Partition: Vertical opening; individual panels stacked in drive box above ceiling; motor operated.

B. Panel Construction:
   1. Frame: 16 gauge, 0.0598 inch (1.52 mm) thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
   2. Panel Substrate Facing: Steel sheet, manufacturer's standard thickness.
   3. Panel Properties:
      a) Thickness With Finish: 11-3/4 inches (298.5 mm).
      b) Height: 26-1/2 inches.

C. Panel Finishes:
   1. Facing:
      a) Main Street Side: Wood veneer as indicated in Finish Product List on drawings.
      b) Classroom Side: Markerboard and painted metal panels.

D. Panel Seals:
   1. Panel to Panel Seals: Tongue and groove configuration, color to match panel finish.
   2. Horizontal Bottom Seal: Retractable safety sensor seal providing minimum of 2 inches (51 mm) floor adjustability to accommodate out-of-level floors.

E. Suspension System:
   1. Guide Rails: Extruded aluminum; 6 inches (152 mm) wide and 6 inches (152 mm) deep.
   2. Guide Rollers: Sealed rollers with hardened steel ball bearings.
   3. Drive Box: Hardened steel construction.
      a) Supports weight of panels in stacked position.

F. Performance:
   1. Acoustic Performance:
      a) Sound Transmission Class (STC): 55 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft (9.3 sq m).
   2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
   3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

G. Operation:
   1. Electric Operator: 5 to 10 feet per minute (1-1/2 to 3 meters per minute) vertical traveling speed.
      a) Drive system includes drive shafts, couplers, torque limiter, key pressure actuation control station wired in series, dual drive emergency operation and all necessary equipment for electric operation.
      b) Chain drive attaches to dual direction lead panel.
   2. Control Station: One standard keyed switch (RESET-OFF-ON) and one two-position (OPEN-CLOSE, constant pressure) type rocker switch; 24 volt circuit; recess mounted.
      a) Master key switch prepared for mortise lock cylinder.
      b) Key switches alike.
   3. Safety Features:
      a) Load Arrestor: Stops free fall occurrence.
      b) Entrapment Backup System: Automatically reverses downward movement when lead edge makes contact with obstruction within path of travel.
      c) Limit Switches: Automatic type, at both extremes of travel, to prevent over-travel.
      d) Emergency Release: Mechanism to disengage motor drive system and permit manual operation.
   4. Electrical Requirements:
      a) 0.5 HP Motor: 60 Hz and 208 volt 3 phase.
      b) Conduit and Outlet Boxes: Concealed type in accordance with Electrical Sections.
      c) Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
      d) Disconnect Switch: Factory mount disconnect switch in control panel.
   5. Operation Sequence:
      a) Stack/Store Panels: Panels are retracted above ceiling and stored by activating key-switch control.
      b) Extend Partition: When operable wall is being lowered (closed), panels stop and retract if leading (bottom) edge comes in contact with any object between it and floor. Operation of wall may resume once key switch has been reset and obstruction cleared.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Wood Veneer: As indicated in the Finish Product List on drawings.

C. Markerboard: Porcelain enamel on steel, laminated to core; color as selected.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.

C. Verify track supports are laterally braced and will permit track to be level within 1/4 inch (6.4 mm) of required position and parallel to the floor surface.

D. Verify floor flatness of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.

E. Verify wall plumbness of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.

3.2 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Install electric operator, wiring, and controls. Locate control station(s) as indicated.

C. Fit and align partition assembly and pocket doors level and plumb.

D. Install acoustic sealant to achieve required acoustic performance.

E. Coordinate electrical connections.

3.3 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to achieve lightproof seal.

3.4 CLEANING

A. Clean finish surfaces and partition accessories.

3.5 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION 10 2239

SECTION 10 2513 - PATIENT BED SERVICE WALLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Medical equipment management rail system.

1.2 RELATED REQUIREMENTS

A. Section 09 2216 - Non-Structural Metal Framing: Reinforcements in metal-framed partitions for anchoring headwall assemblies or units.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of units with wall framing, including stud spacing, and size, location, and installation of service utilities.

B. Preinstallation Meeting: Conduct preinstallation meeting one week prior to start of work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that facility services connections are achieved in an orderly and expeditious manner.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide descriptive literature that includes dimensions, construction, capacities, utility and service requirements, clearances, locations, required accessories, optional features, test reports, certifications.

C. Shop Drawings: Indicate locations in facility using large-scale plans, elevations, and cross sections.
   1. Include electrical ratings, overall and detailed dimensions, mounting details, rough-in and anchor placement dimensions and tolerances, installation and servicing clearances required, wiring diagrams, materials, and connection diagrams.
   2. Include configuration drawings showing arrangement of devices, including nurse call, medical gases, electrical receptacles, and switches.

D. Certificate: Certify that products of this section meet or exceed specified requirements.
   1. Certify that equipment has been properly installed, adjusted, and tested in accordance with manufacturer’s recommendations.

E. Operation and Maintenance Manuals: Include wiring diagrams, technical data sheets, and information for ordering replacement parts.
   1. Identify terminals on wiring diagrams to facilitate installation, maintenance and operation.
   2. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required, and local spare part sources.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Project Record Documents: Record actual locations of concealed facility services connections.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

B. Installer's Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package each system component to ensure protection from damage during shipment and delivery. Legibly indicate on exterior of each container or crate, shipping address and brief description of contents. Outside of container, fasten waterproof envelope containing packing list and complete instructions for uncrating and handling contents.

B. Coordinate maximum size of each shipment with opening sizes along access routes to places of storage and installation, including sizes of elevator doors and cabs.

C. Store products clear of floor in manner to prevent damage.

D. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.7 WARRANTY

A. See Section 01 7700 - Closeout Procedures for additional warranty requirements.

B. Manufacturer Warranty: Provide 10-year manufacturer warranty for service wall system installation. Complete forms in Owner's name and register with manufacturer.

C. Installer Warranty: Provide 10-year warranty for service wall system installation commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (MEQ-1): Paladin Healthcare LLC; Evolution Equipment Management Rail System: www.paladinhc.com.

2.2 COMPONENTS

A. Rails: Seamless extruded aluminum profile with a clear anodized finish.

1. Rail shall have a groove for attaching a friction-fit and lockable adapter that supports the identified Owner-furnished devices and equipment. To prevent accidental dislodgment, design the groove so that a 7-degree tilt is required to attach the adapter.
   a) Edge-to-Edge Face Dimension: 1.145 inches.
   b) Face-to-Back Dimension: 1.175 inches.
   c) Factory-cut to lengths indicated.
      1) Lengths greater than 10 feet shall be joined together using manufacturer's joiner piece.
   d) Screw Holes in Rail for Mounting to Wall: Pre-drilled on 16-inch centers.
      1) Exception: Provide two mounting holes in rails less than 16-inches long.
2. Face profile of rail shall facilitate the insertion of a decorative inlay strip in the field. Inlay strip shall be a high-pressure decorative laminate material designed to resist most hospital cleaning and disinfecting chemicals. Pre-cut inlay strip to match length of rail.
   a) Color of Laminate Inlay Strip: Wilsonart; As selected by Architect: www.wilsonart.com.
3. At each end of rail, provide friction-fit closure caps constructed of white injection-molded thermoplastic material designed to resist most hospital cleaning and disinfecting chemicals and embedded throughout with a zinc-based anti-microbial compound that cannot be scratched or wiped off.

B. Adapters:
1. Design and manufacture adapters to be easily snapped on and off any standard Fairfield-style rail by employing a 7-degree upward tilt.
2. Adapters shall utilize a spring-loaded friction fit to hold the attached product in place when snapped onto the rail and yet allow the product to slide horizontally along the rail until locked in place.
3. Install Allen-type screws in the bottom of the adapter. Tighten screws to lock the accessories and equipment in place.
4. Material: Molded medical-grade plastic embedded throughout with a zinc-based anti-microbial compound that cannot be scratched or wiped off.
   a) Exceptions for heavy loads, and at rail manufacturer's direction, provide multiple adapters, double-width adapters, and/or aluminum adapters extruded from aluminum alloy with a clear-anodized finish.

C. Accessory Mounting Plates:
1. Material and Finish: Aluminum having a powder-coated finish with anti-microbial silver-ion technology.
2. Sizes and locations of holes in mounting plates shall match sizes and pattern on the back of the device to be hung.
3. Additional holes shall be drilled on plates mounting accessories which may need field height adjustment (Foam/Soap, Sharps containers, Paper Towel holders etc.) based on fixed heights of casework or changing designs of 3rd party manufacturers.
4. To maintain plumb orientation of plates taller than six inches, or those carrying cantilevered loads, manufacture shall provide 1-1/2-inch long hollow cylindrical polymer anti-microbial standoffs near the bottom edges.

D. Hardware for Mounting to Wall: 1/4-inch-diameter fasteners furnished by manufacturer of rail system and of type suitable for relevant wall framing or substrate - and exceeding loading capability specified in Part-3 article entitled "Examination."

2.3 CONFIGURATIONS

A. Single bed assembly with vertical configuration.
   1. Vertical wall-mounted assemblies.
      a) Width: As indicated on drawings.
      b) Number of Rails: As indicated on drawings.

B. Single bed assembly with horizontal configuration.
   1. Horizontal wall-mounted assemblies.
      a) Width: As indicated on drawings.
      b) Number of Rails: As indicated on drawings.

C. Electrical and Piped Services: Wall-mounted, as indicated on drawings.

2.4 ACCESSORIES

A. Manufacturer's standard accessories compatible with service wall, including items indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. The loading capability of the rail system is dependent on the load-bearing capacity of the wall or partition to which it is mounted.
   1. In the case of metal-stud-and-gypsum-board construction, this includes the adequacy of the installation of both the metal framing and the gypsum board.

B. Installed rail system shall be able to accommodate a functional loading of 62 foot-pounds of torque per foot between 16-inch centers.
   1. Exception: Rails less than 16 inches shall accommodate 20 pounds of direct weight.

C. Notify Architect if it appears that relevant existing or new walls or partitions are not capable of accommodating this loading.

D. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of service walls.

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

3.2 INSTALLATION

A. Install rail system in strict accordance with manufacturer’s installation instructions and approved Shop Drawings.

B. Comply with licensure rules and local, state, and national codes applicable to this installation.
   1. Contact manufacturer with installation questions prior to beginning installation.

C. Position and level the rail on the wall at the correct height and location as shown on approved Shop Drawings. Mark location on wall.

D. For Stud Mounting:
   1. Align holes in rail with studs. If required, drill new holes into rail to align with stud locations.
   2. Drive 1/4-inch-diameter sheet-metal screws through rail and drywall and securely fasten into studs.

E. For Mounting through Gypsum Board to Metal or Wood Backing:
   1. Mark through each of the pre-drilled holes in the rail and onto the drywall.
   2. Use 1/4-inch-diameter screws to securely mount the rail to the wall.
      a) For sheet metal backing use sheet-metal screws.
      b) For wood backing, use wood screws.

F. For Mounting to Gypsum Board without Backing:
   1. Mark through each of the pre-drilled holes in the rail and onto the drywall.
   2. Remove the rail and securely install toggle-type wall anchors with a 1/4-inch nominal diameter in locations as marked.
   3. Realign the rail holes with the installed wall anchors and tightly secure the rail to the wall with the wall anchor machine screws.

G. Ensure a tight fit between rail and wall.

H. Remove location marks that remain visible after installation.

I. Insert supplied inlay strip into grooves and secure end caps.

J. Mounting of Owner-furnished medical devices and equipment to their respective adapters and accessory mounting plates may be included in the scope of work by the vendor. Owner (or owner representative) shall install accessories in rooms to which they have been assigned on approved Shop Drawings.

3.3 TOLERANCES

A. Maximum Variation From True Position in Any Direction: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.4 ADJUSTING

A. Adjust components for proper operation within manufacturer's published tolerances.

B. Adjust controls and moving parts for smooth operation.

3.5 CLEANING

A. Clean surfaces as recommended by manufacturer.

3.6 PROTECTION

A. Protect installed patient bed service walls from subsequent construction operations.

END OF SECTION 10 2513

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Bumper rails.

B. Corner guards.

C. Protective wall covering.

1.2 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

E. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies 2014.

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

G. ASTM G22 - Standard Practice for Determining Resistance of Plastics to Bacteria 1976(96).

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit two sections of corner guards, bumper rails, and protective corridor handrails, 24 inches (610 mm) long.
   2. Submit two samples of protective wall covering and door surface protection, 6 by 6 inches (152 by 152 mm) square.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Stock Materials: One package(s) of minimum 96 inches (2438 mm) long unit of each kind of covers for corner guards, bumper rails, and protective corridor handrails.

F. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bumper Rails, Corner Guards, and Rubrails:
1. Basis of Design: As indicated in the Finish Product List on drawings.

B. Protective Wall Covering:
1. Basis of Design: As indicated in the Finish Product List on drawings.

C. Protective Wall Panels: Fiber Reinforced Laminate (FRL):
1. Basis of Design: As indicated in the Finish Product List on drawings.

2.2 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.3 PRODUCT TYPES

A. Bumper Rails (CR1): Factory- or shop-fabricated, with preformed end caps and internal and external corners:
   1. Performance of Installed Assembly:
      a) Resist lateral force of 250 lbs (1112 N) at any point without damage or permanent set.
   2. Material: Polyethylene terephthalate (PET or PETG); PVC-free, color as indicated in the Finish Product List on drawings.
   3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   4. Mounting: Surface.

B. Rub Rails (CR2):
   1. Material: Polyethylene terephthalate (PET or PETG); PVC-free, color as indicated in the Finish Product List on drawings.
   2. Performance Requirements:
      a) Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
      b) Impact Strength: Provide materials tested in accordance with the applicable provisions of ASTM D256.
      c) Chemical and Stain Resistance: Provide material that shows resistance to stain when tested in accordance with applicable provisions of ASTM D543.
      d) Fungal and Bacterial Resistance: Provide material that does not support fungal or bacterial growth as tested in accordance with ASTM G21 and ASTM G22.
   3. Mounting: Surface, with adhesive.

C. Corner Guards - Flush Mounted (CG1):
   1. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
   2. Performance: Resist lateral impact force of 100 lbs (445 N) at any point without damage or permanent set.
   3. Fire Resistance: Where fire rating is specified for the wall in which the guard is mounted, provide assemblies that have been tested in accordance with ASTM E119 for the same rating as the wall.
   4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   5. Width of Wings: 2 inches (51 mm).
   6. Corner: Square.
   7. Color: As indicated in the Finish Product List on drawings.
   8. Length: One piece.

D. Protective Wall Covering (WP1):
   1. Material: Polyethylene terephthalate (PET or PETG); PVC and PBTs-free.
   2. Thickness: 0.040 inch (1.02 mm).
   3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   4. Color: As indicated in the Finish Product List on drawings.
   5. Accessories: Provide manufacturer's standard color-matched trim and moldings.
      a) Inside Corner Trim: Standard angle

b) Outside Corner Trim: Standard angle.

6. Mounting: Adhesive.

E. Protective Wall Panels (WP2):
1. Material: Fiber Reinforced Laminate (FRL): Thermofused melamine overlay, decorative paper and fire-rated phenolic paper with fiber reinforcing inner layers.
2. Thickness: As indicated in the Finish Product List on drawings.
3. Panel Size: As indicated in the Finish Product List on drawings.
4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 55 or less, when tested in accordance with ASTM E84.
5. Color and Pattern: As indicated in the Finish Product List on drawings.
6. Texture: As indicated in the Finish Product List on drawings.
7. Accessories: Provide manufacturer's standard color-matched trim and moldings.
a) Outside Corner Trim: Flat.
b) Division Bar: Flat.
8. Mounting: Adhesive.

F. Adhesives and Primers: As recommended by manufacturer.

G. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

2.4 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.
1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

D. Start of installation constitutes acceptance of project conditions.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position top of bumper rail 36 inches (914 mm) from finished floor.

C. Position corner guard 4 inches (102 mm) above finished floor to underside of ceiling.

D. Terminate rails 1 inch (25.4 mm) short of door openings and intersecting walls.

E. Position protective wall covering no less than 1 inch (25.4 mm) above finished floor to allow for floor level variation.
   1. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
   2. Apply adhesive with 1/8 inch (3.2 mm) V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
   3. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
   4. At joints indicated to be caulked, allow for a minimum 1/16 inch (1.6 mm) wide gap between edges of sheets. Gaps are required to be of consistent width throughout the project.
   5. Use a roller to ensure maximum contact with adhesive.
   6. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

3.3 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch (6 mm).

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

3.4 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION 10 2600

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SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial toilet accessories.

B. Diaper changing stations.

C. Utility room accessories.

1.2 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.

1.3 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

B. ASTM C1036 - Standard Specification for Flat Glass 2021.

C. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

D. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2004, with Editorial Revision (2016).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Materials identified below as OFCI will be furnished by Owner and installed by Contractor.

B. Materials identified below as CFCI will be furnished and installed by Contractor.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:
   1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.

2.3 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. American Specialties, Inc: www.americanspecialties.com/#sle.
   2. Bobrick Washroom Equipment, Inc: www.bobrick.com.
   3. Bradley Corporation: www.bradleycorp.com/#sle.

2.4 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Stainless Steel Sheet: ASTM A666, Type 304.

2.5 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.6 COMMERCIAL TOILET ACCESSORIES - OFCI

A. Paper Towel Dispenser, Type T-1: Owner-Furnished, Contractor-Installed.

B. Soap Dispenser, Type T-2: Owner-Furnished, Contractor-Installed.

C. Toilet Paper Dispenser, Type T-3: Owner-Furnished, Contractor-Installed.

2.7 COMMERCIAL TOILET ACCESSORIES - CFCI

A. Mirror Unit, Type T4: 0.05 inch (1.3 mm) thick stainless steel angle frame with manufacturer's standard corners; 1/4 inch (6 mm) thick annealed float glass; ASTM C1036 with silvering, protective and physical characteristics in compliance with ASTM C1503.
   1. Size: 24 inches wide by 36 inches high.
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc; Model No. B-290 2436 Framed Mirror or a comparable product by one of the following:
      a) American Specialties, Inc.; Model No. 0600-2436.
      b) Bradley Corporation; Model No. 781-2436.
      c) Substitutions: Section 01 6000 - Product Requirements.

B. Surface-Mounted Sanitary-Napkin Disposal Unit Type T7: Stainless steel construction, surface-mounted sanitary-napkin disposal with self-closing, disposal-opening cover and hinged face panel with tumbler lockset; removable receptacle; No. 4 (satin) finish.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc; Model No. B-254 Surface-Mounted Sanitary Napkin Disposal or comparable product by one of the following:
   a) American Specialties, Inc.; Model No. 0473-1A.
   b) Bradley Corporation; Model No. 4722-15.
   c) Substitutions: Section 01 6000 - Product Requirements.

C. Grab Bar Types T11, T11A, and T14:
1. Mounting: Flanges with concealed fasteners.
2. Material and Finish: Stainless steel, 0.05-inch (1.3-mm) thick; smooth, No. 4 (satin) finish.
3. Outside Diameter: 1-1/2 inches (38 mm).
4. Configuration and Length:
   a) Type T11: Horizontal, 36-inches long.
   b) Type T11A: Horizontal, 42-inches long.
   c) Type T14: Vertical, 18-inches long.
5. Basis-of-Design Product: Subject to compliance with requirements, Bobrick Washroom Equipment, Inc.; Model No. B-6806 Series Grab Bars, or one of the following:
   a) American Specialties, Inc.; Model No. 3800.
   b) Bradley Corporation; Model No. 812.
   c) Substitutions: Section 01 6000 - Product Requirements.

2.8 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Robe Hook Type T15: Double-prong unit; 0.031-inch (0.8-mm) stainless steel flange and support arm, 0.063-inch (1.6-mm) stainless steel concealed wall plate, 0.142-inch (3.6-mm) stainless steel cap; No. 4 (satin) finish.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; Model No. B-6727 Double Robe Hook or one of the following:
   a) American Specialties, Inc.; Model No. 7345.
   b) Bradley Corporation; Model No. 9125.

2.9 DIAPER CHANGING STATIONS

A. Diaper Changing Station Type T22: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
1. Material: Polyethylene with stainless steel exteror finish.
2. Mounting: Surface.
3. Color: As selected.
4. Minimum Rated Load: 250 pounds (113.4 kg).
5. Basis-of-Design Product: Subject to compliance with requirements, Koala Kare Products, a Division of Bobrick; Model No. KB110-SSWM, or one of the following:
   a) American Specialties, Inc.; Model No. 9013-9.
   b) Bradley Corporation; Model No. 962-11.
   c) Substitutions: Section 01 6000 - Product Requirements.

2.10 UTILITY ROOM ACCESSORIES

A. Utility Shelf Type T20: 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 3/4 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.

1. Length: As indicated on drawings.
2. Depth: 5-inches at scrub sinks, and 8-inches at janitor closets.
3. Basis-of-Design Product (5-inch depth): Subject to compliance with requirements, Bobrick Model No. B-295 Stainless Steel Utility Shelf or comparable product by one of the following:
   a) American Specialties, Inc.; Model No. 0692-5XX.
   b) Bradley Corporation; Model No. 755.
4. Basis-of-Design Product (8-inch depth): Subject to compliance with requirements, Bobrick Model No. B-298 Stainless Steel Utility Shelf or comparable product by one of the following:
   a) American Specialties, Inc.; Model No. 0692-8XX.
   b) Bradley Corporation; Model No. 758.

B. Combination Utility Shelf/Mop and Broom Holder Type T21: 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
1. Hooks: Two, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
2. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
3. Size: 34 inches (864 mm) long by 8 inches (203 mm) deep.
4. Basis-of-Design Product: Subject to compliance with requirements, Bobrick Model No. B-239 x 34 Utility Shelf with Mop/Broom Holders and Rag Hooks or comparable product by one of the following:
   a) American Specialties, Inc.; Model No. 1308.
   b) Bradley Corporation; Model No. 9933.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
1. See Drawing Sheet A701 - Typical Mounting Heights.

3.4 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10 2800

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SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.2 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers 2022.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.4 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Size: 10 pound (4.54 kg).
   3. Size and classification as scheduled.
   4. Finish: Baked polyester powder coat, color as selected.
   5. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 95 degrees F (35 degrees C).

2.2 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.
   1. Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

B. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.
   2. Trim: Flat square edge, with 1-1/2 inch (38 mm) wide face.
   3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge.

D. Door Glazing: Tempered glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

H. Finish of Cabinet Interior: White colored enamel.

2.3 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, as indicated on drawings

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

END OF SECTION 10 4400

SECTION 10 5129 - PHENOLIC LOCKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Phenolic lockers.

1.2 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan.

D. Samples: Submit two samples 3 by 6 inches (75 by 150 mm) in size, of each color scheduled.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Phenolic Lockers:
   1. ASI Storage Solutions: www.asi-storage.com/#sle.
   2. Columbia Lockers, a division of PSiSC; Phenolic Lockers: www.psisc.com/#sle.
   3. Grid; Club Lockers - Phenolic: www.builtbygrid.com/#sle.
   4. List Industries, Inc: www.listindustries.com/#sle.
   5. Summit Lockers, Inc: www.summitlockers.com/#sle.

2.2 LOCKER APPLICATIONS

A. Student Lockers: Phenolic lockers, wall mounted for base indicated on drawings.
   1. Accessibility: Comply with ICC A117.1 and ADA Standards.
   2. Width: 9 inches (229 mm).
   3. Depth: 12 inches (305 mm).
   4. Height: 72 inches (1830 mm).

5. Locker Configuration: Two tier.
6. Fittings: Size and configuration as indicated on drawings.
   a) Hooks: Two double prong.
7. Ventilation: By open space between the back of the door and locker body.
8. Locking: Padlock hasps.

2.3 PHENOLIC LOCKERS

A. Lockers: Factory assembled, made of phenolic core panels with mortise and tenon joints and stainless steel mechanical joint fasteners; fully finished inside and out; each locker capable of standing alone.
   1. Doors: Full overlay, covering full width and height of locker body; square edges.
   2. Panel Core Exposed at Edges: Machine polished, without chips or tool marks; square edge unless otherwise indicated.
   3. Where locker ends or sides are exposed, finish the same as fronts or provide extra panels to match fronts.
   4. Provide filler strips where indicated, securely attached to lockers.
   5. Color: As indicated in the Finish Product List on drawings.
   6. Fasteners for Accessories and Locking Mechanisms: Tamperproof type.

B. Component Thicknesses:
   1. Doors: 1/2 inch (13 mm) minimum thickness.
   2. Locker Body: One of the following combinations:
      a) Tops, bottoms, and shelves 1/2 inch (13 mm); sides 3/8 inch (10 mm); backs 1/4 inch (6 mm); minimum.
   3. End Panels and Filler Panels: 1/2 inch (13 mm) minimum thickness.
   4. Sloped Tops: 1/2 inch (13 mm) minimum thickness.
   5. Toe Kick Plates: 1/2 inch (13 mm) minimum thickness.

C. Phenolic Core Panels: Nonporous phenolic resin and paper core formed under high pressure, with natural colored finished edges, integral melamine surface, matte finish, and uniform surface appearance; glued laminated panels not acceptable.
   1. Surface Burning Characteristics: Flame spread index of 75 or less, and smoke developed index of 450 or less; when tested in accordance with ASTM E84.

D. Hinges: Stainless steel, satin finish; minimum of 180 degree opening; either exposed barrel 5-knuckle hinge attached to back of door and inside of body with tamperproof screws, or concealed cabinetwork style hinge attached with tamperproof screws.

E. Coat Hooks: Stainless steel or reinforced nylon; attached with tamperproof screws.

F. Number Plates: Manufacturer's standard, minimum 4-digit, permanently attached with adhesive; may be field installed.

G. Locks: Locker manufacturer's standard type indicated above.

H. Lock Strike: Stainless steel, or black high impact ABS plastic strike plate attached to locker body with throughbolts.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases and embedded anchors are properly sized.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared base.

C. Install lockers plumb and square.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds (445 N).

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install accessories.

H. Replace components that do not operate smoothly.

3.3 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION 10 5129

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SECTION 10 5605 - PEGBOARD WALL STORAGE SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pegboards.

B. Accessories.

1.2 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: For each type of product.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Uline; Steel Pegboard Model H-4293-GR.

B. Substitutions: See Section 01 6000 - Product Requirements.

C. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

2.2 PEGBOARDS

A. Steel pegboards with pre-drilled or punched holes in a staggered pattern, designed to accept removable pegboard accessories.
   1. Size: 48 inches wide by 24 inches high.
   2. Heavy-duty 20 gauge steel, 0.04-inches thick.
   3. Holes: 9/32-inch diameter holes, spaced 1-inch apart.
   4. Powder coated steel, color: Gray.
   5. Mounting: 3/4-inches from wall.

2.3 ACCESSORIES

A. Wire Basket: Model H-6452.
   1. Overall Size: 12 by 7-15/16 by 4 inches (W x D x H).
   2. Distance between Rod Ends: 8 inches.
   3. Wire Diameter: 0.184 inches (8 gauge).
   4. Zinc-plated finish.

5. Quantity: 2 per pegboard.

B. 43-Piece Pegboard Assortment Kit: Model H-2685.
   1. Kit Contents:
      a) 10 each of 3- and 5-inch straight hooks, 5-inch double straight hooks, 7/8-inch double-ring holders.
      b) 3 Multi-prong holders.
   2. Zinc-plated finish.
   3. Quantity: 1 kit per pegboard.

C. Fasteners: Screws and anchors, as recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Install pegboards in accordance with manufacturer's written instructions.

B. Deliver 1 set of accessories per pegboard to Owner.

3.3 PROTECTION

A. Protect installed pegboards from subsequent construction operations.

END OF SECTION 10 5605

SECTION 12 2400 - WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior manual roller shades.

B. Interior motorized roller shades.

C. Motor controls.

1.2 REFERENCE STANDARDS

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2019.

D. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

E. WCMA A100.1 - Safety of Window Covering Products 2018.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
   2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

C. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
   1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.

D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.

E. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.

F. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.

G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.
   1. Manufacturer's authorized representative.
   2. Factory training and demonstrated experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.7 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. See Section 01 7700 - Closeout Procedures, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Electric Motors: One year.
   3. Electronic Control Equipment: One year.
   4. Fabric: One year.
   5. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Basis of Design: As indicated in the Finish Product List on drawings.

B. Interior Motorized Roller Shades, Motors and Motor Controls:
   1. Basis of Design: As indicated in the Finish Product List on drawings.

C. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.
   3. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
      a) Comply with NFPA 70.
      b) Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.
      c) Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view; fully compatible with controls to be installed.

B. Roller Shades Type RS1, RS3:
   1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
      a) Drop Position: Regular roll.
      b) Roll Direction: Roll down, closed position is at window sill.
      c) Mounting: As indicated on drawings.
      d) Size: As indicated on drawings.
      e) Fabric: As indicated under Shade Fabric article.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   3. Roller Tubes: As required for type of shade operation.
      a) Material: Extruded aluminum, clear anodized finish.
      b) Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c) Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
      d) Take-Up Roller: Manufacturer's standard roller tube pretensioned for winding lift cable in bottom-up type shades.
   4. Hembars: Designed to maintain bottom of shade straight and flat.
      a) Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.

5. Manual Operation for Interior Shades:
   a) Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
   b) Drive Chain: Continuous loop beaded ball chain, 95 pounds (43 kg) minimum breaking strength. Provide upper and lower limit stops.
   c) Shade Lift Assistance: Manufacturer's standard spring device contained in the idler end of roller tube to reduce force required to lift shades; as required based on shade weight.
   d) Chain Retainer:
      1) Chain tensioning device complying with WCMA A100.1.
6. Accessories:
   a) Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
   b) End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.
   c) Lifting Cables: Nylon coated cable for lifting bottom-up type shades.
   d) Fasteners: Noncorrosive, and as recommended by shade manufacturer.

C. Roller Shades Type RS2:
1. Description - Interior Roller Shades: Single roller, motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
   a) Drop Position: Regular roll.
   b) Roll Direction: Roll down, closed position is at window sill.
   c) Mounting: As indicated on drawings.
   d) Size: As indicated on drawings.
   e) Fabric: As indicated under Shade Fabric article.
2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   a) Material: Stamped steel.
3. Roller Tubes: As required for type of shade operation.
   a) Material: Extruded aluminum, clear anodized finish.
   b) Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
   c) Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
   d) Take-Up Roller: Manufacturer's standard roller tube pretensioned for winding lift cable in bottom-up type shades.
4. Hembars: Designed to maintain bottom of shade straight and flat.
   a) Style: Exposed aluminum bottom bar, flat profile with closed ends; clear anodized finish.
   b) Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
5. Manual Operation for Interior Shades:
   a) Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
   b) Drive Chain: Continuous loop beaded ball chain, 95 pounds (43 kg) minimum breaking strength. Provide upper and lower limit stops.
   c) Shade Lift Assistance: Manufacturer's standard spring device contained in the idler end of roller tube to reduce force required to lift shades; as required based on shade weight.

d) Chain Retainer:
1) Chain tensioning device complying with WCMA A100.1.

6. Accessories:
a) Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
1) Color: As indicated in the Finish Product List on drawings.
2) Profile: Square.
b) End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.
c) Lifting Cables: Nylon coated cable for lifting bottom-up type shades.
d) Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.3 SHADE FABRIC

A. Fabric for RS1, RS2, & RS3: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
1. Manufacturers:
a) Basis of Design: As indicated in the Finish Product List on drawings.
2. Material: Vinyl coated polyester.
3. Performance Requirements:
a) Flammability: Pass NFPA 701 large and small tests.
b) Fungal Resistance: No growth when tested according to ASTM G21.
4. Openness Factor: As indicated in the Finish Product List on drawings.
5. Color: As indicated in the Finish Product List on drawings.
6. Fabrication:
a) Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.

2.4 MOTOR CONTROLS

A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

B. Provide all components and connections necessary to interface with other systems as indicated.

C. Digital Network Controls:
1. Intelligent Motors and Devices: Identifiable over network without separate interface.
2. Provide suitable interface modules as indicated or as required for connection to standard (nonintelligent) motors and devices.
3. Capable of reprogrammed control without requiring wiring modifications.
4. Capable of assigning shade motors to shade groups/sub-groups.
5. Capable of storing programmable open and close limits and minimum of three intermediate preset stop positions for each shade.
6. Capable of aligning adjacent shades within accuracy of plus/minus 0.25 inch (6.4 mm).
7. Provide 10 year nonvolatile power failure memory for system configuration settings.

D. Manual Controls:
1. Control Functions:
a) Open: Automatically open controlled shade(s) to fully open position when button is pressed.

b) Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
c) Presets: For selection of predetermined shade positions.

2. Wall Controls: Provided by shade manufacturer.
a) Finish: To be selected by Architect.
b) Button Engraving: Custom engraving to be selected by Architect.

2.5 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
3. Horizontal Dimensions - Outside Mounting: Cover window frames, trim, and casings completely.

C. Dimensional Tolerances: As recommended in writing by manufacturer.

D. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.4 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.5 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.6 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

D. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.7 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION 12 2400

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SECTION 12 3600 - COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters and vanity tops.

1.2 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework.

1.3 REFERENCE STANDARDS

A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications 2016.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.

F. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

G. PS 1 - Structural Plywood 2009 (Revised 2019).

1.4 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Installer's qualification statement.

H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet, Type PL2: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
      a) Manufacturers:
         1) Basis of Design: As indicated in the Finish Product List on drawings.
      b) Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c) Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
      d) Laminate Core Color: Same as decorative surface.
      e) Finish: Matte or suede, gloss rating of 5 to 20.
      f) Surface Color and Pattern: As indicated in the Finish Product List on drawings.
   2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch (32 mm) thick; covered with matching laminate.
   3. Back and End Splashes: Same material, same construction.

4. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.

C. Solid Surfacing Countertops (SOSF1, SOSF2): Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a) Manufacturers:
         1) Basis of Design: As indicated in the Finish Product List on drawings.
      b) Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c) Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
      d) Color and Pattern: As indicated in the Finish Product List on drawings.
   3. Other Components Thickness: 1/2 inch (12 mm), minimum.
   4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge.
   5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
   6. Skirts: As indicated on drawings.
   7. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.2 MATERIALS

A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

B. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.

C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

D. Joint Sealant: Mildew-resistant silicone sealant, white.

2.3 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3,657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).

C. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.5 CLEANING

A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 12 3600

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SECTION 12 5220 - UPHOLSTERED SEAT CUSHIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Seat Cushions.

1.2 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Samples:
   1. Fabric: Submit minimum 12 inch long length of each type of fabric, from same bolt/dye lot as fabric proposed for the work.
   2. Cushions: One half scale seat cushion, fully assembled.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

PART 2 PRODUCTS

2.1 MATERIALS

A. Foam: Urethane; densities as specified.

B. Fabric (FR): As indicated in the Finish Product List on drawings.

2.2 FABRICATION

A. Fabricate cushions to the shapes indicated:
   1. Seat Cushion: 3 inch thick 2.7# density ILD (Indent Load Deflection). 43 foam core with 1 inch thick 1.8# density ILD 35 foam topping for 4 inch overall cushion thickness.
   2. Seat Back: 1.8 - 2.0# density; ILD 24-28, or approved; 3 inch thickness.

B. Wrap foam cushions fully in 1/2 oz. Dacron meeting fire regulations.

C. Fabricate for tight fit between cushions and adjacent construction.

D. Sew cushion fabric covers with bull nose finish; no welts; non reversible design unless otherwise indicated on the drawings. Provide heat resistant zipper along length of cushion at back side.

E. Sew loop portions of woven nylon hook and loop ("Velcro") fastener section to align with hook sections mounted to substrate.

F. Install covers to cushions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION

A. Adhere hook portion of hook and loop fastener sections to substrates.

B. Tightly and evenly fit cushions in position, secure hook and loop fasteners.

END OF SECTION 12 5220

SECTION 12 9233 - INTERIOR PLANTERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior planters.

1.2 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, and maintenance information.

C. Samples: Submit two sets of manufacturer's available colors for fiberglass planters.

1.3 WARRANTY

A. See Section 01 7700 - Closeout Procedures, for additional warranty requirements.

B. Provide manufacturer’s warranty against defects in materials or workmanship for fiberglass planters for a period of 5 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fiberglass Planters:
   1. Basis of Design: Garden Artisans LLC; Fiberglass Cube Planter 39" - Hammered Aluminum: www.gardenartisans.com.

2.2 FIBERGLASS PLANTERS

A. Planters: Fiberglass.
   1. Shape: Square.
   2. Length: 39 inches (1000 mm).
   3. Width: 39 inches (1000 mm).
   4. Height: 39 inches (1000 mm).
   5. Finish: Hammered Aluminum.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide level mounting surfaces for interior planters.

END OF SECTION 12 9233

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SECTION 14 0125 - ELEVATOR CAB RENOVATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Renovations to existing elevator cab.

B. Selective demolition of existing elevator cab fiiishes.

1.2 REFERENCE STANDARDS

A. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices 2019, with Errata (2021).

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. PS 1 - Structural Plywood 2009 (Revised 2019).

G. UL (DIR) - Online Certifications Directory Current Edition.

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
   1. Reflected ceiling plan showing panel layout and location of downlights.
   2. Electrical characteristics and connection requirements.

C. Samples: Submit samples illustrating car interior finishes in the form of physical samples.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

PART 2 PRODUCTS

2.1 SCOPE

A. Suspended Ceiling:
   1. Construct from 5/8 inch thick, minimum, plywood core materials, faced and edged with stainless steel, No. 4 finish, of sufficient thickness to avoid warping, wrinkles and oil canning. Cover the top of each panel with plastic laminate to stabilize the panel against warping or sagging.
   2. Divide the ceiling into six panels, as indicated on drawings.
   3. Provide concealed suspension system, with flush joints between panels.

B. Lighting:
   1. Provide six (6) LED type down lights, centered in each ceiling panel.
   2. The lighting shall include one (1) control module for operation of the cab lighting, and emergency cab lighting system. Operate at least three of the normal down lights on emergency power supply.
   3. The down lights shall have silver colored rims on the lights. LED lighting shall be type 4100K neutral white. The lighting power supplies shall be adjustable to vary the lighting level, as desired by Owner.

2.2 PERFORMANCE REQUIREMENTS

A. Perform electrical work in accordance with NFPA 70.

2.3 EMERGENCY POWER

A. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.

2.4 MATERIALS

A. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish.

B. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

C. Plywood: PS 1, Structural I, Grade C-D or better, sanded.

D. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.5 CAR EQUIPMENT AND MATERIALS

A. Elevator Car:
   1. Ceiling:
      a) Concealed Frame Suspended Ceiling: Stainless steel, mount at height matching removed ceiling below car canopy with 1-1/2 inch (38 mm) nominal space between edge of ceiling and wall.
      b) Panel Finish: No. 4 Brushed stainless steel.
      c) Lighting: LED down lights.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting this work.

3.2 PREPARATION

A. Remove existing cab ceiling assembly.

3.3 INSTALLATION

A. Install system components, and connect equipment to building utilities.

3.4 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components in accordance with manufacturers written instructions.

3.5 PROTECTION

A. Do not permit construction traffic within car after cleaning.

B. Protect installed products until Date of Substantial Completion.

C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

END OF SECTION 14 0125

SECTION 21 0400 - GENERAL CONDITIONS FOR FIRE PROTECTION TRADES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

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

B. This section applies to certain sections of Division 26, "Electrical," and this section applies to all sections of Division 21, "Fire Protection" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades (Architectural, Structural, Landscape, Civil, Mechanical, Plumbing, Electrical, Communications and Fire Alarm) shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

1.2 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division. Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

1.3 INTENT

A. It is the intent of the Specifications and Drawings to call for finished work, tested and ready for operation.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section includes the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

1.4 DEFINITIONS

A. "Approved equal" also known as "alternative" mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

B. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

C. "Finished" refers to all rooms and areas to be specified to receive architectural treatment as indicated on the drawings. All rooms and areas not covered, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

D. "Furnish" or "supply" shall mean purchase, deliver to, and off-load at the job site, ready to be installed including where appropriate all necessary interim storage and protection.

E. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

F. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

G. "Install" shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

H. "Lead Free" shall mean not more than .25% in the wetted surface area.

I. "Product" shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

J. "Provide" shall mean furnish (or supply) and install as necessary.

K. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

L. Remove: The term “remove” means “to disconnect from its present position, remove from the premises and to dispose of in a legal manner.”

M. Special Warranties: The term “Special Warranties” are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

N. Standard Product Warranties: The term “Standard Product Warranties” are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

O. “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Fire Protection Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

P. Substitutions: Requests for changes in products, materials, equipment, and methods of construction proposed by the Contractor are considered requests for "substitutions."

Q. “Wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

1.5 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

B. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

C. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

D. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

1.6 SURVEYS AND MEASUREMENTS

A. Before submitting his Bid, the Contractors shall visit the site and become thoroughly familiar with all existing conditions under which work will be installed. This Contract includes all modifications of existing systems required for the installation of new equipment. This Contract includes all necessary offsets, transitions and modifications required to install all new equipment in existing spaces. All new and existing equipment and systems shall be fully operational under this Contract before the job is considered complete. The Contractors shall be held responsible for any assumptions he makes, any omissions or errors he makes as a result of his failure to become fully familiar with the existing conditions at the site and the Contract Documents.

B. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.7 CODES AND STANDARDS

A. Reference Standard Compliance
1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.
2. Independent Testing Organization Certificate: In lieu of the label or listing indicated above, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. The Following Codes and Standards listed below apply to all Fire Protection work. Wherever Codes and/or Standards are mentioned in these Specifications, the latest applicable edition or revision shall be followed:
Building Code Including all Supplements

Fire Safety Code Including all Supplements

Construction Standards and Guidelines

The International Building Code

The International Mechanical Code

The International Fire Protection Code

The International Energy Conservation Code

NFPA 13, Standard for Installation of Sprinkler Systems

NFPA 70, the National Electrical Code

NFPA 101, the Life Safety Code

ASHRAE 90.1 and International Energy Conservation Code

C. The following Standards shall be used where referenced by the following abbreviations:

AIA	American Institute of Architects
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society of Testing and Materials
AWS	American Welding Society
CISPI	Cast Iron Soil Pipe Institute
EJMA	Expansion Joint Manufacturing Association
EPA	Environmental Protection Agency
FM	Factory Mutual
FSSC	Federal Specification
HIS	Hydraulic Institute Standards
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
ISO	Insurance Services Office
NEMA	National Electrical Manufacturers Association

NFPA	National Fire Protection Association
NSC	National Safety Council
OSHA	Occupational Safety and Health Administration
UL	Underwriters' Laboratories

D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.8 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.9 EQUIPMENT SUBSTITUTIONS

A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of workmanship, finish and design that is required. If the Contractors uses an "approved equal" alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.

B. Where one name only is used and is followed by the words "or approved equal", the Contractor must use the item named or he is required to apply for a substitution. Where one name only is used, the Contractor must use that item named.

C. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

D. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical,

plumbing, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.

E. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer's equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

F. If an alternative or substitute item results in a difference in quantity and arrangement of piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.

G. .Equipment, material or devices submitted for review as an "equivalent" shall meet the following requirements:
   1. The equivalent shall have the same construction features such as, but not limited to:
      a. Material thickness, gauge, weight, density, etc.
      b. Welded, riveted, bolted, etc., construction
      c. Finish, undercoating, corrosion protection
   2. The equivalent shall perform with the same or better operating efficiency.
   3. The equivalent shall be locally represented by the manufacturer for service, parts and technical information.
   4. The equivalent shall bear the same labels of performance certification as is applicable to the specified item, such as UL or NEMA labels.

H. Equipment, material or devices submitted for review as a "substitution" shall meet the following requirements:
   1. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.
   2. Submit three (3) copies of each request for substitution for consideration.
   3. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
      a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.

b. Samples, where applicable or requested.

c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.

e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

f. Cost information, including a proposal of the net change, if any in the Contract Sum.

g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.

i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

    1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.

    2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

    3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.10 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 01 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
   1. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
   2. If an intermediate submittal is necessary, process the same as the initial submittal.
   3. Allow two weeks for reprocessing each submittal.
   4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Submittals shall be arranged in order of specification sections.
   1. Include the following information on the label for processing and recording action taken.
      a. Project name.
      b. Date.
      c. Name and address of Engineer.
      d. Name and address of Contractor.
      e. Name and address of subcontractor.
      f. Name and address of supplier.
      g. Name of manufacturer.
      h. Number, title and paragraph of appropriate Specification Section.
      i. Drawing number and detail references, as appropriate.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the

form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

F. Except for submittals for record, information or similar purposes, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.

1.11 SHOP DRAWINGS

A. Submit neatly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated sprinkler layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review copies of all shop drawings to be incorporated in the Fire Protection Contract. Refer to Division 01 for the quantity of copies required for submission. Where quantities are not specified, provide seven (7) copies for review.

C. Provide shop drawings for all devices specified under equipment specifications for all systems. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures), of all shop drawings, performance cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. When a submittal could involve more than one trade, e.g., valves, piping, etc., the submitted shall be separated by traded involved, ie. HVAC, plumbing, electrical, etc.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

F. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

G. "No Exception Taken" rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings. Review of shop drawings shall not apply to quantity of material.

H. After shop drawings have been reviewed, with no exceptions taken, no further changes will be allowed without the written consent of the Engineer.

I. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

J. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to Bidding to allow for issuance of an Addendum.

K. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.12 COORDINATION DRAWINGS

A. Prepare coordination drawings drawn in the latest AutoCAD or Revit version in accordance with Division 01 to a minimum scale of 1/4"=1'-0" detailing major elements, components, and systems of fire protection equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. The Contractor shall indicate the proposed locations of piping, conduit, ductwork, equipment, and materials. Include the following:
      a. Clearances for servicing and maintaining equipment and space for equipment disassembly required for periodic maintenance.
      b. Equipment connections and support details.
      c. Exterior wall and foundation penetrations.
      d. Fire-rated wall and floor penetrations.
      e. Sizes and locations of required concrete pads and bases.

B. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

D. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

E. The Contractor and each subcontractor shall sign and date each coordination drawing prior to submission.

F. Work shall not be performed until coordination drawings have been approved by the architect and engineer.

G. Electronic copies of the MEP floor plans are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. The cost for these floor plans is a lump sum fee of $ 1,000.00. If the Contractor elects to obtain the Engineers electronic files an Electronic Drawing File Release Form must be submitted with payment. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic Drawing File Release Form, and payment, the Engineer will provide copies of the electronic files for the Contractor's use. A copy of the Electronic Drawing File Release Form is appended to the end of this specification section.

1.13 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, HVAC piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

1.14 WORKMANSHIP

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory

service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled workmen, fitters, metal workers, welders, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of Fire Protection systems shall be performed by experienced, skilled tradesmen under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, workmanlike manner. The Engineer reserves the right to reject any work which, in his opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.15 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.

B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.16 TEMPORARY UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Utilities: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.

F. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

H. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.17 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, piping, heating, temperature control work, fire stopping, water heaters, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required to maintain existing systems operational or to accommodate the construction phasing of the project.

1.18 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or workmen and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by workmen or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.19 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer's recommendations and is operating as intended by the manufacturer.

1.20 CLEANING

A. The Contractor shall thoroughly clean and flush all piping and equipment of all foreign substances, oils, burrs, solder, flux, etc., inside and out before being placed in operation.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all pipes shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
   1. Remove labels that are not permanent labels.
   2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
   3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
   4. Wipe surfaces of fire protection equipment. Remove excess lubrication and other substances.

F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.21 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or the Owner’s representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) days notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer's representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. The following equipment will require this inspection: pumps; controls, water heaters, compressors, boilers etc. These letters shall be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.

F. Demonstration shall be recorded on (2) USB Flash drives and be turned over to the Owner.

1.22 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 01 and as follows. The Contractor shall prepare six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information and designation partitions with identification tabs. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing and operating instructions including lubrication charts and schedules.
5. Emergency and safety instructions.
6. Spare parts list.
7. Copies of warranties.
8. Wiring diagrams.
9. Recommended "turn around" cycles.
10. Inspection procedures.
11. Approved Shop Drawings and Product Data.
12. Equipment Start-up Reports.

C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.

1.23 ACCEPTANCES

A. The equipment, materials, workmanship, design and arrangement of all work installed under the Fire Protection Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Fire Protection Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Fire Protection Sections. The intent to use the exact manufacturers and models specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of award of the Contract. In such instances, equipment substitutions may be made pending acceptance by the Engineer or the Owner's representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Fire Protection Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.24 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Items to be indicated include but are not limited to:

1. Dimensional change
2. Revision to drawing detail
3. Location and depth of underground utility
4. Revision to pipe routing
5. Revision to electrical circuitry
6. Actual equipment location
7. Pipe size and routing
8. Location of concealed internal utility
9. Changes made by Change Order
10. Details not on original Contract Drawing
11. Information on concealed elements which would be difficult to identify or measure later

C. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

D. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

E. Note related Change Order numbers where applicable.

F. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

G. Final record documents shall be prepared in the latest AutoCAD or Revit version and CD Rom of all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.25 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties are to be included:
1. General close-out requirements included in Division 01.
2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions-02 through -50.
3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.26 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.
   1. Refer to individual Sections of Divisions-02 through -50 for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
   1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the installer.
   2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.
   3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.27 GUARANTEES

A. The Contractor shall guarantee all material and workmanship under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner. During this guarantee period, all defects developing through faulty equipment, materials or workmanship shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineer's satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided.

1.28 PROJECT CLOSE-OUT

A. Contractor shall submit annual maintenance proposal to the Architect/Engineer for review and approval as part of the close out documents.

B. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents in accordance with Division 01.

C. Deliver tools, spare parts, extra stock, and similar items.

D. Complete start-up testing of systems, including measuring and documenting all required startup checklist requirements documented in installation and maintenance instructions by the equipment manufacturer, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

E. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

F. Field Observation Procedures: On receipt of a request for an Engineers Field Observation, the Engineer will advise the Contractor of unfulfilled requirements. The Engineer will advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Engineer will repeat the Field Observation when requested and assured that the Work has been substantially completed.
2. Results of the completed list of unfulfilled items will form the basis of requirements for final acceptance.

END OF SECTION 21 0400

Electronic Drawing File Release Form

DELIVERY OF ELECTRONIC FILES FOR: _____
Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys' fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____ _____
Client's Signature Date

_____
Company - Title

_____ _____
Architects' Signature Date

_____
Firm - Title

_____ _____
Owner's Signature Date

_____
Company - Title

SECTION 21 0500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes pipe, fittings, valves, backflow preventers and connections for sprinkler systems.

B. Related Sections:
1. Division 01- General Requirements
2. Division 03 - Concrete.
3. Division 09 - Finishes.
4. Division 21 – Fire Protection.
5. Section 23 04 00 – General Conditions for Mechanical Trades

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
2. ASME B16.3 – Malleable Iron Threaded Fittings, Class 150 and 300.
3. ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
4. ASME B16.5 - Pipe Flanges and Flanged Fittings
5. ASME B16.9 – Factory-made Wrought Steel Butt Welding Fittings.
6. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
7. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
8. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
9. ASME B16.25 – Butt Welding Ends.
10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
11. ASME Sec 9 - Welding and Brazing Qualifications.

B. ASTM International:
1. ASTM A47 – Malleable Iron Castings.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
4. ASTM A126 – Standard for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
5. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
6. ASTM A536 – Standard for Ductile Iron Casting.
7. ASTM A795 - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

8. ASTM B32 - Standard Specification for Solder Metal.
9. ASTM B75 - Standard Specification for Seamless Copper Tube.
10. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
11. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
12. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
14. ASTM F442 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
15. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.
3. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.

D. American Water Works Association:
1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
4. AWWA C510 – Standard for Double Check Valve Backflow Prevention Assembly.
5. AWWA C511 – Standard for Reduced Pressure Principal Backflow Prevention Assembly.
6. AWWA C606 – Standard for Grooved and Shouldered Joints.

E. National Fire Protection Association:
1. NFPA 10 - Portable Fire Extinguishers.
2. NFPA 13 - Installation of Sprinkler Systems.
3. NFPA 13D – Installation of Sprinkler Systems in One and Two Family Dwellings and Mobile Homes
4. NFPA 13R – Standard for Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height.
5. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.
6. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.

F. Underwriter Laboratories, Inc.:
1. UL 1887 - Fire Tests of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.
2. UL - Fire Resistance Directory.

G. Factory Mutual:
   1. FM - Factory Mutual Approval Guide.

1.3 SUBMITTALS

A. Division 01 - General Requirements.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Product Data: Submit manufacturer's catalogue information. Provide data on valves, and fittings, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

D. Grooved joint couplings and fittings shall be shown on shop drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series designation.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and all code requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - General Requirements.

B. Project Record Documents: Record actual locations of components and tag numbering.

C. Operation and Maintenance Data: Submit spare parts lists.

1.5 QUALITY ASSURANCE

A. Workmanship and Qualifications: All materials and equipment shall be installed in accordance with NFPA and all applicable local codes and ordinances. The Sprinkler Contractor shall be state licensed to install sprinkler systems. The Sprinkler Contractor shall make sure that all work and materials conform to the requirements set forth by this Specification. Fire protection equipment shall be installed to conform to NFPA as applicable, and devices used shall be listed and approved by Underwriters laboratories (UL) and/or Factory Mutual (FM).

B. Codes and Standards: All work shall be equal or superior to that required by codes, regulations, ordinances, and laws imposed by the jurisdictional authorities, including those of the State, State Fire Marshall, local ordinances, Underwriter's Requirements and OSHA. Nothing in the Specifications permit violations of such directives, and where conflict occurs, the directive shall govern, except where superior work is specified or indicated.

C. In addition to complying with the above codes and regulations, comply with the requirements of the following:

1. NFPA Standard 13.
2. NFPA Standard 25
3. NFPA Standard 72.
4. State Building and Fire Codes.
5. Local Jurisdictional Authorities.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. Valves: Bear UL and/or FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

F. All items of similar class shall be the products of the same manufacturer. All valves, accessory items, etc., shall be from the same source.

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 five years documented experience.

1.7 PRE-INSTALLATION MEETINGS

A. Division 01 - General Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - General Requirements.

B. Deliver and store valves in shipping containers, with labeling in place.

C. Furnish cast iron and steel valves with temporary protective coating.

D. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. All equipment, valves, gages and etc., shall be covered and protected during the execution of the work. All equipment and piping shall be protected from freezing. Labeling to remain in place.

F. All unloading, hauling, and handling of materials shall be the responsibility of the Sprinkler Contractor.

G. The Sprinkler Contractor can obtain information on available storage space on site from the Owner when making examination of the site.

1.9 WARRANTY

A. Division 01 - General Requirements.

1.10 EXTRA MATERIALS

A. Division 01 - General Requirements.

B. Furnish two sets of valve stem packing for each size and type of valve installed.

PART 2 PRODUCTS

2.1 VALVES

A. Manufacturers:
1. Kennedy Valve Mfg. Co.
2. Victaulic.
3. Stockham.
4. Nibco.
5. Watts.
6. Hammond.
7. Milwaukee.
8. Substitutions: Division 01 - General Requirements.

B. Gate Valves:
1. Up to and including 2 inches: Bronze body and trim, 175 lb, cold water non-shock working pressure, rising stem, hand wheel, solid wedge or disc, threaded ends.
2. Over 2 inches: Iron body, bronze trim, 175 lb, cold water non-shock working pressure, rising stem pre-grooved for mounting tamper switch, hand wheel, outside screw and yoke, solid taper bronze or cast iron wedge, grooved or flanged ends.
3. Over 4 inches: Iron body, bronze trim, 175 pound cold water, non-shock working pressure. Valve shall have solid taper wedge; outside screw and yoke, rising stem; flanged bonnet with body and bonnet conforming to ASTM A126 Class B; replaceable bronze wedge facing rings; grooved or flanged ends; and a packing assembly consisting of a cast iron gland flange, brass gland, packing, bonnet and bronze bonnet bushing. Valve shall be capable of being repacked under pressure, with valve wide open.

C. Globe Valves:
1. Up to and including 2 inches: Class 125, Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable rubber disc, threaded ends, with back seating capacity, packable under pressure.

2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

D. Angle Valves:
1. Up to and including 2 inches: Class 125, Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable rubber disc, threaded ends, with back seating capacity, packable under pressure.
2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

E. Ball Valves:
1. Up to and including 2 inches: Bronze two piece body, standard port, chrome plated brass ball, 316 stainless steel stem, teflon seats brass stem nut, die-cast brass gear box with supervisory switches, threaded or grooved ends.
2. Over 2 inches: Manufacturers: Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle.

F. Butterfly Valves:
1. Ductile iron body, ductile iron disc with EPDM disc coating and integrally cast stem, grooved ends.
2. Cast bronze body, ductile iron disc with EPDM disc coating and integrally cast stem, copper-tubing dimensioned grooved ends.
3. Cast iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck with 316 stainless steel stem, MSS-SP-67, 200 psi.
4. Disc: EPDM coated ductile iron or Aluminum bronze.
5. Operator: Notched plate lever handle, Handwheel and Weatherproof Actuator with supervisory switches.

G. Check Valves:
1. Up to and including 2 inches: Class 125, Bronze swing disc, screwed ends.
2. Horizontal Swing Over 2 inches:
   a. 300 psi CWP, ductile iron body and coupled cap conforming to ASTM A536, Grade 65-45-12; horizontal swing, with stainless steel disc, elastomer seat, and grooved ends.
   b. Class 175, cast iron body and bolted cap conforming to ASTM A126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends.
   c. Valve shall be capable of being refitted while the valve remains in line.
3. Spring Actuated Over 2 inches:
   a. 300 psi CWP, ductile iron body conforming to ASTM A536, Grade 65-45-12; vertical or horizontal check; with stainless steel spring and shaft.
      1) 2-1/2 (65 mm) and 3 inches (75 mm): Aluminum bronze disc with disc mounted elastomer seal and PPS (Polyphenylene Sulfide) coated seat.
      2) 4 inches (100 mm) and Larger: Elastomer coated ductile iron disc with welded-in nickel seat.

H. Drain Valves:

1. Compression Stop: Bronze with hose thread nipple and cap.
2. Ball Valve: Brass with cap and chain, 3/4 inch hose thread.

I. All valves shall be either UL listed or FM approved for use on fire protection systems.

2.2 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp or Angle ring.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate work of this Section with other affected work.

B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

C. Remove scale and foreign material, from inside and outside, before assembly.

D. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION – GENERAL

A. Install in accordance with manufacturer’s instructions.

B. The Contractor shall maintain a clean and orderly site during the installation of the sprinkler system. Materials shall not be stored in the halls or other public areas.

C. Cutting, welding and other hot work shall not be permitted without permission from the building owner. Contractor shall provide a fire watch for one hour after all welding.

D. The required tests shall be witnessed by the Fire Marshall, authority having jurisdiction, Owner's insurance underwriter and Architect/Engineer.

E. Pipe Hangers and Supports:
1. Install in accordance with NFPA 13.
2. Install hangers to with minimum 1/2 inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.

7. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.3 INSTALLATION – PIPE AND FITTINGS

A. Install piping in accordance with NFPA 13 for sprinkler systems.

B. Pipe and fitting shall be installed per the manufacture's installation requirements. The fire protection contractor shall furnish all materials necessary to meet these requirements including but not limited to hangers, support, insulation, shields, sleeves and power supplies.

C. Place piping in concealed spaces above finished ceilings unless noted otherwise.

D. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

E. Install piping to conserve building space, to not interfere with use of space and other work.

F. Pipe and fitting shall be installed per the manufacture's installation requirements. The fire protection contractor shall furnish all materials necessary to meet these requirements including but not limited to hangers, support, insulation, shields, sleeves and power supplies.

G. Group piping whenever practical at common elevations.

H. Install pipe sleeve at piping penetrations through partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Use Victaulic Style 77 or 75 couplings in accordance with Victaulic instructions for expansion and contraction of pipe.

J. Grooved joint couplings and fittings shall be installed in accordance with the manufacturer's written installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

K. Pitch piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

L. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 09 90 00.

M. Do not penetrate building structural members unless indicated.

N. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.

O. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

P. Provide dielectric fittings whenever joining two dissimilar metals.

Q. Provide surge restrainers on all end of branches and arm overs in excess of 12-inches.

3.4 INSTALLATION – VALVES

A. Install drain valves at main shut-off valves, low points of piping and apparatus.

B. All valves shall be accessible for operation and servicing. Provide access panels where required.

C. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

D. Install butterfly valves for shut-off or isolating service.

3.5 TESTING

A. Piping: The complete system shall be subject to a pressure test, and to such other tests as the authorities having jurisdiction may require. The pressure test shall be a hydrostatic pressure of 200 pounds per square inch for a period of two hours. The above ground

piping and attached appurtenances shall show no pressure loss or leaks, refer to NFPA Standard 13 Hydrostatic tests. Before applying specified test pressure, all air must be expelled from the system. All defects of whatever type shall be repaired or replaced to the satisfaction of the Owner and authorities having jurisdiction and at no additional cost to the Owner. Packing rings, special joint bolts, gaskets, and other material required for the proper installation of the pipe and fittings shall be provided. Testing shall be completed prior to permanent sealing of walls and partitions.

B. Leaks in mechanical joints shall be repaired by dismantling the joint, reassembling it, and tightening the bolts in the correct order. Leaks in screw or grooved joint shall be repaired by dismantling the joint and reassembling it. Attempting to repair leaks in joints by over tightening the bolts or fittings shall not be permitted.

C. Upon satisfactory completion of all tests, the Contractor shall submit three copies of the Standard Contractors Material and Test Certificate to the Owner.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Inserts:
1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Install hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.7 CLEANING

A. Division 01 - General Requirements.

B. Clean entire system after other construction is complete.

END OF SECTION 21 0500

SECTION 21 0516 - EXPANSION FITTINGS AND LOOPS FOR FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor, Subcontractors, and/or suppliers providing goods and services referenced in or related to this Section shall also be bound by the Related Documents identified in Division 01 Section "Summary."

1.2 SUMMARY

A. Section Includes:

1. Flexible pipe connectors.
2. Expansion joints.
3. Expansion compensators.
4. Pipe alignment guides.
5. Swivel joints.
6. Pipe anchors.

B. Related Sections:

1. Division 21 – Fire Protection.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.
2. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:

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

1.4 DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints. Submit shop drawings sealed by a registered professional engineer.

C. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

D. Design Data: Indicate criteria and show calculations. Submit calculations sealed by a registered professional engineer.

E. Manufacturer's Installation Instructions: Submit special procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Welders' Certificate: Include welders' certification of compliance with ASME Section IX. AWS D1.1.

H. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

C. Operation and Maintenance Data: Submit adjustment instructions.

1.7 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.

B. Perform Work in accordance with the Connecticut State Building Code and Connecticut State Fire Safety Code.

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.

C. Design expansion compensating system under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Connecticut.

1.9 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.11 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish one year manufacturer warranty for leak free performance of packed expansion joints.

1.12 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Supply two 12 ounce containers of packing lubricant and cartridge style grease gun.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Manufacturers:

1. Mason.

2. Metraflex.

3. Vibration Eliminator.

4. Substitutions: Section 01 60 00 - Product Requirements.

5. Inner Hose: Carbon Steel.

6. Exterior Sleeve: Double braided stainless steel.

7. Pressure Rating: 125 psig WSP and 450 degrees F.

8. Joint: Flanged.

9. Size: Use pipe-sized units.

10. Maximum offset: 3/4 inch on each side of installed center line.

2.2 EXPANSION JOINTS

A. Manufacturers:

1. Metraflex.

2. Mason.

3. Vibration Elimination.

4. Substitutions: Section 01 60 00 - Product Requirements.

5. Pressure Rating: 200 psig WOG and 250 degrees F.

6. Maximum Compression: 1-3/4 inch.

7. Maximum Extension: 1/4 inch.

8. Joint: Flanged.

9. Size: Use pipe sized units

10. Application: Steel piping 3 inch and smaller.

2.3 ACCESSORIES

A. Manufacturers:

1. Metraflex.

2. Mason.

3. Vibration Elimination.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

C. Swivel Joints:Fabricated steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install Work in accordance with ASME B31.9.

B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Refer to Section 21 05 48. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

D. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

E. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 21 05 00 for pipe hanger installation requirements.

F. Provide grooved piping systems with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation. Grooved piping systems need not be anchored.

G. Provide expansion loops as required.

3.2 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturers’ field services.

B. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION 21 0516

SECTION 21 0548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Seismic restraints for fire protection piping and equipment.
2. Certification of seismic restraint designs and installation supervision.
3. Certification of seismic attachment of housekeeping pads.

B. Related Sections:
1. Division 03 - Cast-In-Place Concrete: Execution requirements for placement of isolators in floating floor slabs specified by this section and product requirements for concrete for placement by this section.
2. Division 07 - Joint Protection: Product requirements for joint sealers specified for placement by this section.
3. Division 21 – Fire Protection.

1.2 REFERENCES

A. National Fire Protection Association
1. NFPA 13 – Standard for the Installation of Sprinkler Systems

1.3 PERFORMANCE REQUIREMENTS

A. Provide seismic restraints in accordance with the requirements of NFPA 13.

***** OR *****

B. Projects located in Seismic Design Category B shall be exempt from the requirements of this section. Verify Seismic Design Category with structural engineer.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:
1. Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
2. Provide all details of suspension and support for ceiling suspended equipment.
3. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for

installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.

4. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.

C. Product Data:
   1. Catalog cuts or data sheets on specific restraints detailing compliance with the specification.
   2. Detailed schedules of flexible and rigidly mounted equipment, showing seismic restraints by referencing numbered descriptive drawings.

D. Seismic Certification and Analysis:
   1. Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.
   2. All restraining devices shall have a preapproval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Preapprovals based on independent testing are preferred to preapprovals based on calculations. Where preapproved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 45° to the weakest mode.
   3. Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length.

E. Manufacturer's Responsibilities:
   1. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.
   2. Provide written certification that isolators meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of seismic restraints.

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 documented experience.

C. Design application of seismic restraints under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State where the Project is located.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All seismic restraints described in this section shall be the product of a single manufacturer

B. Provide products manufactured by one of the following:
1. Mason Industries
2. Vibration Eliminator
3. Vibro-Acoustics Ltd.
4. Metraflex Company

2.2 SEISMIC CABLE RESTRAINTS

A. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint.

B. Cables must be prestretched to achieve a certified minimum modulus of elasticity.

C. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement.

D. Cables must not be allowed to bend across sharp edges.

E. Cable assemblies shall have an Anchorage Preapproval “OPA” Number from OSHPD in the State of California verifying the maximum certified load ratings.

F. Cable assemblies shall be type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod nut and the clevis or SCBV if clamped to a beam, all as manufactured by Mason Industries, Inc.

2.3 SEISMIC SOLID BRACES

A. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint.

B. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment.

C. Seismic solid brace assembly shall have anchorage preapproval “OPA” number from OSHPD in the state of California verifying the maximum certified load ratings.

D. Solid seismic brace assemblies shall be type SSB, SSBS or SSRF as manufactured by Mason Industries, Inc.

2.4 SEISMIC ROD CLAMPS

A. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable.

B. Rod clamp assemblies shall have an Anchorage Preapproval “OPA” Number from OSHPD in the State of California.

C. Rod clamp assemblies shall be type SRC or UC as manufactured by Mason Industries, Inc.

2.5 CLEVIS CROSS BRACE

A. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt.

B. Clevis cross braces shall have an Anchorage Preapproval “OPA” Number from OSHPD in the State of California.

C. Clevis cross brace shall be type CCB as manufactured by Mason Industries, Inc.

2.6 STUD WEDGE ANCHORS

A. Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that is “rolled up” to create the thread.

B. The stud anchor shall also have a safety shoulder which fully supports the wedge ring under load.

C. The stud anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying its allowable loads.

D. Drill-in stud wedge anchors shall be type SAS as manufactured by Mason Industries, Inc.

2.7 FEMALE WEDGE ANCHORS

A. Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed.

B. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load.

C. Female wedge anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying to its allowable loads.

D. Drill-in female wedge anchors shall be type SAB as manufactured by Mason Industries, Inc.

2.8 STAINLESS STEEL HOSE

A. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" (75mm) and larger shall be flanged. Smaller sizes shall have male nipples. Minimum lengths shall be as tabulated:

Flanged

3" x 14" (75 x 350mm)	6" x 20" (150 x 500mm)	12" x 28" (300 x 700mm)
4" x 15" (100 x 375mm)	8" x 22" (200 x 550mm)	14" x 30" (350 x 750mm)
5" x 19" (125 x 475mm)	10" x 26" (250 x 650mm)	16" x 32" (400 x 800mm)

Male Nipples

1/2" x 9" (12 x 225mm)	11/4" x 12" (32 x 300mm)	2" x 14" (50 x 350mm)
3/4" x 10" (19 x 250mm)	11/2" x 13" (38 x 325mm)	21/2" x 18" (64 x 450mm)
1" x 11" (25 x 275mm)		

B. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible.

C. Hoses shall be type BSS as manufactured by Mason Industries, Inc.

2.9 FLEXIBLE EXPANSION LOOP

A. All sprinkler pipe passing through or crossing building seismic joints, shall contain a flexible expansion loop, designed for seismic movement.

B. Flexible loops shall impart no thrust loads to building structure.

C. Loops shall be located at, or near, the building seismic joint. Seismic bracing shall not pass through building seismic joint and shall not connect or tie together different sides or parts of building structure. Refer to architectural drawings for locations of building seismic joints.

D. Flexible loops shall be capable of movement in the X, Y, and Z planes.

E. All flexible loop connections to sprinkler piping shall be installed, inspected, and tested in accordance with current NFPA-13 standards.

F. Flexible loops shall consist of two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return. Loops shall include a factory supplied, center support nut located at the bottom of the 180 degree return, and a drain/air release plug. Materials of construction and end fitting type shall be consistent with pipe material and equipment/pipe connection fittings.

G. Alternatively, the flexible loop shall consist of two flexible sections of hose and braid, two 45 degree elbows, and 90 degree return. Loops shall include a factory supplied, center support nut located at the bottom of the 90 degree return, and a drain/air release plug. Materials of construction and end fitting type shall be consistent with pipe material and equipment/pipe connection fittings

H. Flexible expansion/seismic loops to be Metraloop Fireloop or Metraloop Firevoop as manufactured by The Metraflex Company, Chicago, IL.

I. Provide seismic breakaway hangers where recommended by the flexible expansion loop manufacturer. Seismic breakaway hanger shall be by the same manufacturer as the flexible expansion loop.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify equipment and piping is installed before work in this section is started.

3.2 INSTALLATION

A. All seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

B. Installation of seismic restraints must not cause any change of position of equipment or piping resulting in stresses or misalignment.

C. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractor’s expense.

D. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractor’s expense.

E. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:

1. Flanges of structural beams.
2. Upper truss cords in bar joist construction.
3. Cast in place inserts or wedge type drill-in concrete anchors.

F. Seismic cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.

G. Seismic cable assemblies are installed taut on non-isolated systems. Seismic solid braces may be used in place of cables on rigidly attached systems only.

H. At locations where seismic cable restraints or seismic solid braces are located, the support rods must be braced when necessary to accept compressive loads.

I. At all locations where seismic cable restraints or seismic solid braces are attached to pipe clevis's, the clevis cross bolt must be reinforced with a preformed heavy gauge channel cross brace.

J. Drill-in concrete anchors for ceiling and wall installation shall be stud wedge anchors or female wedge anchors for floor mounted equipment.

K. All fire protection piping shall be braced in accordance with NFPA 13 and 14.

END OF SECTION 21 0548

SECTION 21 1313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wet-pipe sprinkler system, system design, installation, and certification.

B. Related Sections:
   1. Division 21 – Fire Protection.
   2. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 13 - Installation of Sprinkler Systems.
   2. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.

B. Factory Mutual:
   1. FM - Factory Mutual Approval Guide.

C. Underwritters Laboratory:
   1. UL - Fire Resistance Directory.

1.3 SYSTEM DESCRIPTION

A. Provide a wet pipe system hydraulically designed in accordance with NFPA 13 and all requirements of the local Authority Having Jurisdiction.

B. System to provide coverage for entire building.

C. Provide system to NFPA Standard occupancy requirements as noted on the drawings.

D. Hydraulic data and water supply information shall be as noted on the drawings.

E. Interface system with building fire alarm system.

F. The sprinkler locations and piping arrangements indicated on the contract documents are diagrammatic. It is the responsibility of the contractor to fully coordinate sprinkler and piping locations with all other trades.

G. Sprinkler locations indicated on the Contract Documents indicate sprinkler coverage utilizing standard coverage sprinklers maximum 225 square feet per sprinkler for light hazard and 130 square feet per sprinkler for ordinary hazard. Extended coverage sprinklers shall not be installed in any locations unless specifically indicated on the Contract Document drawings.

H. All sprinklers installed in a light hazard classification occupancy shall be a listed quick response type.

I. Provide fire department connections as indicated on Drawings.

1.4 SUBMITTALS

A. Division 01 – General Requirements: Submittal procedures.

B. Where the terms “authorities having jurisdiction” is used, within this Specification, it is intended to include the Insurance Underwriter and all regulatory agencies having vested interest in this project.

C. Shop Drawings:
1. Provide fire protections shop drawings drawn to a minimum scale of ¼”=1’-0”. Shop drawings shall be in accordance with the requirements of NFPA 13. Indicate pipe materials used, joining methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
2. Provide hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories. Indicate system controls.
3. All sprinkler drawings and calculations shall bear the seal of a Professional Engineer licensed in the State where the project is located. Seal and signature shall not be copied and shall be provided as an original on drawings and each calculation.
4. Sprinklers shall be as shown on drawings and submittals and shall be specifically identified with the applicable style or series designation as published in the appropriate agency listing or approval. Trade names or other abbreviated designations are not permitted.

D. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

E. After successful review by the Engineer, submit sprinkler layout shop drawings, product data, and hydraulic calculations to authority having jurisdiction, Fire Marshall, and Owner's insurance underwriter for approval. Submit proof of approval to Architect/Engineer.

F. Grooved joint couplings and fittings shall be shown on shop drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series designation.

G. Manufacturer’s Certificate: Certify that system has been tested and meets or exceeds specified requirements and all code requirements.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 – General Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

A. Workmanship and Qualifications: All materials and equipment shall be installed in accordance with NFPA and all applicable local codes and ordinances. The Sprinkler Contractor shall be state licensed to install sprinkler systems. The Sprinkler Contractor shall make sure that all work and materials conform to the requirements set forth by this Specification. Fire protection equipment shall be installed to conform to NFPA as applicable, and devices used shall be listed and approved by Underwriters laboratories (UL) and/or Factory Mutual (FM).

B. Codes and Standards: All work shall be equal or superior to that required by codes, regulations, ordinances, and laws imposed by the jurisdictional authorities, including those of state codes, the State Fire Marshall, local ordinances and OSHA. Nothing in the Specifications permit violations of such directives, and where conflict occurs, the directive shall govern, except where superior work is specified or indicated.

C. In addition to complying with the above codes and regulations, comply with the requirements of the following:
   1. NFPA Standard 13.
   2. NFPA Standard 24.
   3. State Building and Fire Codes.
   4. Local Jurisdictional Authorities.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. Valves: Bear UL and/or FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

F. All items of similar class shall be the products of the same manufacturer. All valves, accessory items, etc., shall be from the same source.

G. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

H. Installer: Company specializing in performing work of this Section with minimum five years experience.

I. Design sprinkler system under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State where the project is located.

1.7 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.

1.8 PRE-INSTALLATION MEETINGS

A. Division 01 – General Requirements: Pre-installation meeting.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver and store products in shipping containers, with labeling in place.

C. All equipment, valves, gages and etc., shall be covered and protected during the execution of the work. All equipment and piping shall be protected from freezing. Labeling to remain in place.

D. All unloading, hauling, and handling of materials shall be the responsibility of the Sprinkler Contractor.

E. The Sprinkler Contractor can obtain information on available storage space on site from the Owner when making examination of the site.

1.10 WARRANTY

A. Division 01 – General Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

A. Division 01 – General Requirements: Spare parts and maintenance products.

B. Furnish extra sprinklers under provisions of NFPA 13.

C. Furnish suitable wrenches for each sprinkler type.

D. Provide metal storage cabinet adjacent to the sprinkler riser.

PART 2 PRODUCTS

2.1 SPRINKLERS

A. Manufacturers:
   1. Viking.
   2. Tyco.

3. Victaulic.
4. Grinnell Corp.
5. Reliable Sprinkler Corp.
6. Substitutions: Division 01 – General Requirements

B. All sprinklers shall be adjustable, glass bulb, automatic sprinklers with ½ inch orifice and 5.6 K-factor unless noted otherwise. Type of sprinkler head shall be as indicated on the plans and in accordance with the following.

C. Sprinkler bodies shall be die-cast brass, with hex shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation.

D. Unless noted otherwise, ordinary temperature rated sprinkler heads shall be used throughout the building.

E. Where sprinklers will be installed in close proximity to heat sources and special locations, as identified in NFPA 13, temperature ratings shall be in accordance with the requirements of NFPA 13.

F. Where plans call for extended coverage sprinkler heads coordinate coverage requirements with required pressure and K-factor.

G. Spare Sprinklers: The Sprinkler Contractor shall furnish spare automatic sprinklers in accordance with the requirements of NFPA for stock of extra sprinklers. The sprinklers shall be packed in a suitable container and shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. The Sprinkler Contractor shall furnish no less than two special sprinkler wrenches, or at least one wrench for each container or sprinkler box, whichever is greater.

H. In areas where sprinkler heads are subject to physical damage, provide sprinkler guard assembly over head, finish to match sprinkler finish. This shall include but not limited to the following locations.
1. Heads in elevator shafts.
2. Heads under lower rakes of stairways.
3. Heads in electrical rooms, boiler rooms and other mechanical rooms.
4. Heads installed 7’-0” or less above finished floors.

I. Sprinklers shall be in accordance with the schedule indicated on the plans.

2.2 BURIED PIPING

A. Ductile Iron Pipe: ANSI/AWWA C151, cement lined.
1. Fittings: ANSI/AWWA C110, standard thickness.
2. Joints: ANSI/AWWA C111, rubber gasket.

2.3 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53, ASTM A795 or ASTM A135; Schedule 40 carbon steel. Schedule 10 pipe shall be allowed for pipe sizes 1 ¼" diameter and larger when roll grooved mechanical couplings are used.

1. Fittings:
   a. Cast Iron Fittings: ANSI/ASME B16.1, flanges and flanged fittings; ANSI/ASME B16.4, screwed fittings.
   b. Malleable Iron Fittings: ANSI/ASME B16.3, screwed Class 300 type. Threads shall conform to ANSI/ASTM A47.
   c. Grooved Mechanical Fittings: ANSI A21.10/AWWA C-110 ductile iron; ASTM A536 Grade 65-45-12 ductile iron; ASTM A234 Grade WPB; or factory fabricated from carbon steel pipe conforming to ASTM A53; with grooves or shoulders designed to accept grooved end couplings. Fittings shall be of the same manufacturer as the adjoining couplings. Grooved Mechanical Couplings: ASTM A536 Grade 65-45-12, ductile iron housing, elastomer gasket with nuts and bolts to secure roll grooved pipe and fittings.

Fire Protection Service	**Temperature Range**	**Gasket Recommendation**
Dry Systems	Ambient	FlushSeal®, or EZ Style 009 design Grade EPDM, Type A
Freezer Applications	-40°F to 0°F	FlushSeal®, Grade L, Silicone
Water/Wet Systems	Ambient	C-Shape or EZ Style 009

1) Rigid Type Couplings: Housings cast with offsetting, angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with NFPA-13.
   a) 1-1/4" through 4": Factory assembled for direct stab installation without field disassembly. Victaulic Style 009 EZ.
   b) 5" through 8": Victaulic FireLock™ Style 005.
   c) 10" and larger: Victaulic Zero-Flex® Style 07.
2) Flexible Type Couplings: Use in locations where vibration attenuation and stress relief are required, and for seismic considerations in accordance with the manufacturer's instructions. Victaulic Style 75.

2.4 OUTLET FITTINGS

A. Rubber-gasketed outlet fittings that are used on sprinkler systems shall meet the following requirements:

1. Be installed in accordance with the listing and manufacturer's installation instructions
2. Have all disks retrieved
3. Have smooth bores cut into the pipe, with all cutting residue removed
4. Not be modified

2.5 UNIONS AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches (50 mm) and Under:
   1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Dielectric Connections: Union, waterway fitting, or flange with water impervious isolation barrier; Victaulic Style 47 or Watts 3000 Series or approved equal.

2.6 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp or Angle ring.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.7 CYCLING DOUBLE INTERLOCK PRE-ACTION SYSTEM

A. Manufacturers:
   1. Viking.
   2. Tyco.
   3. Victaulic.
   4. Grinnell Corp.
   5. Reliable Sprinkler Corp.
   6. Substitutions: Section 01 60 00 - Product Requirements

B. Supply and install a double interlocked cycling preaction self-contained cabinet containing all hydraulic and electrical components required for the control of a cycling preaction system. The cabinet shall include the following:
   1. Self-contained unit (with control panel) in sturdy free-standing 14 gauge steel cabinet.
   2. Textured rust proof coating, inside and outside, fire red, oven baked polyester powder on phosphate base.

3. Locked access door required for opening, easily removable without tools to allow easy installation & servicing.
4. Individual access doors for the hydraulic and electrical sections and the emergency release (unlocked) with a neoprene gasket to avoid vibrations.
5. Control Valve complete with Schedule 40 galvanized steel pipe trim rated at 250 psi.
6. Integrated release control panel, with emergency batteries.
7. Field wiring terminal strips integrated with the cabinet for connection of field wiring for detection system, audible devices, auxiliary contacts and power supply for control panel and air compressor.
8. Pressure gauges to indicate water supply pressure, priming water pressure and air pressure of the system.
9. Cycling release trim with solenoid valves and each supervisory device required.
10. Schedule 40 steel pipe header with grooved ends to be connected to supply water.
11. Schedule 40 steel pipe drain manifold of 2" diameter for drain connections. Open drain cups in the cabinet and multiple drain manifolds will not be accepted.

C. The cabinet assembly must be pre-assembled, pre-wired and factory tested under ISO-9001 conditions, as a TotalPac3 Preaction system, by FireFlex Systems Inc. It shall also be UL Listed as an assembled unit.

D. The TotalPac3 system shall be provided with a UL/ULC Listed and FM Approved integrated by-pass butterfly valve installed on the system riser inside the cabinet for full flow test purposes. The valve shall also be supervised. An integrated sight glass shall be part of this arrangement for visually confirm water flow upon system actuation. Detailed instructions placard must be provided inside the cabinet

E. Detection and Signaling System:
1. Supply and install a complete electrical detection system including:
   a. System tubing, wiring, heat detectors and signaling devices.
2. Detectors shall be wired on zone 1 and allow automatic discharge control.
3. Light & Ordinary Hazard: The detectors shall be connected with FPL plenum type cable in series from and to the Cycling preaction cabinet.
4. The detectors and the audible devices (bell & horn 24 VDC) must be compatible with the release control panel. The bell and horn should be installed near the TotalPac3 cabinet.

F. System Operation:
1. The activation of two detectors AND the opening of an automatic sprinkler are necessary to cause the water discharge.
2. The activation alone of a detector will initiate the sounding of a warning device and the activation of alarm contact for remote transmission but will not cause the system to fill.
3. The opening of an automatic sprinkler OR damage to system piping without electrical detection will initiate the sounding of a warning device and the activation of an alarm contact but will not cause the system to fill.
4. The activation of two detectors AND the opening of an automatic sprinkler will cause water to discharge. The alarm signal will sound and an auxiliary contact for a water flow signal will be activated.

5. Discharge shall continue for as long as any detector remains in alarm. When ambient temperature is lowered below all the detectors trip point, detectors reset themselves automatically. At this moment, a soaking timer is activated, allowing water to flow for an additional period of time. At the end of the Soak Timer delay, the flow of water is automatically stopped.
6. At the end of the Soak timer delay, waterflow is automatically stopped. If any detector is reactivated by heat, water discharge is immediately reactivated, and the same soaking timer delay will be applied once all detectors have cooled down and reset. Stopping the flow of water should be maintained only when the detection zone is not activated and the timer cycle is ended.
7. Operation of the electric manual release pull station shall activate the same functions as a detector except that because of its latching internal contact, the cycling function will be by-passed and system will discharge until Main Control Valve is manually shut off.
8. The Normally Closed Detectors shall form a single line closed loop. When the heat detectors are exposed to the heat of the fire, their contacts shall open. When the detectors cool off below their set point, the contacts shall close. If exposed to excessive temperatures for extended periods, the detectors shall normally fail with an open contact.
9. If the detectors wiring is broken due to physical damage, the system's control panel shall detect an open in the loop, as if a detector had operated. When the detectors or their wiring is damaged, the Control Panel shall activate an alarm but no water should enter the piping. If a sprinkler operates during this condition, control panel shall energize both solenoids, flow control valve should open and water fill the piping system and discharge through all open sprinklers until manually turned off.
10. If the damage occurs during a fire condition, the system must continue to discharge water and also must be manually turned off. This failsafe condition shall continue to provide sprinkler protection, even when the detectors or wiring has been damaged.
11. System shall also be failsafe during total power failure. When both the AC and DC Standby Battery Power fail prior to the system operating, the system shall continue to provide sprinkler protection and operate as a Dry System. If all power fails while the system is flowing water, the system shall continue to flow water, until manually turned off.

G. Air Supply:
1. The automatic sprinkler piping shall be supervised by air from a compressed air source installed inside the preaction cabinet. Air compressor shall be 115V.
2. The air supply shall be regulated and of the proper size in order to be able to restore normal system air pressure within 30 minutes.
3. Air compressor and supervisory trim (Air Option "A") shall be factory installed inside the cabinet and adjusted for the selected configuration.
4. A dehydrator assembly shall be factory installed in the air trim, with bowl guard, supply control and drain valves. Dehydrator shall be Viking manually generated dessicant-type air dryer, the dessicant acting as a moisture indicator by changing color.

H. System Drain:
1. The single drain collector of the TotalPac3 system shall be connected to an open drain. The drain piping shall not be restricted or reduced and shall be of the same diameter as the drain collector. Multiple drain collectors and open drain cups inside the cabinet will not be accepted.

2.8 ALARM CHECK VALVES

A. Manufacturers:
1. Viking.
2. Tyco.
3. Victaulic.
4. Grinnell Corp.
5. Reliable Sprinkler Corp.
6. Substitutions: Division 01 – General Requirements.

B. Wet Pipe Alarm Valve:
1. Check type valve with Nitrile seat o-ring aluminum bronze clapper with EPDM seal to automatically actuate electrically and hydraulically operated alarms, with pressure retard chamber and variable pressure trim. Valve internal components shall be replaceable without removing valve from the installed position. Valve shall be Series 751 as manufactured by Victaulic Co or engineer approved equal.
2. Provide retard chamber as part of wet alarm valve trim to allow for pressure fluctuations. Retard chamber shall be Victaulic Series 752 or engineer approved equal by manufacturers listed above. Provide all other trim as recommended by the manufacturer.
3. Alarm check valve assembly shall allow discharge of one or more sprinklers to activate electric and hydraulic alarms.

2.9 PIPING SPECIALTIES

A. Manufacturers:
1. Potter.
2. Potter-Roemer.
3. System Sensor.
4. Victaulic.
5. Viking.

B. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch and weatherproof back box.

C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two form C contacts; rated 10 amp at 120 volt.

D. Valve Tamper Supervisory Switch: Two form C contacts; rated 10 amp at 120 volt. UL listed and FM approved. Up to 2” – Potter Model PCVS-1. Over 2" switch shall be Potter Model OSYSU-2.

E. Pressure Switch: ½ inch male pressure connection to alarm valve riser and actuated by any flow of water in excess of one sprinkler. Maximum pressure rating 175 psi, weather-proof with tamper resistant screws, rated 10 amps at 120 volt.

F. Pressure Gage: Rated for 300 psi use, 3-1/2" in diameter.

2.10 FIRE DEPARTMENT CONNECTION

A. Fire department connection shall be 2-1/2"x2-1/2"x4", polished brass, single clapper siamese type connection. Provide with polished brass identification plate.

B. Clapper design shall allow for one or both inlets to be pressurized during operation.

C. Provide polished brass cast aluminum alloy caps and chains for protection of the 2-1/2" inlets.

D. The fire department connection shall be constructed of cast brass with brass clapper, brass swivel couplings and a brass hinge pin. The words "AUTO SPKR" and "F.D. Conn" shall be cast in raised letters on the body.

E. Fire department connection threads shall match the local fire departments standard.

F. Drain: 3/4 inch automatic drip, install at low point after check valve, pipe to building exterior.

G. Provide a 90-degree elbow with drain connection at each fire department connection to allow for drainage in areas exposed to the building exterior to prevent freezing. Elbow shall be Victaulic #10-DR.

PART 3 EXECUTION

3.1 PREPERATION

A. Coordinate work of this Section with other affected work.

B. Prepare piping connections to equipment with grooved joint couplings, flanges, or unions.

3.2 INSTALLATION

A. Install equipment in accordance with manufacturers instructions.

B. Install fire protection systems in accordance with NFPA 13 for sprinkler systems and NFPA 24 for service mains.

C. Impairments to the existing water supplies shall be minimized. All work shall be complete before making the final connections to the existing water supplies. The Contractor shall notify the owners representative before impairing any fire protection equipment.

D. The Contractor shall maintain a clean and orderly site during the installation of the sprinkler system. Materials shall not be stored in the halls or other public areas.

E. Cutting, welding and other hot work shall not be permitted without permission from the building owner. Contractor shall provide a fire watch for one hour after all welding

F. The required tests shall be witnessed by the Fire Marshall, authority having jurisdiction, Owner's insurance underwriter and Architect/Engineer.

G. Locate fire department connection with sufficient clearance from walls, obstructions, etc., to allow full swing of fire department wrench handle. Coordinate the exact location of the fire department connection with the local fire officials. Installation shall conform to the local fire officials requirements.

H. Installation of Alarm Valves: Install a drain line from the drain connection to the nearest floor drain. Install a test line from the test connection to the exterior of the building. Provide a splash block. Provide gate valves at each line. Minimum alarm valve riser shall be 4-inch.

I. Locate outside alarm bell on building wall as indicated.

J. Center heads in two directions in ceiling tile and provide piping offsets as required.

K. Sprinkler Bulb protector must remain in place until the sprinkler is completely installed. Remove the bulb protector by hand after installation and before the system is placed in service. (Do not use any tools to remove the bulb protector.)

L. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

M. Coordinate flow switches, tamper switches, and all other sprinkler devices with the fire alarm system.

N. Provide wire guards on sprinklers as indicated on drawings.

O. Place pipe runs to minimize obstruction to other work.

P. Install piping in concealed spaces above finished ceilings.

Q. Pipe and fitting shall be installed per the manufacture’s installation requirements. The fire protection contractor shall furnish all materials necessary to meet these requirements including but not limited to hangers, support, insulation, shields, sleeves and power supplies.

R. Hydrostatically test entire system in accordance with the requirements of NFPA 13.

S. Require test be witnessed by Fire Marshall, Authority having jurisdiction, Owner's insurance underwriter.

3.3 INSTALLATION – PRE-ACTION SYSTEM

A. The installation must meet all established standards and be according to all applicable laws, regulations and codes.

B. The proper operation and coordination for the system's installation, including the automatic sprinkler system, detection system, signaling system and initial start-ups are all under the responsibility of the fire protection contractor.

C. The contractor must plan and organize a training session of at least two hours for the building maintenance staff, in the presence of building owner or his representative.

D. The training session must include the normal operation, emergency procedures and system maintenance.

E. Hydrostatic tests must be performed on the entire sprinkler piping system, as required by NFPA 13.

F. In addition to the standard hydrostatic test, an air pressure leakage test at 40 psi (2.8 bars) shall be conducted for 24 hours. Any leakage that results in a loss of pressure in excess of 1 1/2 psi (0.1 bar) during the 24 hours shall be corrected.

G. A drain test using the auxiliary drain valve fully open (drain located on water supply side, deluge valve inlet) must be performed to make sure that no back pressure in drain piping exists, which could affect the proper operation of the preaction system

H. An air supply test must be performed, to confirm that normal air pressure can be restored within 30 minutes.

I. The verification of the fire alarm system must be done in accordance with the NFPA 72, Chapter 7 (and CAN/ULC-S537 in Canada).

J. An inspection report and a certificate must be supplied to the engineer at the completion of the project. All tests results shall be registered in a booklet to be included with the inspection report.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Verify signal devices are installed and connected to fire alarm system.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Flush entire piping system of foreign matter.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Replace painted sprinklers with new.

3.7 IDENTIFICATION

A. Provide and apply signs to control, drain, test and alarm valves to identify their purpose and function.

B. Provide and permanently attach hydraulic calculations data nameplate at the controlling valve for the sprinkler system. Provide lettering size and style from NFPA's suggested styles.

3.8 TESTING

A. Section 21 05 00 - Common Work Results for Fire Suppression.

END OF SECTION 21 1313

SECTION 22 0400 - GENERAL CONDITIONS FOR PLUMBING TRADES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

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

B. This section applies to certain sections of Division 26, "Electrical," and this section applies to all sections of Division 22, "Plumbing" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades (Architectural, Structural, Landscape, Civil, Mechanical, Fire Protection and Electrical) shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

1.2 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division. Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

1.3 INTENT

A. It is the intent of the Specifications and Drawings to call for finished work, tested and ready for operation. Provide all parts necessary for the intended use, fully complete and operational, and installed in professional manner in accordance with the design intent.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section includes the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

1.4 DEFINITIONS

A. “Approved equal” also known as “alternative” mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

B. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

D. “Finished” refers to all rooms and areas to be specified to receive architectural treatment as indicated on the drawings. All rooms and areas not covered, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

E. “Furnish” or “supply” shall mean purchase, deliver to, and off-load at the job site, ready to be installed including where appropriate all necessary interim storage and protection.

F. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

G. “Install” shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

H. "Lead Free" shall mean not more than .25% in the wetted surface area.

I. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

J. “Product” shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

K. “Provide” shall mean furnish (or supply) and install as necessary.

L. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

M. Remove: The term “remove” means “to disconnect from its present position, remove from the premises and to dispose of in a legal manner.”

N. Special Warranties: The term “Special Warranties” are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

O. Standard Product Warranties: The term “Standard Product Warranties” are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

P. “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Plumbing Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

Q. Substitutions: Requests for changes in products, materials, equipment, and methods of construction proposed by the Contractor are considered requests for "substitutions."

R. “Wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

1.5 CONTRACT DOCUMENTS

A. The two dimensional drawings govern the construction. They show the design intent and are part of the Contract Documents. BIM models are not part of contract documents. They are developed for convenience only.

B. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

C. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

D. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

1.6 DISCREPANCIES IN DOCUMENTS

A. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

B. Where Drawings or Specifications conflict or are unclear, submit clarification request in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or un-clarities thus resolved.

C. Where Drawings or Specifications do not coincide with manufacturers' recommendations or with applicable codes and standards, submit clarification request in form of an RFI before installation. Otherwise, make changes in installed work required for compliance with manufacturer instructions or codes and standards within Contract Price.

D. Where insufficient information exists in the documents to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements, where notification required by Paragraph (B) above has not been submitted, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in professional manner either concealed or exposed in accordance with the design intent.

E. Where discrepancies exist between the mechanical, plumbing, fire protection, and electrical drawings in regards to what trade owns disconnects or starters, the discrepancy shall be brought to the Architect’s attention in accordance with paragraph (B) above. If the scope is not resolved prior to the Award of Contract, Division 26 shall provide such items.

1.7 SURVEYS AND MEASUREMENTS

A. Before submitting the Bid, the Contractors shall visit the site and become thoroughly familiar with all existing conditions under which work will be installed. This Contract includes all modifications of existing systems required for the installation of new equipment. This Contract includes all necessary offsets, transitions and modifications required to install all new equipment in existing spaces. All new and existing equipment and systems shall be fully operational under this Contract before the job is considered complete. The Contractors shall be held responsible for any assumptions made, any omissions or errors made as a result of their failure to become fully familiar with the existing conditions at the site and the Contract Documents.

B. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.8 CODES AND STANDARDS

A. Reference Standard Compliance

1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

2. Independent Testing Organization Certificate: In lieu of the label or listing indicated above, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. Wherever Codes and/ or standards are mentioned in these specifications, the latest applicable edition or revision of the local building or life safety code shall be followed.

C. The following Standards shall be used where referenced by the following abbreviations:

ACGIH	American Conference of Governmental Industrial Hygienists
AGA	American Gas Association
AIA	American Institute of Architects
ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society of Testing and Materials

AWS	American Welding Society
AWWA	American Water Works Association
CGA	Compressed Gas Association
CSA	Canadian Standards Association
CISPI	Cast Iron Soil Pipe Institute
EJMA	Expansion Joint Manufacturing Association
EPA	Environmental Protection Agency
FM	Factory Mutual
FSSC	Federal Specification
HIS	Hydraulic Institute Standards
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
ISO	Insurance Services Office
MCAA	Mechanical Contractors Association of America
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NOFI	National Oil Fuel Institute
NSC	National Safety Council
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PDI	Plumbing and Drainage Institute
SBI	Steel Boiler Industry (Division of Hydronics Institute)
SDWA	Safe Drinking Water Act

SMACNA Sheet Metal and Air Conditioning Contractors National Association

STI Steel Tank Institute

UL Underwriters' Laboratories

D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.9 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.10 EQUIPMENT EQUIVALENTS AND SUBSTITUTIONS

A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of quality, finish and design that is required. If the Contractors uses an "approved equal" alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.

B. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

C. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.

D. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for

substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non-approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer's equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

E. If an alternative or substitute item results in a difference in quantity and arrangement of structure, piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.

F. Equipment, material or devices submitted for review as a "substitution" shall meet the following requirements:

1. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.

2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

    a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.

    b. Samples, where applicable or requested.

    c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

    d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.

    e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

f. Cost information, including a proposal of the net change, if any in the Contract Sum.

g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.

i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.

2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.11 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 01 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

1. Allow ten business days for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.

2. If an intermediate submittal is necessary, process the same as the initial submittal.

3. Allow ten business days for reprocessing each submittal.

4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Submittals shall be arranged in order of specification sections.

1. Include the following information on the label for processing and recording action taken.

a. Project name.

b. Date.

c. Name and address of Engineer.

d. Name and address of Contractor.

e. Name and address of subcontractor.

f. Name and address of supplier.

g. Name of manufacturer.

h. Number, title and paragraph of appropriate Specification Section.

i. Drawing number and detail references, as appropriate.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

F. Except for submittals for record, information or similar purposes, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.

1.12 SHOP DRAWINGS

A. Submit neatly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated plumbing layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review all shop drawings to be incorporated in the Plumbing Contract.

C. Provide shop drawings for all devices specified under equipment specifications for all systems. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures), of all shop drawings, performance cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. When a submittal could involve more than one trade, e.g., valves, piping, etc., the submitted shall be separated by traded involved, ie. HVAC, plumbing, fire protection, etc.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

F. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

G. "No Exception Taken" rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings. Review of shop drawings shall not apply to quantity of material.

H. After shop drawings have been reviewed, with no exceptions taken, no further changes will be allowed without the written consent of the Engineer.

I. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

J. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to bidding to allow for issuance of an Addendum.

K. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

L. All submittals shall be made in electronic PDF format with searchable OCR (Optical Character Recognition) format. This excludes scanned and faxed materials.

1.13 COORDINATION DRAWINGS AND BIM MODEL

A. Coordination drawings are required for all fire protection, plumbing, mechanical and electrical trades. The content and procedures described in Division 01 shall be followed, with the additional requirements specifically for the plumbing and electrical trades as described in this Section. If a BIM model is not used on this project, the below requirements shall be accomplished in CAD.

B. Prepare coordination drawings in accordance with Division 01 to a minimum scale of 1/4"=1'-0" detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. The Contractor shall indicate the proposed locations of piping, conduit, ductwork, equipment, and materials. Include the following:

a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

b. Equipment connections and support details.

c. Exterior wall and foundation penetrations.

d. Fire-rated wall and floor penetrations.

e. Sizes and locations of required concrete pads and bases.

C. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

D. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

E. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

F. The Contractor and each subcontractor shall sign and date each coordination drawing prior to submission.

G. Work shall not be performed until coordination drawings have been approved by the architect and engineer.

H. Electronic copies of the MEP floor plans and/or BIM model are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. If the Contractor elects to obtain the Engineers electronic files an Electronic Drawing File Release Form must be submitted. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic Drawing File Release Form, the Engineer will provide copies of the electronic files for the Contractor's use. A copy of the Electronic Drawing File Release Form is appended to the end of this specification section

I. Review by Engineer of coordination drawings is limited to confirming that requirements for coordination and preparation of plans have been complied with by the Contractor and shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other related work.

1.14 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information

as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, HVAC piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

E. The two dimensional drawings are diagrammatic. They indicate general arrangements of mechanical systems and other work, and are intended to convey sufficient information for skilled contractors and tradespeople to furnish and install complete systems. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, provide all other components and materials to make the systems fully complete, coordinated with other systems and the structure and space available, and operational. Similarly, the drawings 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 in order to avoid interferences and to meet ceiling heights and other Architectural requirements. Establish and provide offsets, changes in direction, and exact routings to coordinate all systems. Where conflicts or potential conflicts exist and engineering guidance is desired, submit a “Request for Information” (RFI).

F. Controls contractor shall coordinate and sequences of operation with all other trades as necessary to provide a complete and functioning system.

1.15 QUALITY CONTROL

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled tradespeople, fitters, metal workers, welders, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of plumbing systems shall be performed by experienced, skilled tradespeople under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, professional manner. The Engineer reserves the right to reject any work which, in their opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.16 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.

B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.17 TEMPORARY UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Utilities: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.

F. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

H. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.18 EQUIPMENT ACCESS

A. Appliances, controls devices, valves and accessories that utilize energy shall be accessible for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping not connected to the appliance being inspected, serviced, repaired or replaced. A level working space not less than 30 inches deep and 30 inches wide shall be provided in front of the control side to service an appliance.

1.19 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, piping, heating, temperature control work, fire stopping, water heaters, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required to maintain existing systems operational or to accommodate the construction phasing of the project.

1.20 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or tradespeople and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by tradespeople or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.21 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer's recommendations and is operating as intended by the manufacturer.

1.22 CLEANING

A. The Contractor shall thoroughly clean and flush all piping and equipment of all foreign substances, oils, burrs, solder, flux, etc., inside and out before being placed in operation.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all pipes shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.

2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

4. Wipe surfaces of plumbing equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition.

F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.23 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or the Owner’s representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) days’ notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer's representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. The following equipment will require this inspection: pumps; controls, water heaters, compressors, boilers etc. These letters shall be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.

F. Demonstration shall be recorded on USB Flash drive and turned over to the Owner. Video recording shall be done in a professional manner with quality video (1080p resolution) and clear audible sound.

1.24 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 01 and as follows. The Contractor shall prepare up to six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information and designation partitions with identification tabs. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing and operating instructions including lubrication charts and schedules.

5. Emergency and safety instructions.

6. Spare parts list.

7. Copies of warranties.

8. Wiring diagrams.

9. Recommended "turn around" cycles.

10. Inspection procedures.

11. Approved Shop Drawings and Product Data.

12. Equipment Start-up Reports.

13. Balance reports.

C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.

1.25 ACCEPTANCES

A. The equipment, materials, quality, design and arrangement of all work installed under the Plumbing Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Plumbing Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Plumbing Sections. The intent to use the exact manufacturers and models specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of award of the Contract. In such instances, equipment substitutions may be made pending acceptance by the Engineer or the Owner’s representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Plumbing Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings

and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.26 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Items to be indicated include but are not limited to:

1. Dimensional change
2. Revision to drawing detail
3. Location and depth of underground utility
4. Revision to pipe routing
5. Revision to electrical circuitry
6. Actual equipment location
7. Pipe size and routing
8. Location of concealed internal utility
9. Changes made by Change Order
10. Details not on original Contract Drawing
11. Information on concealed elements which would be difficult to identify or measure later

C. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

D. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

E. Note related Change Order numbers where applicable.

F. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

G. Final record documents shall be prepared in the latest electronic version and on USB Flash drive of all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.27 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers' standard warranties on products and special warranties are to be included:

1. General close-out requirements included in Division 01.

2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions-02 through -50.

3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.28 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.

1. Refer to individual Sections of Divisions-02 through -50 for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the installer.

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

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.29 GUARANTEES

A. The Contractor shall guarantee all material and installation quality under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner. During this guarantee period, all defects developing through faulty equipment, materials or installation quality shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineer's satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided.

1.30 PROJECT CLOSE-OUT

A. Submit specific warranties, quality bonds, maintenance agreements, final certifications and similar documents in accordance with Division 01.

B. Deliver tools, spare parts, extra stock, and similar items.

C. Complete start-up testing of systems, including measuring and documenting all required startup checklist requirements documented in installation and maintenance instructions by the equipment manufacturer, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

D. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

E. Field Observation Procedures: On receipt of a request for an Engineers Field Observation, the Engineer will advise the Contractor of unfulfilled requirements. The Engineer will advise the Contractor of construction that must be completed or corrected before the certificate will be issued. Contractor shall submit written response to each corrective item including specific photos prior to final Engineering inspection.

1. The Engineer will repeat the Field Observation when requested and assured that the Work has been substantially completed.

2. Results of the completed list of unfulfilled items will form the basis of requirements for final acceptance.

END OF SECTION 22 0400

Electronic Drawing File Release Form

DELIVERY OF ELECTRONIC FILES FOR: _____
Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys' fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____ _____
Client's Signature Date

_____
Company - Title

_____ _____
Architects' Signature Date

_____
Firm - Title

_____ _____
Owner's Signature Date

_____
Company - Title

SECTION 22 0500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Certification of seismic restraint designs and installation supervision.
2. Certification of seismic attachment of housekeeping pads.
3. Seismic restraint products
    a. Vibration isolation elements.
    b. Equipment isolation bases.
    c. Piping flexible connections.
    d. Seismic restraints for isolated and non-isolated mechanical and electrical items.
4. Inertia bases.

B. Identification for Piping and Equipment:

1. Nameplates.
2. Tags.
3. Pipe markers.
4. Ceiling tacks.
5. Labels.
6. Radon Labels

1.2 INTENT

A. All plumbing equipment and piping as noted on the equipment schedule or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.

B. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.

C. It is the intent of the seismic portion of this specification to keep all mechanical and electrical building system components in place during a seismic event.

D. All such systems must be installed in strict accordance with seismic codes, component manufacturer's recommendations and building construction standards. Whenever a conflict occurs between the manufacturer's recommendations or construction standards, the most stringent shall apply.

E. This specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements (i.e. California Title 24, California OSHPD, Canadian Building Codes, or other requirements).

F. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. American Society of Mechanical Engineers:

1. ASME B31.1 - Power Piping.

2. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84-18b - Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction Materials.

3. ASTM E814-13a - Standard Test Method for Fire Tests of Penetration Fire Stop Systems.

4. ASTM F708-92 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

5. ASTM E1966-15 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

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

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Underwriters Laboratories Inc.:

1. UL 263 - Standard for Fire Test of Building Construction and Materials

2. UL 723 – Standard for Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 – Standard for Fire Tests of Penetration Firestops.

4. UL 2079 – Standard Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

1.4 RELATED WORK

A. Housekeeping Pads

1. Housekeeping pad reinforcement and monolithic pad attachment to the structure details and design shall be prepared by the restraint vendor if not already indicated on the drawings.

2. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.

B. Supplementary Support Steel

1. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment, as required or specified.

C. Attachments

1. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

1.5 SEISMIC FORCE LEVELS

A. Installations shall be designed to safely accept external forces determined in accordance with the International Building Code –2003, Section 1621 in any direction for all rigidly supported equipment without failure and permanent displacement of the equipment. Seismic restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise.

1.6 PERFORMANCE REQUIREMENTS

A. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping.

B. Provide minimum static deflection of isolators for equipment as follows:

1. Basement, Under 20 hp

a. Under 400 rpm: 1 inch

b. 400 - 600 rpm: 1 inch

c. 600 - 800 rpm: 0.5 inch

d. 800 - 900 rpm: 0.2 inch

e. 1100 - 1500 rpm: 0.14 inch

f. Over 1500 rpm: 0.1 inch

2. Basement, Over 20 hp

a. Under 400 rpm: 2 inch

b. 400 - 600 rpm: 2 inch

c. 600 - 800 rpm: 1 inch

d. 800 - 900 rpm: 0.5 inch

e. 1100 - 1500 rpm: 0.2 inch

f. Over 1500 rpm: 0.15 inch

C. Use concrete inertia bases for motors in excess of 40 hp and on base mounted pumps over 10 hp.

1.7 DEFINITIONS

A. Life Safety Systems:

1. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flow paths to fire protection and/or emergency lighting systems.

2. All medical and life support systems.

3. Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.

B. Positive Attachment:

1. A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, or any other equipment are not acceptable on this project as seismic anchor points.

C. Transverse Bracing:

1. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.

D. Longitudinal Bracing:

1. Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.

E. Failure

1. For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8" (3mm) and/or horizontal permanent deformation greater that 1/4" (6mm).

1.8 SUBMITTALS

A. See Division 01 – Requirements for Submittals.

B. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Shop Drawings (Identification): Submit list of wording, symbols, letter size, and color coding for identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Submit special procedures.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Welders' Certificate: Include welders' certification of compliance with ASME Section IX or AWS D1.1.

G. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

H. Product Data:

1. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.

I. Shop Drawings:

1. Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.

2. Provide Drawings showing methods of suspension and support guides for conduit, piping and ceiling hung equipment.

3. Record actual locations and installation of vibration isolators and seismic restraints including attachment points.

4. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.

5. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.

6. Drawings showing methods for isolation of conduits and pipes penetrating walls and floor slabs.

7. Specific details of restraints including anchor bolts for mounting and maximum loading at each location, for each piece of equipment and/or pipe locations.

J. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.

K. Seismic Certification and Analysis:

1. Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.

2. All restraining devices shall have a preapproval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Preapprovals based on independent testing are preferred to preapprovals based on calculations. Where preapproved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 45 degrees to the weakest mode.

3. Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in section 1.06 acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.

L. Design Data: Submit calculations indicating maximum room sound levels are not exceeded. Use sound power levels of actual equipment to be installed on project. Analysis shall include breakout noise calculations. In the absence of specified background sound level criteria, the guidelines as express in Table 34 of Chapter 47,

"Sound and Vibration Control" of the 2003 ASHRAE Handbook – HVAC Applications, shall be used.

M. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

N. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.

O. Manufacturer's Field Reports: Indicate sound isolation installation is complete and in accordance with instructions.

P. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.9 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Perform vibration and seismic control Work in accordance with ARI 575, ANSI S12.36.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing work of this section with minimum three years of experience.

1.11 PRE-INSTALLATION MEETINGS

A. See Division 01 - General Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.12 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 - General Requirements.

B. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

C. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

1.13 WARRANTY

A. See Division 01 - General Requirements.

1.14 VIBRATION AND SEISMIC CONROL - CONTRACTORS RESPONSIBILITIES

A. Verify field measurements prior to fabrication.

B. Contractor shall have the following responsibilities:
1. Determine vibration isolation and seismic restraint sizes and locations per specifications.
2. Provide and install isolation systems and seismic restraints as scheduled or specified.
3. Guarantee specified isolation system deflection.
4. Provide installation instructions, drawings and field supervision to assure proper installation and performance.
5. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.
6. Substitution of "Internally Isolated" plumbing equipment in lieu of the specified isolation of this section is acceptable

1.15 CLOSEOUT SUBMITTALS

A. See Division 01 - General Requirements.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, guides, tagged valves; include valve tag numbers.

C. Operation and Maintenance Data (Expansion): Submit adjustment instructions.

PART 2 PRODUCTS

2.1 CONCRETE HOUSEKEEPING PAD

A. Refer to Division 03 - Concrete

2.2 INERTIA BASES

A. Manufacturers:

1. Mason

2. Vibration Eliminator

3. Vibro-Acoustics Ltd.

4. Substitutions: Division 01 – General Requirements

B. Structural Bases:

1. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.

2. Construction: Welded structural steel with gusset brackets, supporting equipment and motor with motor slide rails.

C. Concrete Inertia Bases:

1. Mass: Minimum of 1.5 times weight of isolated equipment.

2. Construction: Structured steel channel perimeter frame, with gusset brackets and anchor bolts, adequately reinforced, concrete filled.

3. Connecting Point: Reinforced to connect isolators and snubbers to base.

4. Concrete: Reinforced 3,000 psi concrete.

2.3 VIBRATION ISOLATORS

A. Manufacturers:

1. Mason

2. Vibration Eliminator

3. Amber Booth

4. Substitutions: Division 01 – General Requirements

B. Open Spring Isolators:

1. Spring Isolators:

a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

b. Code: Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.

4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

C. Restrained Spring Isolators:

1. Spring Isolators:

a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

b. Code: Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.

4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

5. Restraint: Furnish mounting frame and limit stops.

D. Closed Spring Isolators:

1. Spring Isolators:

a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

b. Code: Color code springs for load carrying capacity.

2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.

3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.

E. Restrained Closed Spring Isolators:

1. Spring Isolators:

a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

b. Code: Color code springs for load carrying capacity.

2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.

3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.

F. Spring Hanger:

1. Spring Isolators:

    a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

    b. Code: Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.

4. Misalignment: Capable of 20 degree hanger rod misalignment.

G. Neoprene Pad Isolators:

1. Rubber or neoprene-waffle pads.

    a. 30 durometer.

    b. Minimum 1/2 inch thick.

    c. Maximum loading 40 psi.

    d. Height of ribs: not to exceed 0.7 times width.

2. Configuration: Single layer.

H. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.

I. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.

J. Seismic Snubbers:

1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.

2. Neoprene Elements: Replaceable, minimum of 0.75 inch thick.

3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.

4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

2.4 IDENTIFICATION FOR PIPING AND EQUIPMENT

A. Manufacturers:

1. Craftmark Identification Systems

2. Safety Sign Co.

3. Seton Identification Products

4. Substitutions: Division 01 – General Requirements and 22 04 00 – General Requirements.

B. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light background color.

C. Plastic Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches diameter.

D. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Color and Lettering: Conform to ASME A13.1.

E. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Color and Lettering: Conform to ASME A13.1.

F. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 NAMEPLATES

A. Manufacturers:

1. Craftmark Identification Systems

2. Safety Sign Co.

3. Seton Identification Products

4. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Product Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.

2. Letter Height: 1/4 inch

3. Background Color: Black.

4. Plastic: Conform to ASTM D709.

2.6 TAGS

A. Plastic Tags:

1. Manufacturers:

a. Craftmark Identification Systems

b. Safety Sign Co.

c. Seton Identification Products

d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:

1. Manufacturers:

a. Craftmark Identification Systems

b. Safety Sign Co.

c. Seton Identification Products

d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Aluminum with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. Manufacturers:

a. Craftmark Identification Systems

b. Safety Sign Co.

c. Seton Identification Products

d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.7 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers:

a. Craftmark Identification Systems

b. Safety Sign Co.

c. Seton Identification Products

d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers:

1. Manufacturers:

a. Craftmark Identification Systems

b. Safety Sign Co.

c. Seton Identification Products

d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Underground Pipe Markers:

1. Manufacturers:

a. Seton

b. Northtown

c. Kolbi

d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with color code as follows:

a. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.

b. Fire Quenching Fluids: Red with white letters.

c. Toxic and Corrosive Fluids: Orange with black letters.

d. Flammable Fluids: Yellow with black letters.

e. Combustible Fluids: Brown with white letters.

f. Compressed Air: Blue with white letters.

2.8 CEILING TACKS

A. Manufacturers:

1. Seton

2. Northtown

3. Kolbi

4. Substitutions: Division 01 - Product Requirements and 22 04 00 – General Requirements.

B. Description: Steel with 3/4 inch diameter color-coded head.

C. Color code as follows:

1. Plumbing valves: Green.

2.9 LABELS

A. Manufacturers:

1. Seton

2. Northtown

3. Kolbi

4. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Description: Polyester for above grade and Laminated Mylar for below grade, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 EXECUTION

3.1 INSTALLATION – VIBRATION AND SEISMIC CONTROL

A. Install isolation for motor driven equipment.

B. Bases:

1. Set steel bases for 1 inch clearance between housekeeping pad and base.

2. Set concrete inertia bases for 2 inch clearance between housekeeping pad and base.

C. Adjust equipment level.

D. Install spring hangers without binding.

E. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

F. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

G. Provide pairs of horizontal limit springs on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans.

H. Provide resiliently mounted equipment and piping with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05 inch maximum clearance. Provide other snubbers with clearance between 0.15 inch and 0.25 inch.

I. Support piping connections to isolated equipment resiliently as follows:

1. Up to 4 inch Diameter: First three points of support.

2. 5 to 8 inch Diameter: First four points of support.

3. 10 inch Diameter and Over: First six points of support.

4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.2 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

A. Install plastic nameplates with adhesive.

B. Install plastic tags with corrosion resistant metal chain.

3.3 INSTALLATION - IDENTIFICATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 10 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

J. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.4 SCHEDULES

Pipe Size Inch	Isolated Distance from Equipment
1	120 diameters
2	90 diameters
3	80 diameters
4	75 diameters
6	60 diameters
8	60 diameters

3.5 VIBRATION ISOLATION AND SEIMIC RESTRAINT INSTALLATION

A. Horizontal pipe isolation: The first three pipe hangers in the main lines near the mechanical equipment shall be as described in specification 11. Specification 11 hangers must also be used in all transverse braced isolated locations. Brace hanger rods with SRC clamps specification 14. Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in specification 10. Floor supported piping shall

rest on isolators as described in specification 6. Heat exchanger's and expansion tanks are considered part of the piping run. The first three isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" deflection for pipe sizes up to and including 3", 1 1/2" deflection for pipe sizes up to and including 6", and 2 1/2" deflection thereafter. Hangers shall be located as close to the overhead structure as practical. Where piping connects to mechanical equipment install specification 23 expansion joints or specification 24 stainless hoses if 23 is not suitable for the service.

B. Riser isolation: Risers shall be suspended from specification 10 hangers or supported by specification 5 mountings, anchored with specification 25 anchors, and guided with specification 26 sliding guides. Steel springs shall be a minimum of 0.75" except in those expansion locations where additional deflection is required to limit load changes to $\pm$ 25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

C. Seismic Restraint of Piping

1. Seismically restrain all piping listed as a, b or c below. Use specification 12 cables if isolated. Specification 12 or 13 restraints may be used on unisolated piping.

    a. Fuel oil piping, gas piping, medical gas piping, and compressed air piping that is 1" I.D. or larger.
    b. Piping located in boiler rooms, mechanical equipment rooms, and refrigeration equipment rooms that is 1 1/4" I.D. and larger.
    c. All other piping 2 1/2" diameter and larger.

2. Transverse piping restraints shall be at 40' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.

3. Longitudinal restraints shall be at 80' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.

4. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.

5. For fuel oil and all gas piping transverse restraints must be at 20' maximum and longitudinal restraints at 40' maximum spacing.

6. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" of the elbow or TEE or combined stresses are within allowable limits at longer distances.

7. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.

8. Branch lines may not be used to restrain main lines.

9. Cast iron pipe of all types, glass pipe and any other pipes joined with a four band shield and clamp assembly in Zones 2B, 3 and 4 shall be braced as in sections 3.2.D.2 and 3. For Zones 0, 1 and 2A, 2 band clamps may be used with reduced spacings of 1/2 of those listed in sections 3.2.D.2 and 3.

D. Vibration Isolation and Seismic Restraint of Plumbing Equipment

1. All equipment shall be vibration isolated and seismically restrained as per the schedules in part 3.5 of this specification.

2. Equipment mounted on housekeeping pads: Pads shall be properly doweled or expansion shielded to deck to meet acceleration criteria.

3. Requirements for installation on concrete inertia bases shall be as follows:

a. Minimum operating clearance between concrete inertia and base and housekeeping pad or floor shall be 2".
b. The equipment structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine or isolators.
c. The isolators shall be installed without raising the machine and frame assembly.
d. After the entire installation is complete and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
e. Install equipment with flexibility in wiring connection.
f. Verify that all installed isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4".
g. Prior to start-up, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base, isolators, or seismic restraints.

3.6 SEISMIC RESTRAINT EXCLUSIONS

A. General: All mechanical and electrical components and systems that are considered exempt from the requirement for seismic restraint, in accordance with The International Building Code – 2003, Section.1621 and all related State of Connecticut Supplements, shall not require seismic restraint.

B. Piping

1. Piping in boiler and mechanical rooms less than 1 1/4" inside diameter.

2. All other piping less than 2 1/2" inside diameter.

3. All piping suspended by individual hangers 12" or less as measured from the top of the pipe to the bottom of the support where the hanger is attached. However, if

the 12" limit is exceeded by any hanger in the run, seismic bracing is required for the run.

4. The 12" exemption applies for trapeze supported systems if the top of each item supported by the trapeze qualifies.

3.7 FIELD QUALITY CONTROL

A. Division 01 - General Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.15.

3.8 PROTECTION OF FINISHED WORK

A. Division 01 - General Requirements.

B. Protect adjacent surfaces from damage by material installation.

3.9 INSPECTION

A. Examine systems under provisions of Division 01.

B. On completion of installation of all vibration isolation devices herein specified, the local representative shall inspect the completed system and report in writing any installation error, improperly elected isolation devices, or other faults in the system that could affect the performance of the system. Contractor shall submit a report to the Owner, including the manufacturers representatives' final report, indicating all isolation reported as properly installed or requiring correction, and include a report by the Contractor on steps taken to properly complete the isolation work.

END OF SECTION 22 0500

SECTION 22 0516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Design of expansion system and anchors
2. Flexible pipe connectors.
3. Expansion joints.
4. Expansion compensators.
5. Pipe alignment guides.
6. Swivel joints.
7. Pipe anchors.

B. Related Sections:
1. Division 22 – Plumbing.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.9 - Building Services Piping.
2. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

1.3 DESIGN REQUIREMENTS

A. Provide design, details, work and equipment required for expansion and contraction of hot water and hot water return piping systems. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

C. Expansion Compensation Design Criteria:
1. Installation Temperature: 50 degrees F.
2. Domestic Hot Water: 140 degrees F.
3. Domestic Hot Water Recirculation: 110 degrees F.
4. Safety Factor: 30 percent.

1.4 SUBMITTALS

A. See Division 01 – General Requirements: Requirements for submittals.

B. Pipe Expansion Analysis, Design and Certification:

1. Provide pipe expansion and anchoring calculations for all domestic hot water and domestic hot water recirculation piping systems including connections to equipment, fixtures, appliances, and to the structure. Piping layouts and associated calculations must be stamped by a registered professional engineer with at least five years of pipe expansion experience, licensed in the state of the job location.
2. Analysis must indicate calculated dead loads, active expansion loads and capacity of materials utilized for connections to equipment, fixtures, appliances, and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All expansion and anchoring devices shall be designed to accept the forces as calculated.

C. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints.

D. Product Data:
1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

E. Manufacturer's Installation Instructions: Submit special procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Welders' Certificate: Include welders' certification of compliance with ASME Section IX or AWS D1.1 as applicable

H. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

1.5 CLOSEOUT SUBMITTALS

A. See Division 01 – General Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

C. Operation and Maintenance Data: Submit adjustment instructions.

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.

B. All pre-manufactured expansion fittings and loops installed on the domestic water system shall meet the requirements of SDWA 1417.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing work of this section with minimum three years of experience.

C. Design expansion compensating system under direct supervision of professional engineer experienced in design of this work and licensed at project location.

1.8 PRE-INSTALLATION MEETINGS

A. See Division 01 – General Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

A. See Division 01 – General Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

A. See Division 01 – General Requirements: Spare parts and maintenance products.

B. Supply two 12 ounce containers of packing lubricant and cartridge style grease gun.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL

A. Manufacturers:
   1. Metraflex Company – SLPC
   2. Mason Industries Inc. / Mercer Rubber Company; - FFLSS Series
   3. Flexicraft FF Series
   4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Inner Hose: 304 Stainless Steel

C. Exterior Sleeve: Single braided, type 304 stainless steel

D. Pressure Rating: 125 psi minimum working pressure at 70 degrees F.

E. Fittings Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings shall not be attached to stainless steel hose.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.2 FLEXIBLE PIPE CONNECTORS - COPPER

A. Manufacturers:
1. Metraflex Company Series BBSC
2. Mason Industries Inc. Series CPSB
3. Flexicraft Series SS
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi minimum working pressure at 70 degrees F.

E. Fittings Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings shall not be attached to stainless steel hose.

F. Maximum offset: 1/2 inch on each side of installed center line.

G. NSF 61 and NSF 372 certified for use with potable water

2.3 EXPANSION JOINTS - STEEL WITH PACKED SLIDING SLEEVE (AXIAL MOVEMENT)

A. Manufacturers:
1. Hyspan Precision Products – Series 8500
2. Mason Industries / Mercer Rubber Company Type ECGWN
3. ATS (Advanced Thermal Systems, Inc.) - Thermal Pak Series
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Working Pressure and Temperature: Class 150.

C. Joint: Sweat or equivalent connection as specified for pipe joints.

D. Size: Use pipe sized units.

E. Application: Steel piping 2 inches and over.

2.4 EXPANSION JOINTS - COPPER WITH PACKED SLIDING SLEEVE (AXIAL MOVEMENT)

A. Manufacturers:
1. Hyspan Precision Products – Series 8500
2. Mason Industries / Mercer Rubber Company Type ECGWN
3. Flexicraft Compensator Series
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Working Pressure: 125 psi.

C. Maximum Temperature: 250 degrees F.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Application: Copper or steel piping 2 inches and over.

2.5 EXPANSION LOOPS - HOSE AND BRAID

A. Manufacturers:
1. Metraflex Company: Metraloop
2. Mason Industries / Mercer Rubber Company: FFL Series or CPSB Series
3. Flexicraft: SS Connector Series
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.

C. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.

D. Flexible Connectors: Flanged or as specified in 22 0503 Pipe and Tubes for Plumbing and Equipment, braided type with wetted components of stainless steel, sized to match piping.
1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
2. Accommodate the Following:
   a. Axial Deflection in Compression and Expansion: To be determined by the Professional Engineer providing calculations.
   b. Lateral Movement: To be determined by the Professional Engineer providing calculations.
   c. Angular Rotation: 15 degrees.

d. Force developed by 1.5 times specified maximum allowable operating pressure.

3. End Connections: Same as specified for pipe jointing.
4. Provide necessary accessories including, but not limited to, swivel joints.

2.6 EXPANSION JOINTS - EXTERNALLY PRESSURIZED EXPANSION JOINTS

A. Manufacturers:
1. Metraflex Company: Metragator
2. Mason Industries / Mercer Rubber Company: HEJFFL Series
3. Flexicraft: EP Series
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Construction: Stainless steel with anti-torque device, limit stops, internal guides.

C. Maximum Allowable Working Pressure: 150 psig at 700 degrees F.

D. Maximum Axial Compression: 4 inches.

E. End Connections: Flanged or weld end.

F. Size: Use pipe sized units.

G. Application: Steel piping 2 inches and over.

2.7 EXPANSION ACCESSORIES

A. Manufacturers:
1. Metraflex
2. Mason Industries / Mercer Rubber Company
3. Vibration Eliminator
4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for insulation, minimum 3 inch travel.

C. Swivel Joints: Bronze, double ball bearing race, field lubricated, with Buna-N o-ring seals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install Work in accordance with ASME B31.9

C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Refer to Section 22 05 00. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

F. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 22 05 00 for pipe hanger installation requirements.

G. Provide grooved piping systems with minimum three flexible couplings per flexible connector supported by vibration isolation.

H. Provide expansion loops as indicated on Drawings.

3.2 MANUFACTURER'S FIELD SERVICES

A. See Division 01 – General Requirements: Manufacturers' field services.

B. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

PIPING SYSTEM	PIPING MATERIAL	PIPE SIZE	CONDITION REQUIRING EXPANSION JOINT OR EXPANSION LOOP (ALL CONDITIONS ASSUME "OFFSET LEG" AT END OF RUNS ARE MINIMUM 12'0" LONG)
Domestic hot water supply and recirculation piping (all temperatures)	Copper	Up to 3 inches	All straight sections of piping over 90' long. All straight sections of piping where "offset leg" is less than 12'0"
Domestic hot water supply and recirculation piping (all temperatures)	Steel	Up to 2 inches	All straight sections of piping over 140' long.

Domestic hot water supply and recirculation piping (all temperatures)	Steel	2" to 4"	All straight sections of piping over 90' long

END OF SECTION 22 0516

SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Gate valves.
2. Ball valves.
3. Butterfly valves.
4. Check valves.
5. Pressure relief.
6. Strainers.
7. Balancing valves.
8. Reduced pressure backflow preventers.
9. Thermostatic mixing valves.
10. Plug valves.
11. Gas pressure regulators.

B. Related Sections:
1. Division 01 – General Requirements.

2. Division 22 – Plumbing.

1.2 REFERENCES

A. ASTM International:
1. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
2. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

B. 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 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

C. Safe Drinking Water Act:
1. SDWA 1417 - Reduction of Lead in Drinking Water.

1.3 SUBMITTALS

A. Division 01 – General Requirements: 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. Division 01 - General 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 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

B. All valves installed on the domestic water distribution system shall comply with SDWA 1417. Exception shall be main shut-off valve at domestic water service entrance that is 2-inches or larger.

C. All valve manufacturers shall demonstrate that valve products have been certified per NSF/ANSI Standard 372.

D. All valves installed on the domestic water system shall have labeling of lead content engraved on the valve body.

E. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by Victaulic or an Engineer Approved Equal

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 3 years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - General 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.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Division 01 – General Requirements: Environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet or frozen.

1.9 WARRANTY

A. Division 01 – General Requirements: Requirements for warranties.

B. Furnish five year manufacturer warranty for valves excluding packing.

1.10 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish two packing kits for each size valve.

PART 2 PRODUCTS

2.1 GATE VALVES

A. Manufacturers:
1. Apollo
2. Milwaukee Valve Co.
3. NIBCO, Inc.
4. American Valve Co.
5. Watts
6. Division 01 – General Requirements

B. 2 inches and Smaller: MSS SP 80, Class 300, bronze body, bronze trim, lead free, threaded bonnet, non-rising stem, hand-wheel, inside screw, solid wedge disc, solder ends, Milwaukee Valve Company Model # UP115.

C. 2 1/2 inches and Larger: MSS SP 70, Class 175, cast iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends, Milwaukee Valve Company F-2885-FP. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.2 BALL VALVES

A. Manufacturers:
1. Apollo
2. Milwaukee Valve Co.

3. NIBCO, Inc.
4. American Valve Co.
5. Watts
6. Division 01 – General Requirements

B. 2 inches and Smaller: MSS SP 110, 600 psi WOG, two piece bronze body, lead free, type 316 stainless steel ball, full port, teflon seats, stainless steel blow-out proof stem, solder ends with lever handle, Milwaukee Valve Company Model #UPBA450S.

C. 2 inches and Smaller: MSS SP 110, Class 600, bronze, three piece body, lead free, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder ends, lever handle, Milwaukee Valve Company Model #UPBA350S.

D. 2 inches and Smaller: MSS SP 110, Class 250, bronze, two piece body, lead free, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, press ends, lever handle, Nibco Model # PC585-66-LF.

2.3 BUTTERFLY VALVES

A. Manufacturers:
1. Victaulic
2. Milwaukee Valve Company
3. NIBCO, Inc.
4. American Valve Co.
5. Watts
6. Division 01 – General Requirements

B. 2-inches and Larger: MSS SP 67, Class 200.
1. Body: Cast bronze, lug ends, stainless steel stem, extended neck.
2. Disc: Aluminum bronze.
3. Seat: Resilient replaceable EPDM or Fluoroelastomer.
4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.
5. Milwaukee Valve Company Model # ML 233E.

C. 2-inches and Larger: MSS SP 67, Class 200.
1. Body: Ductile iron, lug ends, stainless steel stem, extended neck.
2. Disc: Aluminum bronze.
3. Seat: Resilient replaceable EPDM .
4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.
5. Lead free.
6. Milwaukee Valve Company Model # ML 233E.

D. D. 2-1/2 inches and Larger: MSS SP 67, 300 CWP.

1. Body: Cast bronze, grooved ends
2. Disc: Offset ductile iron
3. Seat: Resilient replaceable Flouroelastomer
4. Handle and Operator: 10 position lever handle. Furnish chain-wheel operators for valves mounted over 8 feet above floor
5. Victaulic Model #608N.

2.4 CHECK VALVES

A. Horizontal Swing Check Valves:
1. Manufacturers:
a. Apollo
b. Milwaukee Valve Co.
c. NIBCO, Inc.
d. American Valve Co.
e. Watts
f. Division 01 – General Requirements

2. 2 inches and Smaller: MSS SP 80, Class 300, bronze body and cap, bronze seat, brass disc, solder ends, Milwaukee Valve Co. Model # 1509.
3. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, [renewable disc seal and seat,] flanged ends.

B. Spring Loaded Check Valves:
1. Manufacturers:
a. Apollo
b. Milwaukee Valve Company
c. NIBCO, Inc.
d. American Valve Co.
e. Watts
f. Division 01 – General Requirements

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 125, Class 125, lead free, wafer style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends, Nibco Model # F-910-LF.

2.5 TEMPERATURE AND PRESSURE RELIEF VALVES

A. Watts Model 40, 140, N240, 340:
1. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

2.6 STRAINERS

A. Watts series 77:

1. Size 2 inch and Under: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
2. Size 2-1/2 inch to 4 inch: Flanged cast iron body, Class 125 for 200 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.7 BALANCING VALVES

A. Bell & Gossett CB Series:
1. Construction: Brass or bronze body with union on inlet, temperature and pressure test plug on inlet and outlet.
2. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control.

2.8 BACKFLOW PREVENTERS

A. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013, AWWA C506; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; test cocks, Watts 909 or equal.

2.9 THERMOSTATIC MIXING VALVES

A. Manufacturers: Symmons model as scheduled on the drawings.

B. Other acceptable manufacturers offer equivalent products:

1. Lawler
2. Leonard
3. Powers
4. Watts

C. Accessories:

1. Check valves on inlets.
2. Volume control shut-off valve on outlet.
3. Stem thermometer on outlet.
4. Strainer stop checks on inlets.

D. Temp control thermostatic controller with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid filled motor with bellows mounted out of water, rough brass finish

E. Valve body: lead free bronze or brass.

2.10 PLUG VALVES

A. Manufacturers:
1. DeZURIK, Unit of SPX Corp.
2. Flow Control Equipment, Inc.
3. Homestead Valve

4. Milliken Valve Co.
5. Substitutions: Division 01 – General Requirements

B. 2 inches and Smaller: MSS SP 78, Class 300, semi-steel construction, rectangular port, full pipe area, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 300, semi-steel construction, rectangular port, full pipe area, pressure lubricated, teflon packing, flanged ends. Furnish wrench-operated.

2.11 GAS REGULATORS

A. Manufacturers:
1. Equimeter.
2. DeZurik.
3. Maxitrol.
4. Substitutions: Division 01 – General Requirements

B. Cast iron body (ASTM A126) spring adjustment, Buna-N soft seat, aluminum orifices, die cast aluminum alloy diaphragm case, vent valve and seal cap.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 – General Requirements: Verification of existing conditions before starting work.

B. 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 08 - Openings.

3.3 VALVE APPLICATIONS

A. Install ball, butterfly, or gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

B. Install lug or grooved end butterfly valves adjacent to equipment when functioning to isolate equipment.

C. Install flow control valves at the remote part of the domestic hot water return system. Valve size shall be minimum of 3/4-inch

D. Provide line sized isolation valves on all domestic water branches greater than ¾" when more than two fixtures are supplied.

END OF SECTION 22 0523

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING 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. Formed steel channel.
6. Equipment bases and supports.

B. Related Sections:
1. Division 03- Concrete Section 23 04 00 – General Conditions for Mechanical Trades
2. Division 07 - Thermal and Moisture Protection
3. Division 09- Finishes
4. Division 22 – Plumbing.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
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, Manufacture, Selection, Application, and Installation

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 Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

1.3 SUBMITTALS

A. Division 01 - General Requirements

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: Submit manufacturers catalog data including load capacity.

D. Manufacturer's Installation Instructions: Submit special procedures and assembly of components.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing Work of this section with minimum 3 years of experience.

1.6 PRE-INSTALLATION MEETINGS

A. Division 01 - General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01- General Requirements.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - General Requirements.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Globe Pipe Hanger Products Inc.
2. Anvil International
3. Empire Industries
4. Hilti Inc.
5. Substitutions: Division 01- General Requirements

B. Plumbing Piping - DWV:
1. Conform to ASME B31.9, ASTM F708, or MSS SP 58.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, 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.

C. Plumbing Piping - Water:
1. Conform to ASME B31.9, ASTM F708, or MSS SP 58.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, 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 ring.

D. Natural Gas / LP Gas Piping:
1. Conform to MSS SP 58.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, 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 3 inches and Smaller: Cast iron hook.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded as required by application.

2.3 INSERTS

A. Manufacturers:
1. HiltiInc.
2. Anvil International
3. Eaton
4. 3M
5. Substitutions: Refer to Division 01 – General Requirements.

B. 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. Refer to Division 07 - Thermal and Moisture Protection

2.5 SLEEVES

A. Manufacturers:
1. Flexicraft Industries; Pipe Wall Sleeve
2. Metraflex; Pipe Wall Sleeve
3. CCI Pipeline; Pipe Wall Sleeve
4. GPT – Centuryline Sleeve Series
5. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Pipe Passing Through Below Grade or Exterior Walls:
1. Anchored Sleeve - Zinc coated or cast iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

E. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814-13A in accordance with Division 07 Thermal and Moisture Protection to prevent the spread of fire, smoke, and gases.

F. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

G. Sleeves for Pipes through Non-fire Rated Walls, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

H. Sealant: refer to Division 07 Thermal and Moisture Protection.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. Thunderline Link-Seal, Inc.
2. NMP Corporation
3. Fernco
4. BWM
5. Substitutions: Refer to Division 01 – General Requirements.

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.

C. Provide NSF 61 certified assembly when used in potable water storage tank applications.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:

1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division
4. Unistrut Corp.
5. Substitutions: Refer to Division 01 – General Requirements

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - General Requirements.

B. Verify openings are ready to receive sleeves.

C. 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 backing and 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 [above] [flush with top of] [recessed into and grouted flush with] slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, or MSS SP 58.

B. Support horizontal piping as scheduled.

C. All pipe hangers and supports shall be sized in accordance with the manufacturer's guidelines to support the piping based on final layout coordinated by the contractor.

D. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

E. Place hangers within 12 inches of each horizontal elbow.

F. Use hangers with 1-1/2 inch minimum vertical adjustment.

G. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

H. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

I. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

J. Support riser piping independently of connected horizontal piping.

K. Provide copper plated hangers and supports for copper piping.

L. Design hangers for pipe movement without disengagement of supported pipe.

M. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

N. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00 Provide supplemental angles, channels and formed steel supports to support piping, ductwork, equipment, etc. from building's structure. Piping, ductwork, equipment, etc. shall not be supported from the roof deck.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment. Refer to Division 01

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members, formed steel channel, or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 21 05 48.

3.6 INSTALLATION - FLASHING

A. Refer to Division 08 - Openings

B. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

C. 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.

D. Seal mop sink drains watertight to adjacent materials.

3.7 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 1inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with stuffing, and firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel, or stainless steel escutcheons at finished surfaces.

3.8 FIELD QUALITY CONTROL

A. Refer to Division 01 - Quality Requirements and Execution and Closeout Requirements.

3.9 CLEANING

A. Refer to Division 01 - Execution and Closeout Requirements:

3.10 PROTECTION OF FINISHED WORK

A. Refer to Division 01 Execution and Closeout Requirements

3.11 SCHEDULES

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Brass	6	1/2
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
CPVC, 1 inch and smaller	3	1/2
CPVC, 1-1/4 inches and larger	4	1/2
Copper Tube and Pipe, 1-1/4 inches and smaller	6	1/2
Copper Tube and Pipe, 1-1/2 inches and larger	10	1/2
PVC 1 1/2 inch and smaller	3	3/8
PVC 2 inch and larger	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION 22 0529

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Underground pipe warning tape

E. Ceiling grid markers

1.2 RELATED REQUIREMENTS

A. Division 09 - Finishes: Identification painting.

B. Division 22 – Plumbing.

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems

B. American Society for Testing Materials
   1. ASTM D709 - Standard Specification for Laminated Thermosetting Materials

C. National Fire Protection Association
   1. NFPA 99 - Standard for Health Care Facilities

1.4 SUBMITTALS

A. See Division 01 – General Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalog literature for each product required.

C. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

D. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

1.5 QUALITY ASSURANCE

A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Identification products shall be provided by the following manufacturers:
1. Craftmark Pipe Markers
2. Brimar Industries, Inc.
3. Kolbi Pipe Marker Co.
4. Seton Identification Products
5. Substitutions: See Division 01 - General Requirements.

B. All identification products shall be by a single manufacturer

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.
4. Plastic: Conform to ASTM D709.

2.3 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.4 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.5 UNDERGROUND PIPE WARNING TAPE

A. Detectable Underground Warning Tape: Bright colored continuously printed, 2 mil clear film laminated to ½ mil Aluminum Foil Center Core. Suitable for direct burial. Designed for detectability by non-ferrous locator. Minimum widths as follows:
1. 2” width for burial depths of up to 12”
2. 3” width for burial depth of 12” to 18”
3. 6” width for burial depth of 18” to 24”

B. Provide with a continuous printed message similar to “Caution Water Line Buried Below”.

2.6 CEILING GRID MARKERS

A. Description: 10 mil self-stick vinyl -7/8” diameter markers. Color coded.

B. Color code as follows:
1. Plumbing Valves: Green.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 – Finishes, for stencil painting.

3.2 INSTALLATION

A. Install identifying devices after completion of testing and installation of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion.

C. Install tags using corrosion resistant chain. Number tags consecutively by location.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install detectable underground warning tape 6 to 8 inches below finished grade, directly above buried pipe.

G. Install piping identification on medical gas systems.

3.3 APPLICATIONS

A. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

B. Identify control panels and major control components outside panels with plastic nameplates.

C. Identify valves in main and branch piping with tags.

D. Identify piping, concealed or exposed, with plastic pipe markers plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, and flow direction.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops.
   4. For concealed piping identification shall be located not to exceed 10 feet.
   5. Locate identification adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

E. Provide ceiling grid markers to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 22 0553

SECTION 22 0700 - PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plumbing piping insulation, jackets and accessories.
2. Plumbing equipment insulation, jackets and accessories.

B. Related Sections:
1. Division 01 General Requirements
2. Division 07 - Firestopping
3. Division 09 – Finishes
4. Division 22 – Plumbing.

1.2 REFERENCES (follow the most currently adopted amended version)

A. ASTM International:
1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
5. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
6. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
7. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
8. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
9. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
10. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
11. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
12. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
13. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
14. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
15. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.

16. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
17. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
18. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
19. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
20. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation.
21. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber.
22. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
23. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
24. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
25. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
26. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
27. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Underwriters Laboratories Inc.:
1. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Division 01 – General Requirements

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and installation standards will be achieved.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

B. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

D. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping. Store all insulation materials in a clean, dry environment.

1.6 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements.

1.9 SCHEDULING

A. Schedule insulation application after pressure and leak testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency. Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 MANUFACTURER

A. Pre-Molded Glass Fiber (PGF):
   1. Johns Manville Corporation – Microlok HP Pipe Insulation
   2. CertainTeed Corporation - Crimpwrap
   3. Knauf Insulation – Earthwool
   4. Owens Corning Corporation; SSL II w ASJ:

5. Substitutions: Refer to Division 01 – General Requirements.

B. Manufacturers for Closed Cell Elastomeric (CCE) Pipe Insulation Products:
1. Armacell LLC - AP Armaflex 25/50
2. Aeroflex USA, Inc – Aerocel –SSPT w/SaniGuard
3. K-Flex USA LLC – Insul-tube
4. Substitutions: See Division 01 – General Requirements.

C. Manufacturers for PVC Jacketing (PVC):
1. Johns Manville - Zeston
2. P.I.C. Plastics Inc.
3. Proto Corporation
4. Substitutions: Division 01.

D. Manufacturers for Aluminum Jacketing (ALM):
1. Johns Manville
2. ITW Insulation Systems
3. RPR Products – Insul-Mate
4. Substitutions: Division 01.

2.3 PIPE INSULATION

A. Pre-Molded Glass Fiber (PGF) Pipe Insulation:
1. ASTM C547 and ASTM C795, rigid molded, noncombustible with jacket.
2. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
3. Maximum Service Temperature: 850 degrees F.
4. Maximum Moisture Absorption: 0.2 percent by volume.
5. Vapor Barrier Jacket: Outer film layer, kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96 of 0.02 perm-inches.
6. Vapor Barrier Lap Adhesive: Compatible with insulation.

B. Closed Cell Elastomeric (CCE) Pipe Insulation:
1. Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 3; use molded tubular material wherever possible.
2. 'K' Value: ASTM C177, between 0.21 and 0.27 at mean rating temperature of 75 degrees F
3. Minimum Service Temperature: Minus 40 degrees F
4. Maximum Service Temperature: 220 degrees F
5. Connection: Waterproof vapor barrier adhesive.
6. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETS

A. Polyvinyl-chloride Plastic Pipe Jacket (PVC):
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.

c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96
d. Thickness: 10 mil.
e. Connections: Brush on welding adhesive.

2. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket (ALM): ASTM B209 formed aluminum sheet.
1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.5 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: hydrous calcium silicate. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.

F. Valve insulation Wraps: White, noncombustible, conforming to ASTM E 84. Match insulation thickness to pipe size. Valve covers shall be easily removable.

2.6 EQUIPMENT INSULATION

A. Pre-Molded Glass Fiber (PGF) Equipment Insulation:
1. ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.
2. Thermal Conductivity: 0.24 at 75 degrees F
3. Operating Temperature Range: 0 to 450 degrees F
4. Density: 3 pound per cubic foot

B. Closed Cell Elastomeric (CCE) Equipment Insulation:
1. ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
2. 'K' Value: ASTM C177, between 0.21 and 0.27 at mean rating temperature of 75 degrees F
3. Operating Temperature Range: Range: Minus 70 to 220 degrees F

2.7 EQUIPMENT INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

E. Adhesives: Compatible with insulation. Refer to manufacturers' installation manual.

PART 3 EXECUTION

3.1 EXAMINATION

A. Protect insulation from exposure to moisture prior to and after installation. All insulation other than flexible elastomeric that becomes wet shall be replaced at no cost to the project.

B. Verify that piping and equipment has been tested before applying insulation materials.

C. Verify that piping and equipment surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Piping and fittings exposed to view: Provide with PVC Plastic pipe jacketing and fittings for additional protection. Locate insulation and cover seams in least visible locations.

D. 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 07 for penetrations of assemblies with fire resistance rating greater than one hour.

E. Insulated pipes conveying fluids below ambient temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.

F. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

G. Pre-molded Glass Fiber (PFG) insulated pipes conveying fluids above or below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.

H. For hot piping conveying fluids, insulate flanges and unions at equipment.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe 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 07 – Thermal and Moisture Protection for penetrations of assemblies with fire resistance rating greater than one hour.

J. Buried Piping: Provide closed cell elastomeric insulation with all-purpose service jacket with self-sealing lap.

K. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer and according to the heat trace manufacturer's installation instructions. Verify required thickness with heat trace manufacturer's installation instructions. Cover with aluminum jacket with seams located on bottom of horizontal piping.

L. Inserts and Shields:
   1. Application: Piping 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 the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

M. Closed Cell Elastomeric (CCE) Insulation:
   1. Push insulation on to piping.
   2. Miter joints at elbows.
   3. Seal seams and butt joints with manufacturer's recommended adhesive.
   4. When application requires multiple layers, apply with joints staggered.
   5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

N. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Below Ambient Temperature:
1. Insulate entire equipment surfaces.
2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
4. Finish insulation at supports, protrusions, and interruptions.

E. Equipment Containing all Fluids Above Ambient Temperature:
1. Insulate flanges and unions with removable sections and jackets.
2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
3. Finish insulation at supports, protrusions, and interruptions.

F. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 PIPE INSULATION SCHEDULE

A. Provide insulation materials and thicknesses scheduled for each system type and pressure/temperature range. If more than one material is listed for a system, selection from materials listed is Division 22 option.

B. Insulation for pre-insulated piping shall meet all specified requirements.

C. Insulation thickness shall be coordinated with heat trace manufacturers' installation instructions. Listed sizes on schedule shall be used as minimum sizes only.

<table>
<tr><td colspan="5">Domestic Hot Water Supply and Recirculation Systems</td></tr>
<tr><td>Insulation Type</td><td>Pipe Size (inch)</td><td>Indoor - Minimum Thickness (inch)</td><td>Factory Applied Jacket</td><td>Field Applied Jacket</td></tr>
<tr><td rowspan="2">Pre-Molded Glass Fiber (PFG)</td><td>1-1/4 inches and smaller</td><td>1.0</td><td rowspan="2">ASJ-SSL</td><td rowspan="2">Indoor: PVC for exposed piping finished space and mechanical rooms.</td></tr>
<tr><td>1-1/2 inches and larger</td><td>1.5</td></tr>
</table>

Closed Cell Elastomeric (CCE)	1-1/4 inches and smaller	1.0	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.
	1-1/2 inches and larger	1.5		

Domestic Cold Water Supply Systems				
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-Molded Glass Fiber (PFG)	1-1/4 inches and smaller	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.
	1-1/2 inches and larger	1.0		
Closed Cell Elastomeric (CCE)	1-1/4 inches and smaller	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.
	1-1/2 inches and larger	1.0		

Storm Systems: Horizontal Above Ground Within Building For The First 30 Feet				
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-Molded Glass Fiber (PFG)	All Sizes	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.
Closed Cell Elastomeric (CCE)	All Sizes	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.

Sanitary and Storm PVC Systems: Vertical Above Ground Within Building				
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-Molded Glass	All Sizes	0.5	ASJ-SSL	Indoor: PVC for

Fiber (PFG)				exposed piping finished space and mechanical rooms. Outdoor: ALM
Closed Cell Elastomeric (CCE)	All Sizes	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms. Outdoor: ALM

Roof Drain Body			
Insulation Type	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-molded Glass Fiber (PFG)	0.5	N/A	Indoor: N/A Outdoor: N/A
Closed Cell Elastomeric (CCE)	0.5	N/A	Indoor: N/A Outdoor: N/A

Domestic Hot Water Storage Tank			
Insulation Type	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-molded Glass Fiber (PFG)	1.5	N/A	Indoor: N/A Outdoor: ALM
Closed Cell Elastomeric (CCE)	1.5	N/A	Indoor: N/A Outdoor: ALM

Domestic Water Storage Tank			
Insulation Type	Indoor -	Factory	Field Applied Jacket

	Minimum Thickness (inch)	Applied Jacket	
Pre-molded Glass Fiber (PFG)	1.0	N/A	Indoor: N/A Outdoor: ALM
Closed Cell Elastomeric (CCE)	1.0	N/A	Indoor: N/A Outdoor: ALM

END OF SECTION 22 0700

SECTION 22 1005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Medical Air.
   4. Vacuum.
   5. Medical Air Compressor.
   6. Medical Vacuum Pump.
   7. Storm water.
   8. Natural gas.
   9. Flanges, unions, and couplings.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements.

B. Division 08 – Openings.

C. Division 07 - Thermal and Moisture Protection

D. Division 09 - Finishes.

E. Division 22 – Plumbing.

F. Division 26 – Electrical: Electrical characteristics and wiring connections.

G. Division 31 - Earthwork

H. Division 33 - Utilities.

1.3 REFERENCE STANDARDS – Most Currently adopted versions and amendments for the location of the project.

A. American National Standards Institute
   1. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; and addenda A&B.
   2. ANSI Z223.1 - National Fuel Gas Code.

B. American Society of Mechanical Engineers
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
   3. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250.

4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
5. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
6. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
7. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
8. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
9. ASME B31.9 - Building Services Piping.
10. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers.
11. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications.

C. American Society of Sanitary Engineering
1. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.

D. American Society for Testing and Materials
1. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53 - 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 A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
6. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
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 B68 - Standard Specification for Seamless Copper Tube, Bright Annealed.
11. ASTM B75 - Standard Specification for Seamless Copper Tube.
12. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
13. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
14. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
15. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
16. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
17. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
18. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

19. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
20. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
21. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
22. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings.
23. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
24. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
25. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
26. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
27. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
28. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
29. ASTM D2846 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
30. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
31. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
32. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
33. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
34. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
35. ASTM F441 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
36. ASTM F442 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
37. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
38. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
39. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
40. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
41. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
42. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.

43. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe;.
44. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
45. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

E. American Welding Society
1. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
2. AWS D1.1 - Structural Welding Code - Steel;.

F. American Water Works Association
1. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.
3. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
6. AWWA C606 - Grooved and Shouldered Joints.
7. AWWA C651 - Disinfecting Water Mains.
8. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Transmission and Distribution; 2016.
9. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service.

G. 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.

H. International Code Council
1. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Element.
2. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.
3. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements.
4. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

I. Manufacturers Standardization Society
1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
2. MSS SP-67 - Butterfly Valves.
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-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 20DA.
   MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
7. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

J. National Sanitation Foundation
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

K. National Fire Protection Association
   1. NFPA 54 – Natural Gas Code
   2. NFPA 58 – Liquefied Petroleum Gas Code.

L. Plastic Pipe Institute
   1. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe.

1.4 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welder Certificate: Include welder’s certification of compliance with ASME BPVC-IX.

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

E. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

F. Project Record Documents: Record actual locations of valves.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 -General Requirements.
   2. Valve Repacking Kits: One for each type and size of valve.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 10 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.4 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88, Type L (A).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Joints: Grooved mechanical couplings.
   4. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non-toxic synthetic rubber sealing elements.
      a. Manufacturers:
         1) Mueller Streamline Co (Mass approved manufacturer)
         2) Oatey Company (Mass approved manufacturer)
         3) Cambridge Lee Industries (Mass approved manufacturer)
         4) JM Eagle (Mass approved manufacturer)
         5) Viega LLC
         6) Substitutions: Division 01- General Requirements.

2.5 MEDICAL AIR PIPING, ABOVE GRADE

A. Piping All Sizes, Below Gage Pressure of 185 psig:
   1. Copper Tubing: ASTM B819, Type L. Furnish piping identified with manufacturer's markings.

B. Piping 2-1/2 inches and Smaller, Above Gage Pressure of 185 psi:
   1. Copper Tubing: ASTM B819, Type L. Furnish piping identified with manufacturer's markings.

C. Fittings: ASME B16.22, wrought copper and bronze or MSS SP 73 wrought and cast copper.

D. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting temperature range 1190 to 1480 degrees F.

2.6 VACUUM PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B819, Type L.
   1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
   3. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting temperature range 1190 to 1480 degrees F.

2.7 VACUUM PUMP EXHAUST PIPING

A. Copper Tubing: ASTM B819, Type L.
   1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting temperature range 1190 to 1480 degrees F.

2.8 MEDICAL AIR COMPRESSOR

A. Manufacturers:
1. Beacon Medaes
2. Allied Health Care
3. Amico Corporation

B. Oil Free Scroll Compressor: Simplex, tank mounted, enclosed in a steel, sound-insulated canopy. Compressor system shall include:
1. Inlet Filter:
   a. Paper cartridge type.
2. Air Compressor Element:
   a. Die cast aluminum, fixed scroll housing, orbiting scroll rotor. Cast iron crankshaft and pulley.
3. Drive Motor:
   a. Belt driven
4. Control Panel:
   a. ON/OFF switch, temp gauge, pressure gauge, hour meter. Pressure switch with automatic on/off.
5. Starter:
   a. Direct across the line.
6. Integrated Dryer:
   a. Prewired to the compressor power supply, integrated inside the canopy, controlled by primary controller. R134A refrigerant, Air-to-air heat exchanger.
7. Receiver Tank:
   a. Size as indicated on drawings, manual drain valve.

2.9 MEDICAL VACUUM PUMP

A. Manufacturers:
1. Beacon Medaes
2. Allied Health Care
3. Amico Corporation

B. Lubricated Rotary Vane Pumps: Oil lubricated, direct driven, air cooled with no water requirements. Integral, fully recirculating oil supply to provide lubrication. An automotive-type, spin-on oil filter. High-discharge temp switch. Oil drain valve assembly with temp gauges. Mount pump on vibration isolators.
1. Vacuum Pump includes:
   a. Built –in, anti-suck-back valve mounted at the pump inlet.
   b. Three non-metallic non-asbestos vanes, 30,000 minimum life hours each.
   c. 5 micron inlet filter
   d. Flexible connector and isolation valve.
2. Vacuum Pump Motor and Lag Alarm:

a. Motor is continuous duty, NEMA rated, C-face, foot-mounted, TEFC, 1800 RPM.

3. Vacuum Receiver:
   a. ASME code stamped, rated for minimum 200 PSIG.
   b. Full size three-valve bypass system for draining.
   c. Manual drain.
4. Intake Piping:
   a. Factory pipe intake with flexible connector
   b. Isolation valve with 24V electric actuator and check valve.

2.10 STORM WATER PIPING, BURIED WITHIN 10 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.11 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets

2.12 NATURAL GAS / LPG GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53 Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

2.13 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Housing Material: Provide ASTM A47 malleable iron, ductile iron, or galvanized.
   3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.

4. Gasket Material: Nitrile rubber suitable for operating temperature range from minus 20 degrees F to 180 degrees F.
5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
7. Manufacturers:
   a. Grinnell Products, a Tyco Business
   b. Bristol Metals (Mass approved manufacturer)
   c. Viega LLC (Mass approved Manufacturer).
   d. Victaulic Company (Mass approved manufacturer)
   e. Substitutions: Division 01 - General Requirements.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier are required where two dissimilar metal products are connected within a system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that 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

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220700.

G. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Division 08 Openings.

H. Establish elevations of buried piping outside the building to ensure not less than the local area's frost depth of cover.

I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly and a minimum of 10 feet from an air intake; refer to Division 08 Openings.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
   1. Painting of interior plumbing systems and components are specified in Division 09 - Finishes.
   2. Painting of exterior plumbing systems and components are specified in Division 09 - Finishes.

M. Excavate in accordance with Division 31- Earthwork requirements.

N. Backfill in accordance with Division 31 – Earthwork requirements.

O. Install bell and spigot pipe with bell end upstream.

P. Install water piping to ASME B31.9.

Q. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

R. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

S. Provide 1-1/4" discharge exhaust connection from medical vacuum pump to exterior.

3.4 TOLERANCES

A. Sanitary Drainage Piping: slope to sanitary drain at minimum of 1/8 inch per foot.

B. Pressure test natural gas piping in accordance with NFPA 54.

3.5 SYSTEM FLUSHING

A. The following system flushing criteria shall apply to all domestic water piping systems inclusive of hot water, cold water and hot water recirculation.

B. Upon completion of installation of piping, and prior to disinfection, flush the piping systems with clean, potable water until dirty water does not appear at the points of outlet.

C. Remove strainers and flow restrictors from fixtures prior to flushing and reinstall after flushing is complete

D. Mixing valves located at fixtures shall not be installed until after flushing is complete. Provide temporary bypass connections as required.

E. Provide isolation and temporary bypass piping for water heaters, expansion tanks, and other equipment.

F. Run fixtures simultaneously for a minimum of 30 minutes or until no debris is evident.

G. Flushing shall be considered satisfactory when no debris is evident after running water through a number 80 mesh screen.

H. Contractor to notify engineer and owner a minimum of 72 hours before performing flushing.

I. Once system has been successfully flushed, contractor shall provide a report to engineer documenting flushing procedure and results.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. 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 22 1005

SECTION 22 3300 – WATER HEATERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.01A, entitled “Related Documents.

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

C. This section applies to all sections of Division 22, "Plumbing” of this project specification unless specified otherwise in the individual sections.

1.2 SUMMARY

A. Section Includes:
   1. Commercial gas-fired water heaters.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for concrete housekeeping pads specified by this section.
   2. Division 22 – Plumbing.
   3. Division 23 – Mechanical.
   4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.3 REFERENCES

A. American National Standards Institute:
   1. ANSI Z21.10.1 - Gas Water Heaters Vol. I Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.
   2. ANSI Z21.10.3 - Gas Water Heaters - Vol. III Storage, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. American Society of Mechanical Engineers:
   1. ASME PTC 25 - Pressure Relief Devices.
   2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. National Fire Protection Association:
   1. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.
   2. NFPA 54 - National Fuel Gas Code.

E. United States Department of Energy:

1. DOE 10 CFR - Uniform Test Method for Measuring the Energy Consumption of Furnaces.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate heat exchanger dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.

C. Product Data:
1. Water Heaters: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Indicate pump type, capacity and power requirements. Submit electrical characteristics and connection locations.
2. Pumps: Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

D. Manufacturer's Installation Instructions: Submit mounting and support requirements.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.6 QUALITY ASSURANCE

A. Conform to ASME for construction of water heaters. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

B. Maintain one copy of each document on site.

1.7 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. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Products storage and handling requirements.

B. Accept water heaters on site in original labeled cartons. Inspect for damage.

C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish 10 year manufacturer warranty for domestic water heaters packaged water heating systems.

1.12 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 COMMERCIAL GAS FIRED WATER HEATERS

A. Manufacturers:
1. A. O. Smith
2. PVI
3. Lochinvar
4. Substitutions: Section 01 60 00 – Product Requirements

B. Type: Automatic, natural gas-fired, vertical storage.

C. Tank: Nickel (nickel/phosphorus) coating welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches polyurethane, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

D. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.

E. Controls: Automatic water thermostat with adjustable temperature range from 120 to 180 degrees F Automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.

2.2 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: In accordance with Section 26 05 03

B. Disconnect Switch: Factory mount disconnect switch on equipment.

PART 3 EXECUTION

3.1 INSTALLATION

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. Install water heater on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than water heater base on each side. Refer to Section 03 30 00.

C. Connect natural gas piping in accordance with NFPA 54.

D. Connect natural gas piping to water heater, full size of water heater gas train inlet. Arrange piping with clearances for burner removal and service.

E. Connect domestic hot water, domestic cold water piping to supply and return water heater connections.

F. Install the following piping accessories. Refer to Section 22 11 00.
   1. On supply:
      a. Thermometer well and thermometer.
      b. Strainer.
      c. Pressure gage.
      d. Shutoff valve.
   2. On return:
      a. Thermometer well and thermometer.
      b. Pressure gage.
      c. Shutoff valve.

G. Install the following piping accessories on natural gas piping connections. Refer to Section 22 11 23.
   1. Strainer.
   2. Pressure gage.
   3. Shutoff valve.
   4. Pressure reducing valve.

H. Install discharge piping from relief valves and drain valves to nearest floor drain.

I. Install circulator and diaphragm expansion tank on water heater.

J. Install pressure regulator vent and pipe to outside.

K. Install condensate neutralization kit and run to nearest floor drain.

L. Install water heater trim and accessories furnished loose for field mounting.

M. Install electrical devices furnished loose for field mounting.

N. Install control wiring between water heater control panel and field mounted control devices.

O. Connect flue to water heater outlet, full size of outlet. Refer to Division 23.

END OF SECTION

SECTION 22 4000 - PLUMBING FIXTURES AND SPECIALTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Attention is directed to the following specifications sections, which are hereby made a part of this Section of the Specifications.

1. Division 01 - General Requirements
2. Division 07 – Thermal and Moisture Protection: Product requirements for calking between fixtures and building components for placement by this section.
3. Division 11 – Equipment.
4. Division 12 – Furnishings: “Plastic Laminate-Clad Countertops”
5. Division 12 – Furnishings: “Solid Surface Countertops”
6. Division 22 – Plumbing.
7. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 SUMMARY

A. Section includes the following plumbing fixtures:

1. Electric water coolers
2. Janitors sinks.
3. Lavatories.
4. Bathtubs.
5. Sinks.
6. Water closets.

B. Section includes the following plumbing specialties:

1. Reduced Pressure Principal Backflow Preventers.
2. Double Check Valve Backflow Preventer Assemblies.
3. Cleanouts.
4. Expansion tanks.

5. Floor sinks.

6. Fixture supports.

7. Lavatory insulation kit.

8. Plumbing traps.

9. Water hammer arrestors.

10. Water Meters.

11. Stops

1.3 REFERENCES

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. American National Standards Institute:

1. ANSI 61 - Drinking Water System Components

2. ANSI A112.21.1 - Floor Drains.

3. ANSI A112.26.1 - Water Hammer Arrestors.

4. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

5. ANSI Z124.1 - Plastic Bathtub Units.

6. ANSI Z124.2 - Plastic Shower Units.

7. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.

8. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

C. Air-Conditioning and Refrigeration Institute:

1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

D. American Society of Mechanical Engineers:

1. ASME A112.6.3 – Floor and Trench Drains

2. ASME A112.6.4 – Roof, Deck, and Balcony Drains

3. ASME A112.18.1 - Plumbing Supply Fittings.

4. ASME A112.18.1M – Plumbing Fixture Fittings.

5. ASME A112.18.2 – Plumbing Waste Fittings.

6. ASME A112.19.1 - Enameled Cast Iron and Enameled Steel Plumbing Fixtures.

7. ASME A112.19.2 - Ceramic Plumbing Fixtures.

8. ASME A112.19.3 - Stainless Steel Plumbing Fixtures

9. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures.

10. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks.

11. ASME A112.19.14 - Six-Liter Water Closets Equipped with Dual Flushing Device.

12. ASME A112.19.15 - Bathtub/Whirlpool Bathtubs with Pressure Sealed Doors.

13. ASME A112.19.19 Vitreous China Non-water Urinals

14. ASME A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use.

15. ASME A112.36.2M – Cleanouts.

E. American Society of Testing and Materials

1. ASTM A888-20 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

2. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

3. ASTM C1613-17 - Standard Specification for Precast Concrete Grease Interceptor Tanks

4. ASTM F409 – Standard Specifications for Thermoplastic and Replaceable Plastic Tub and Tubular Fittings.

5. ASTM F2649-14 - Standard Specification for Corrugated High Density Polyethylene (HDPE) Grease Interceptor Tanks

6. ASTM D-4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials

F. American Society of Safety Engineers

1. ASSE 1012, Performance Requirements For Backflow Preventers With An Intermediate Atmospheric Vent

2. ASSE 1013, Performance Requirements for Reduced Pressure Principle Backflow Preventers

3. ASSE 1016/ASME A112.1016/CSA B125.16-11, Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations

4. ASSE 1017, Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems

5. ASSE 1062, Performance Requirements for Temperature Actuated Flow Reduction (TAFR) Valves for Individual Fixture Fittings

6. ASSE 1066, Performance Requirements for Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings

7. ASSE 1069, Performance Requirements for Automatic Temperature Control Mixing Valves

8. ASSE 1070/ASME A112.1070/CSA B125.70-15, Performance Requirements for Water Temperature Limiting Devices

9. ASSE 1071, Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment

G. American Society of Heating, Refrigeration and Air Conditioning Engineers:

1. ASHRAE Std 18 - Methods of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration.

H. International Association of Plumbing and Mechanical Officials:

1. IAPMO IGC 187 – Roof Drains with Integral Overflow Drain.

2. IAPMO Z124 - Plastic Plumbing Fixtures.

3. IAPMO Z403-13 - Terrazzo, Concrete, and Natural Stone Plumbing Fixtures

I. International Surface Fabricators Association

1. ISFA 2-01 – Classification and Standards for Solid Surfacing Material

J. National Sanitation Foundation:

1. NSF 61 - Drinking Water System Components - Health Effects.

2. NSF 372 - Drinking Water System Components - Lead Content.

K. Plumbing Drainage institute:

1. PDI WH-201 – Water Hammer Arresters.

1.4 SUBMITTALS

A. Division 01 - General Requirements.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Samples: Submit two lavatory supply fittings fixtures for color matching.

E. Manufacturer's Installation Instructions: Submit installation methods and procedures. Indicate assembly and support requirements

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

H. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

I. Waterless Urinals: Submit recommended frequency of maintenance and parts replacement, methods of cleaning, sources of replacement supplies and parts.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - General Requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with State of New York standard.

B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.

C. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

D. Maintain one copy of each document on site.

1.7 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.

1.8 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.9 PRE-INSTALLATION MEETINGS

A. Division 01 - General Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - General Requirements.

B. Accept products on site in factory packaging. Inspect for damage.

C. Protect installed fixtures and specialties from damage by securing areas and by leaving factory packaging in place to protect fixtures and specialties, and prevent use.

1.11 WARRANTY

A. Division 01 - General Requirements.

B. Furnish five year manufacturer warranty for plumbing fixtures.

1.12 EXTRA MATERIALS

A. Division 01 - General Requirements.

B. Furnish two sets of faucet washers flush valve service kits lavatory supply fittings shower heads toilet seats.

C. Provide two loose keys for hose bibs and wall hydrants.

D. Furnish supply of chemicals for treatment and testing during warranty period of solar hot water system.

PART 2 PRODUCTS

2.1 GENERAL

A. See schedule on drawings for additional requirements and accessories.

B. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:

1. Elkay.

2. Haws.

3. Oasis.

4. Murdock.

5. Substitutions: Division 01 - General Requirements.

B. Water Cooler: ARI 1010

C. All components of the electric water cooler in the wetted surface material shall be lead free in accordance with SDWA 1417

1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F (27 degrees C) and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.

2. Electrical: 115 V, 60-Hertz compressor, 6-foot cord and plug for connection to electric wiring system including grounding connector. Refer to division 26 plans and specifications.

2.3 JANITOR SINKS

A. Manufacturers:

1. American Standard

2. Acorn

3. Fiat

4. Kohler Co.

5. Just

6. Substitutions: Division 01 - General Requirements.

B. IAPMO Z403-13; Molded stone basin and integral drain body.

C. Supply Faucets

1. Manufacturers

a. Speakman

b. American Standard, Inc.

c. Kohler Company

d. Zurn Industries, Inc.

e. Symmons

f. T&S Brass

g. Chicago Faucets

h. Substitutions: Division 01 - General Requirements.

D. Faucet and Trim: ASME A112.18.1, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

2.4 LAVATORIES

A. Manufacturers:

1. American Standard

2. Willoughby

3. Bradley

4. Kohler Co.

5. Crane

6. Acorn

7. Substitutions: Division 01 - General Requirements.

B. Basin: ASME A112.19.2; Vitreous China Wall Hung Basin: with 4 inch high back, , rectangular basin with splash lip, front overflow, and soap depression.

C. Basin: ASME A112.19.2; Vitreous China Under-Mount Basin: ASME A112.19.2; front overflow, mounting kit and template by manufacturer.

D. Supply Faucets

1. Manufacturers

a. American Standard, Inc.

b. Kohler Company

c. Zurn Industries, Inc.

d. Symmons

e. T&S Brass

f. Chicago Faucets

g. Substitutions: Division 01 - General Requirements.

2. Supply Fitting: ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator with maximum

E. For public hand washing facilities, provide tempered water through regulating device conforming to ASSE 1070.

F. Waste Fittings: ASME A112.18.2 or ASTM F 409.

G. Accessories:

1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.

2. Perforated open strainer.

3. Screwdriver stops.

4. Rigid supplies.

5. Trap and waste insulated and offset to meet ADA compliance.

H. Wall Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs. See drawings for additional requirements and accessories.

2.5 BATHTUBS

A. Bathtub Manufacturers:

1. American Standard.

2. Kohler Co.

3. Sterling.

4. Substitutions: Division 01 - General Requirements.

B. Bathtub:

1. IAPMO Z124; molded glass fiber reinforced polyester, with slip-resistant bottom surface, contoured shape, color by architect.

C. Bath and Shower Trim: ASME A112.18.1; concealed shower and over rim supply with diverter spout, indexed handles, bent shower arm with adjustable spray ball joint showerhead and escutcheon, lever operated pop-up waste and overflow.

2.6 WATER CLOSETS – FLUSH VALVE

A. Manufacturers:

1. American Standard

2. Gerber Plumbing Fixtures LLC

3. Zurn

4. Toto

5. Kohler Co.

6. Crane

7. Substitutions: Division 01 - General Requirements

B. Bowl: ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.

C. Flush Valve Manufacturers:

1. Sloan

2. American Standard

3. Zurn

4. Hydrotek

5. Substitutions: Division 01 - General Requirements.

D. Sensor Operated Flush Valve: ASME A112.18.1; exposed chrome plated brass, diaphragm type with battery operated solenoid operator, infrared sensor and over-ride button in chrome plated plate, wheel handle stop and vacuum breaker; maximum 1.6 gallon flush volume.

E. Seat: Solid white plastic, open front, extended back, brass bolts, without cover. See drawings for additional requirements and accessories.

F. Wall Mounted Carrier: ASME A112.6.1; cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.7 REDUCED PRESSURE BACKFLOW PREVENTERS

A. Manufacturers:

1. Watts.
2. Zurn.
3. Apollo Valves.
4. Substitutions: See Division 01 - General Requirements.

B. Reduced Pressure Backflow Preventers:

1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type

differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

A. In cold water branch lines serving HVAC equipment, provide all-bronze backflow preventers with strainer, air gap drain funnel and quarter-turn full-port ball valves.

B. For cold water service and hot water 3” and smaller, provide all-bronze flanged backflow preventers with OS&Y gate valves, strainer and air gap drain funnel. For hot water units provide high temperature rated components.

C. For cold water service 4” and larger, provide epoxy-coated cast iron backflow preventers with OS&Y gate valves, strainer and air gap drain funnel.

D. All backflow preventers shall be installed so they can be easily accessed for testing and maintenance, install 36" above floor, pipe vent discharge to floor drain.

2.8 CLEANOUTS

A. Manufacturers:

1. Josam.

2. J.R. Smith.

3. Zurn.

4. Watts.

5. Wade.

6. Substitutions: Division 01 - General Requirements.

B. ASME A112.36.2M; Cleanouts: Cast iron body with adjustable scoriated nickel bronze top and vandal proof screws.

C. Interior Finished Wall Cleanouts: Line type with cast iron body, round epoxy coated gasketed cover and round stainless steel access cover secured with machine screw.

D. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide stack cleanouts on vertical rainwater leaders.

E. Cleanout plugs shall be screwed brass installed either in cast iron-caulked ferrules or directly into threaded drainage fittings. Above floor cleanouts on stacks may be "Dandy" cleanouts.

F. Refer to other Sections of the Specification for access doors which may be used in lieu of covers specified below.

G. Cleanouts are to be accessible and locations coordinated with cabinetry, shelving and other architectural details. DO NOT place cleanouts where they will not be readily accessible.

2.9 EXPANSION TANKS

A. Manufacturers:

1. Amtrol.

2. Bell and Gossett.

3. Taco.

4. Watts.

B. Substitutions: Division 01 - General Requirements Construction: Welded steel, ASME labeled, tested and stamped in accordance with Section 8D of ASME Code; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

2.10 FIXTURE SUPPORTS

A. Manufacturers:

1. J.R. Smith.

2. Josam.

3. Wade.

4. Zurn.

5. MIFAB.

6. Substitutions: Division 01 - General Requirements.

B. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

C. For each wall-hung lavatory, urinal, water cooler, drinking fountain and water closet, provide concealed carrier suited for fixture, location, wall thickness and material.

D. Concealed carriers with exposed arms for sinks and lavatories shall have acid-resisting enamel finish.

2.11 FLOOR SINK

A. Manufacturers:

1. Josam.

2. J.R. Smith.

3. Watts.

4. Zurn.

5. Wade

6. Substitutions: Division 01 - General Requirements.

B. ANSI A112.21.1. Square, cast iron, drainage flange with weep holes, and internal cast iron dome strainer. Provide barrier type trap guard conforming to ASSE 1072.

C. Provide full, half, quarter grates, or less grate as required to suit job conditions.

2.12 LAVATORY INSULATION KIT

A. Manufacturers:

1. McGuire

2. Truebro

3. Plumerex

4. Substitutions: Division 01 - General Requirements.

B. ANSI A117.1; Where Lavatories are noted to be insulated for ADA compliance, furnish safety covers consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

2.13 PLUMBING TRAPS

A. Manufacturers:

1. McGuire Manufacturing Co.

2. Josam.

3. Wade.

4. Zurn.

5. Substitutions: Division 01 - General Requirements.

B. ASTM A888-20; Fixture traps shall be 17 gauge or heavier material; other traps shall be of same size and material as pipe on which trap occurs.

C. Provide cleanout for each trap. Running traps shall have double hubs for two cleanouts.

D. Provide deep traps with 4” minimum seal, for floor drains.

2.14 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Woodford.
2. Josam.
3. Wade.
4. Zurn.
5. Watts.
6. Substitutions: Division 01 - General Requirements.

B. ANSI A112.26.1; sized in accordance with PDI, precharged, suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250

2.15 WATER METERS

A. Manufacturers:

1. Neptune.
2. Badger.
3. EMCO.
4. Hersey Co.
5. Substitutions: Division 01 - General Requirements.

B. NSF 372;

C. Water meter shall be cast bronze, corrosion resistant, light weight, with glass lens readout and with flanged inlets and outlets. Water meter to meet or exceed all the requirements of the local water authority and AWWA standards. Water meter shall be lead free.

2.16 STOPS

A. Manufacturers:

1. Brass Craft.
2. Watts.
3. Nibco.
4. McGuire.
5. Substitutions: Division 01 - General Requirements.

B. ASME A112.18.1;

C. Chrome plated angle brass supply stop valve with full turn brass stem, lead free, inlet shall be 1/2-inch sweat, outlet shall be 3/8-inch compression.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - General Requirements

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.

B. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install each fixture with trap, easily removable for servicing and cleaning.

C. Provide chrome plated rigid supplies to fixtures with screwdriver stops, reducers, and escutcheons.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall carriers and bolts.

F. Seal fixtures to wall and floor surfaces with sealant as specified in Division 07, 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.

I. Refer to architectural drawing for required mounting heights of fixtures.

J. Install in accordance with manufacturer's instructions.

K. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

L. Cleanouts shall be same size as the pipes served, up to 4 inches; 5 and 6 inch pipes shall have 4 inch cleanouts; 8 inch pipes shall have 6 inch cleanouts; 10 inch pipes and larger shall have 8 inch cleanouts.

M. Install components level and plumb.

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. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Division 01 - General Requirements: Product Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Division 01 - General Requirements: Product Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

END OF SECTION 22 4000

SECTION 23 0400 - GENERAL CONDITIONS FOR MECHANICAL TRADES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to all Divisions 23 Sections.

B. This section applies to certain sections of Division 26, "Electrical," and this section applies to all sections of Division 23, "Mechanical" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades (Architectural, Food Service, Structural, Landscape, Civil, Mechanical, Fire Protection and Plumbing) shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

1.2 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division. Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

1.3 INTENT

A. It is the intent of the Specifications and Drawings to call for finished work, tested and ready for operation. Provide all parts necessary for the intended use, fully complete and operational, and installed in professional manner in accordance with the design intent.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section includes the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

1.4 DEFINITIONS

A. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

B. “Approved equal” mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

D. “Finished” refers to all rooms and areas to be specified to receive architectural treatment as indicated on the drawings. All rooms and areas not covered, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

E. “Furnish” or “supply” shall mean purchase, deliver to, and off-load at the job site, ready to be installed including where appropriate all necessary interim storage and protection.

F. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

G. “Install” shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

H. “Product” shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

I. “Provide” shall mean furnish (or supply) and install as necessary.

J. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

K. Remove: The term “remove” means “to disconnect from its present position, remove from the premises and to dispose of in a legal manner.”

L. Special Warranties: The term “Special Warranties” are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

M. Standard Product Warranties: The term “Standard Product Warranties” are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

N. “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Plumbing Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

O. Substitutions: Requests for changes in products, materials, equipment, and methods of construction proposed by the Contractor are considered requests for "substitutions."

P. “Wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

1.5 CONTRACT DOCUMENTS

A. The two dimensional drawings govern the construction. They show the design intent and are part of the Contract Documents. BIM models are not part of contract documents. They are developed for convenience only.

B. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

C. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

D. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

1.6 DISCREPANCIES IN DOCUMENTS

A. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

B. Where Drawings or Specifications conflict or are unclear, submit clarification request in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or un-clarities thus resolved.

C. Where Drawings or Specifications do not coincide with manufacturers' recommendations or with applicable codes and standards, submit clarification request in form of an RFI before installation. Otherwise, make changes in installed work required for compliance with manufacturer instructions or codes and standards within Contract Price.

D. Where insufficient information exists in the documents to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements, where notification required by Paragraph (B) above has not been submitted, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in professional manner either concealed or exposed in accordance with the design intent.

E. Where discrepancies exist between the mechanical, plumbing, fire protection, and electrical drawings in regards to what trade owns disconnects or starters, the discrepancy shall be brought to the Architect’s attention in accordance with paragraph (B) above. If the scope is not resolved prior to the Award of Contract, Division 26 shall provide such items.

1.7 SURVEYS AND MEASUREMENTS

A. Before submitting their Bid, the Contractors shall visit the site and become thoroughly familiar with all existing conditions under which work will be installed. This Contract includes all modifications of existing systems required for the installation of new equipment. This Contract includes all necessary offsets, transitions and modifications required to install all new equipment in existing spaces. All new and existing equipment and systems shall be fully operational under this Contract before the job is considered complete. The Contractors shall be held responsible for any assumptions he makes, any omissions or errors he makes as a result of his failure to become fully familiar with the existing conditions at the site and the Contract Documents.

B. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.8 CODES AND STANDARDS

A. Reference Standard Compliance

1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

2. Independent Testing Organization Certificate: In lieu of the label or listing indicated above, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. Wherever Codes and/or Standards are mentioned in these Specifications, the latest applicable edition or revision of the local building or life safety code shall be followed.

C. The following Standards shall be used where referenced by the following abbreviations:

AABC	Associated Air Balance Council
ACGIH	American Conference of Governmental Industrial Hygienists
ADC	Air Diffusion Council
AGA	American Gas Association
AIA	American Institute of Architects
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers

ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society of Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CGA	Compressed Gas Association
CSA	Canadian Standards Association
CISPI	Cast Iron Soil Pipe Institute
EJMA	Expansion Joint Manufacturing Association
EPA	Environmental Protection Agency
FM	Factory Mutual
FSSC	Federal Specification
HIS	Hydraulic Institute Standards
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
ISO	Insurance Services Office
MCAA	Mechanical Contractors Association of America
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NOFI	National Oil Fuel Institute
NSC	National Safety Council
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PDI	Plumbing and Drainage Institute

SBI	Steel Boiler Industry (Division of Hydronics Institute)
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
STI	Steel Tank Institute
UL	Underwriters' Laboratories

D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.9 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.10 EQUIPMENT EQUIVALENTS AND SUBSTITUTIONS

A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of quality, finish and design that is required. If the Contractors uses an "approved equal" alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.

B. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

C. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.

D. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer's equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

E. If an alternative or substitute item results in a difference in quantity and arrangement of structure, piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.

F. Equipment, material or devices submitted for review as a "substitution" shall meet the following requirements:

G. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.

H. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.

b. Samples, where applicable or requested.

c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.

e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the

substitution. Indicate the effect of the proposed substitution on overall Contract Time.

f. Cost information, including a proposal of the net change, if any in the Contract Sum.

g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.

i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.

2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.11 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 1 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

1. Allow ten business days for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.

2. If an intermediate submittal is necessary, process the same as the initial submittal.

3. Allow ten business days for reprocessing each submittal.

4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Submittals shall be arranged in order of specification sections.

1. Include the following information on the label for processing and recording action taken.

a. Project name.

b. Date.

c. Name and address of Engineer.

d. Name and address of Contractor.

e. Name and address of subcontractor.

f. Name and address of supplier.

g. Name of manufacturer.

h. Number, title and paragraph of appropriate Specification Section.

i. Drawing number and detail references, as appropriate.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

F. Except for submittals for record, information or similar purposes, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.

1.12 SHOP DRAWINGS

A. Submit neatly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated ductwork layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review all shop drawings to be incorporated in the Mechanical Contract.

C. Provide shop drawings for all devices specified under equipment specifications for all systems. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures), of all shop drawings, catalog cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. When a submittal could involve more than one trade, e.g., valves, piping, etc., the submitted shall be separated by traded involved, ie. HVAC, plumbing, fire protection, etc.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

F. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

G. "No Exception Taken" rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings. Review of shop drawings shall not apply to quantity of material.

H. After shop drawings have been reviewed, with no exceptions taken, no further changes will be allowed without the written consent of the Engineer.

I. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

J. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to Bidding to allow for issuance of an Addendum.

K. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

L. All submittals shall be made in electronic PDF format with searchable OCR (Optical Character Recognition) format. This excludes scanned and faxed materials.

1.13 COORDINATION DRAWINGS AND BIM MODEL

A. Coordination drawings are required for all mechanical and electrical trades. The content and procedures described in Division 01 shall be followed, with the additional requirements specifically for the mechanical and electrical trades as described in this Section. If a BIM model is not used on this project, the below requirements shall be accomplished in CAD.

B. Prepare coordination drawings accordance with Division 01, at 1 to 1 (full) scale prepared at ¼" = 1' -0" detailing major elements, components, and systems of

mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. The Contractor shall indicate the proposed locations of piping, conduit, ductwork, equipment, and materials. Include the following:

    a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

    b. Equipment connections and support details.

    c. Exterior wall and foundation penetrations.

    d. Fire-rated wall and floor penetrations.

    e. Sizes and locations of required concrete pads and bases.

C. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

D. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

E. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

F. The Contractor and each subcontractor shall sign and date each coordination drawing prior to submission.

G. Work shall not be performed until coordination drawings have been approved by the architect and engineer.

H. Electronic copies of the MEP floor plans and/or BIM model are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. If the Contractor elects to obtain the Engineers electronic files an Electronic Drawing File Release Form must be submitted. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic Drawing File Release Form, the Engineer will provide copies of the electronic files for the Contractor's use. A copy of the Electronic Drawing File Release Form is appended to the end of this specification section

I. Review by Engineer of coordination drawings is limited to confirming that requirements for coordination and preparation of plans have been complied with by the Contractor and shall not diminish responsibility under this Contract for final coordination of installation

and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other related work.

1.14 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, HVAC piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

E. The two dimensional drawings are diagrammatic. They indicate general arrangements of mechanical systems and other work, and are intended to convey sufficient information for skilled contractors and tradespeople to furnish and install complete systems. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, provide all other components and materials to make the systems fully complete, coordinated with other systems and the structure and space available, and operational. Similarly, the drawings 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 in order to avoid interferences and to meet ceiling heights and other Architectural requirements. Establish and provide offsets, changes in direction, and exact routings to coordinate all systems. Where conflicts or potential conflicts exist and engineering guidance is desired, submit a “Request for Information” (RFI).

F. Controls contractor shall coordinate and sequences of operation with all other trades as necessary to provide a complete and functioning system.

1.15 QUALITY CONTROL

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled tradespeople, fitters, metal workers, welders, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of mechanical systems shall be performed by experienced, skilled tradespeople under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, professional manner. The Engineer reserves the right to reject any work which, in their opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.16 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.

B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.17 TEMPORARY UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Utilities: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.

F. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

G. Temporary Heat-Cool-Dehumidification: Provide temporary services required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate temporary services to produce the ambient condition required and minimize consumption of energy. The building’s permanent HVAC systems shall not be used for these purposes.

H. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

I. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.18 Equipment Access

A. Appliances, controls devices, heat exchangers and HVAC system components that utilize energy shall be accessible for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping or ducts not connected to the *appliance* being inspected, serviced, repaired or replaced. A level working space not less than 30 inches deep and 30 inches wide shall be provided in front of the control side to service an *appliance*.

1.19 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, piping, heating, temperature control work, fire stopping, water heaters, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required to maintain existing systems operational or to accommodate the construction phasing of the project.

1.20 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or workpeople and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and

protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by tradespeople or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.21 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer's recommendations and is operating as intended by the manufacturer.

1.22 CLEANING

A. The Contractor shall thoroughly clean and flush all piping, ducts and equipment of all foreign substances, oils, burrs, solder, flux, etc., inside and out before being placed in operation.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all ducts and pipes shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.

2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

4. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.23 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, the contractor shall fully instruct the Owner or the Owner’s representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) days notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer’s representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. The following equipment will require this inspection: pumps; air conditioning equipment, controls, air handling equipment, compressors, boilers etc. These letters shall be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.

F. Demonstration shall be recorded on USB Flash drive turned over to the Owner. Video recording shall be done in a professional manner with quality video (1080p resolution) and clear audible sound.

1.24 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 1 and as follows. The Contractor shall prepare up to six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information and designation partitions with identification tabs. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing and operating instructions including lubrication charts and schedules.

5. Emergency and safety instructions.

6. Spare parts list.

7. Copies of warranties.

8. Wiring diagrams.

9. Recommended "turn around" cycles.

10. Inspection procedures.

11. Approved Shop Drawings and Product Data.

12. Equipment Start-up Reports.

13. Temperature control diagrams and written sequences of operations.

14. Balance reports.

C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, filter quantities and sizes, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.

1.25 ACCEPTANCES

A. The equipment, materials, quality, design and arrangement of all work installed under the Mechanical Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Mechanical Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Mechanical Sections. The intent to use the exact manufacturers and models specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of award of the Contract. In such instances, equipment substitutions may be made pending acceptance by the Engineer or the Owner’s representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Mechanical Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.26 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Items to be indicated include but are not limited to:

1. Dimensional change
2. Revision to drawing detail
3. Location and depth of underground utility
4. Revision to pipe routing
5. Revision to electrical circuitry
6. Actual equipment location
7. Duct size and routing
8. Location of concealed internal utility
9. Changes made by Change Order
10. Details not on original Contract Drawing
11. Information on concealed elements which would be difficult to identify or measure later

C. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

D. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

E. Note related Change Order numbers where applicable.

F. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

G. Final record documents shall be prepared in the latest electronic version and on USB Flash drive of all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.27 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties are to be included:

1. General close-out requirements included in Division 1.

2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions-2 through -50.

3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.28 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.

1. Refer to individual Sections of Divisions-2 through -50 for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the installer.

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

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.29 GUARANTEES

A. The Contractor shall guarantee all material and installation quality under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner. During this guarantee period, all defects developing through faulty equipment, materials or installation quality shall be corrected or replaced

immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineer's satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided.

1.30 PROJECT CLOSE-OUT

A. Submit specific warranties, quality bonds, maintenance agreements, final certifications and similar documents in accordance with Division 01.

B. Deliver tools, spare parts, extra stock, and similar items.

C. Complete start-up testing of systems, including measuring and documenting all required startup checklist requirements documented in installation and maintenance instructions by the equipment manufacturer, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

D. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

E. Field Observation Procedures: On receipt of a request for an Engineers Field Observation, the Engineer will advise the Contractor of unfulfilled requirements. The Engineer will advise the Contractor of construction that must be completed or corrected before the certificate will be issued. Contractor shall submit written response to each corrective item including specific photos prior to final Engineering inspection.

1. The Engineer will repeat the Field Observation when requested and assured that the Work has been substantially completed.

2. Results of the completed list of unfulfilled items will form the basis of requirements for final acceptance.

END OF SECTION 23 0400

Electronic Drawing File Release Form

DELIVERY OF FILES FOR: _____

Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys' fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____ _____

Client's Signature Date

_____

Company - Title

_____ _____

Architects' Signature Date

_____

Firm - Title

_____ _____

Owner's Signature Date

_____

Company - Title

SECTION 23 0516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Design of expansion systems and anchors

B. Flexible pipe connectors.

C. Expansion joints and compensators.

D. Pipe Alignment Guides

E. Swivel Joints

F. Pipe Anchors

1.2 RELATED REQUIREMENTS

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

B. Division 23 specifications

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

B. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Inch Standard.

C. ASME B16.11 - Forged Fittings, Socket-welding and Threaded.

D. ASME B31.9 – Building Services Piping

E. ASME Section IX – Boiler and Pressure Vessel Code- Welding and Brazing Qualifications.

F. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

G. AWS D1.1 – Structural Welding Code- Steel.

H. EJMA (STDS) - EJMA Standards.

I. FM (AG) - FM Approval Guide.

J. ITS (DIR) - Directory of Listed Products.

K. UL (DIR) - Online Certifications Directory.

1.4 DESIGN REQUIREMENTS

A. Provide design, details, work and equipment required for expansion and contraction of hot water piping systems. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

C. Expansion Compensation Design Criteria:
1. Installation Temperature: 50°F.
2. Hot Water Heating System Temperature: 210°F.
3. Refrigerant System Temperature: Refer to manufacturers design literature.
4. Safety Factor: 30%.

1.5 SUBMITTALS

A. Pipe Expansion Analysis, Design and Certification:
1. Provide pipe expansion and anchoring calculations for all refrigerant and hot water piping systems including connections to equipment and to the structure. Piping layouts and associated calculations must be stamped by a registered professional engineer with at least five years of pipe expansion experience, licensed in the state of the job location.
2. Analysis must indicate calculated dead loads, active expansion loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/ or welded length. All expansion and anchoring devices shall be designed to accept the forces as calculated.

B. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints. Indicate installed locations of flexible pipe connectors, expansion joints, anchors and guides.

C. Product Data:
1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

E. Maintenance Data: Include adjustment instructions.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Packing for Packed Expansion Joints: One set for each joint.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' experience.

B. Installer: Company specializing in performing work of this section with minimum five years' experience.

C. Design expansion compensating system under direct supervision of a Professional Engineer experienced in design of this work and licensed in state which the work will occur.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. Mason Industries

B. The Metraflex Company

C. UniSource Manufacturing

2.2 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Inner Hose: Bronze.

B. Exterior Sleeve: Single braided, stainless steel.

C. Pressure & Temperature Rating: 125 psi and 450°F.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Maximum offset: 3/4 inch on each side of installed center line.

2.3 FLEXIBLE PIPE CONNECTORS - COPPER PIPING SERVING WATER SYSTEMS

A. Inner Hose: Bronze.

B. Exterior Sleeve: Braided bronze.

C. Pressure & Temperature Rating: 125 psi and 450°F.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Maximum offset: 3/4 inch on each side of installed center line.

G. Application: Copper piping serving water-based systems.

2.4 FLEXIBLE PIPE CONNECTORS - COPPER PIPING SERVING REFRIGERANT SYSTEMS

A. Inner Hose: Stainless Steel.

B. Exterior Sleeve: Braided 304 Stainless Steel

C. Pressure Rating: 650 psi.

D. Joint: Brazed.

E. Size: Use pipe sized units.

F. Maximum offset: 3/4 inch on each side of installed center line.

G. Application: Refrigerant Piping.

H. Certifications: UL Listed for Refrigeration Service.

2.5 EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

A. Pressure & Temperature Rating: 125 psi and 400°F.

B. Maximum Compression: 1-3/4 inches.

C. Maximum Extension: 1/4 inch.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Application: Steel piping 3 inches and under.

2.6 EXPANSION JOINTS - EXTERNAL RING CONTROLLED STAINLESS STEEL BELLOWS TYPE

A. Pressure & Temperature Rating: 125 psi and 400°F.

B. Maximum Compression: 15/16 inch.

C. Maximum Extension: 5/16 inch.

D. Maximum Offset: 1/8 inch.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Accessories: Internal flow liner.

H. Application: Steel piping over 2 inches.

2.7 EXPANSION JOINTS - DOUBLE SPHERE, FLEXIBLE COMPENSATOR

A. Body: Multi-Layered Kevlar with EPDM.

B. Pressure & Temperature Rating, Sizes 3/4 Inch to 1-1/4" Inch: 150 psi and 210°F.

C. Pressure & Temperature Rating, Sizes 1-1/2 Inch to 12 Inch: 150 psi and 250°F.

D. Pressure & Temperature Rating, Sizes 14 Inch to 24 Inch: 105 psi and 250°F.

E. Maximum Compression: 1/2 inch.

F. Maximum Elongation: 3/8 inch.

G. Maximum Offset: 3/8 inch.

H. Maximum Angular Movement: 15 degrees.

I. Joint: Tapped steel flanges.

J. Size: Use pipe sized units.

K. Accessories: Control cables.

L. Application: Steel piping 2 inches and over.

2.8 EXPANSION JOINTS - TWO-PLY BRONZE BELLOWS TYPE

A. Construction: Bronze with anti-torque device, limit stops, internal guides.

B. Pressure & Temperature Rating: 125 psi and 400°F.

C. Maximum Compression: 1-3/4 inches.

D. Maximum Extension: 1/4 inch.

E. Joint: Soldered.

F. Size: Use pipe sized units.

G. Application: Copper piping.

2.9 EXPANSION JOINTS - LOW PRESSURE COMPENSATOR WITH TWO-PLY BRONZE BELLOWS

A. Working Pressure: 75 psi.

B. Maximum Temperatures: 250°F.

C. Maximum Compression: 1/2 inch.

D. Maximum Extension: 5/32 inch.

E. Joint: Soldered.

F. Size: Use pipe sized units.

G. Application: Copper or steel piping 3 inches and under.

2.10 EXPANSION JOINTS - STEEL WITH PACKED SLIDING SLEEVE

A. Working Pressure and Temperature: Class 150.

B. Joint: Flanged.

C. Size: Use pipe sized units.

D. Application: Steel piping 2 inches and over.

2.11 EXPANSION JOINTS - COPPER WITH PACKED SLIDING SLEEVE

A. Working Pressure: 125 psi.

B. Maximum Temperature: 250°F.

C. Joint: Flanged.

D. Size: Use pipe sized units.

E. Application: Copper or steel piping 2 inches and over.

2.12 EXPANSION LOOPS - HOSE AND BRAID

A. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.

B. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.

C. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.

1. Maximum Allowable Working Pressure & Temperature: 150 psig at 120°F.
2. Accommodate the Following:
   a. Axial Deflection in Compression and Expansion: To be determined by the Professional Engineer providing calculations.
   b. Lateral Movement: To be determined by the Professional Engineer providing calculations.
   c. Angular Rotation: 15 degrees.
   d. Force developed by 1.5 times specified maximum allowable operating pressure.
3. End Connections: Same as specified for pipe jointing.
4. End Connections: Flanged ductile iron; complying with ASME B16.1 Class 125.
5. End Connections: Threaded; complying with ASME B16.11.
6. Provide necessary accessories including, but not limited to, swivel joints.

2.13 EXPANSION JOINTS - EXTERNALLY PRESSURIZED EXPANSION JOINTS

A. Construction: Stainless steel with anti-torque device, limit stops, internal guides.

B. Maximum Allowable Working Pressure & Temperature: 150 psig at 700°F.

C. Maximum Axial Compression: 4 inches.

D. End Connections: Flanged by weld end.

E. Size: Use pipe sized units.

F. Application: Steel piping 2 inches and over.

2.14 PIPE ALIGNMENT GUIDES

A. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel

2.15 SWIVEL JOINTS

A. Fabricated steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

2.16 PIPE ANCHORS

A. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 PSI and the design shall be balanced for equal resistance in any direction.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on:
   1. Pipes connected to pumps.
   2. Refrigerant piping connections to equipment per recommendations of equipment manufacturer.
   3. Pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Rigidly anchor pipe to building structure. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

G. For systems using grooved piping systems, provide with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation.

H. Provide piping expansion loops at all building expansion joints as indicated on drawings.

I. Provide piping expansion joints or expansion loops as indicated below:
   1. Provide and install pipe expansion joints or expansion loops at all conditions listed below and as required to minimize stress on the piping systems.
   2. Provide pipe guides at inlet and outlet of each expansion joint and expansion loop.
   3. Where expansion joints or loops are required, provide pipe anchors at ends of each straight length of run.
   4. Provide and install expansion joints, expansion loops, pipe guides and anchors per ASHRAE guidelines and manufacturer’s recommendations.

PIPING SYSTEM	PIPING MATERIAL	PIPE SIZE	Condition Requiring expansion joint or expansion loop (all conditions assume "offset leg" at end of runs are minimum 12'0" long)
Hot water supply and return (all temperatures)	Copper	Up to 3 inches	All straight sections of piping over 90' long. All straight sections of piping where "offset leg" is less than 12'0"
Hot water supply and return (all temperatures)	Steel	Up to 2 inches	All straight sections of piping over 140' long.
Hot water supply and return (all temperatures)	Steel	2" to 4"	All straight sections of piping over 90' long
Hot water supply and return (all temperatures)	Steel	5" to 8"	All straight sections of piping over 45' long

END OF SECTION 23 0516

SECTION 23 0517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.2 RELATED REQUIREMENTS

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

B. Division 07 – Thermal and Moisture Protection.

C. Division 09 - Finishes.

D. Section 23 0523 - General-Duty Valves for HVAC Piping.

E. Section 23 0553 - Identification for HVAC Piping and Equipment: Piping identification.

F. Section 23 0716 - HVAC Equipment Insulation.

G. Section 23 0719 - HVAC Piping Insulation.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

1.4 SUBMITTALS

A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Valve Stem Packings: Two for each type and size of valve.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.
   2. Approved by manufacturer.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.7 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Materials
   1. Galvanized-Steel Sheet: 0.0239-inch 0.6-mm minimum thickness; round tube closed with longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.2 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. Flexicraft Industries; PipeSeal.
   2. Metraflex
   3. Link-Seal
   4. Substitutions: See Division - 01 General Requirements.

B. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.
   4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.1 GENERAL

A. Lay out penetration and sleeve openings in advance, to permit provision in work. Coordinate work with architectural and structural work. Set sleeves and conduit in forms before concrete is poured. Provide remedial work where sleeves and conduits are omitted or improperly placed. Remedial work includes core drilling (see requirements below) for penetrations if walls are poured, or otherwise constructed, without required sleeves. Provide core drilling (see requirements below) of existing construction. Do not penetrate structural members without Structural Engineer's/Architect's written approval.

B. Sleeve installation shall meet NFPA-101 requirements, UL rated assemblies requirements, and materials requirements of these specifications. Submit a list of the UL listed details that the Contractor intends on using on this project in all rated assemblies.

C. Sleeves that penetrate outside walls, basement slabs, footings and beams shall be waterproof. Sleeves that penetrate floors shall be fireproof and waterproof.

D. Identify unused sleeves and slots for future installation. Fill slots, sleeves and other openings in floors or walls if not used. Fill spaces in openings after installation of pipe, duct, conduit or cable. Fill for floor penetrations shall prevent passage of water, smoke, fire, and fumes. Fill shall be fire resistant in fire floors and walls, and shall prevent passage of air, smoke and fumes.

E. Do not support piping risers or conduit on sleeves.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 for materials.

G. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements. Verify final equipment locations for roughing-in.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.3 APPLICATIONS

A. Provide sleeves when penetrating footings, floors, walls, partitions, and other building components as follows:
   1. Interior walls, partitions, and floors: galvanized-steel sheet, unless steel or brass sleeves are specified elsewhere.
   2. Below Grade Exterior Walls: Zinc coated or cast iron pipe with mechanical sleeve seals. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

3. Above Grade Exterior Walls: steel pipe sleeve with mechanical sleeve seals.
4. Mechanical, Laundry, and Animal Room Floors above Basement: Galvanized steel pipe or black iron pipe with asphalt coating. Connect sleeve with floor plate except in mechanical rooms.
5. Concrete and masonry walls, concrete floor and roof slabs: galvanized-steel sheet
6. Floors with membrane waterproofing: stack sleeve fittings

3.4 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Install sleeves that are large enough to provide 1/4 inch annular clear space between sleeve and pipe or pipe insulation. Sleeves for insulated pipe and duct in non-fire rated construction shall accommodate continuous insulation without compression. Sleeves and/or penetrations in fire rated construction shall be packed with fire rated material that shall maintain the fire rating of the wall. Seal ends of penetrations to provide continuous vapor barrier where insulation is interrupted.

E. Where pipes passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling, and wall finishes.

F. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

G. Structural Considerations:
1. Do not penetrate building structural members unless indicated.

H. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Underground Piping: Mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
   a. Pack solid using mineral fiber conforming to ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

3. All Rated Openings: Caulk tight with fire stopping material conforming to ASTM E814 in accordance with Division 07 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with Mechanically expandable chloroprene inserts with mastic-sealed components.

I. Vertical Piping:
1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

J. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814 in accordance with Division 07 to prevent the spread of fire, smoke, and gases.

K. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.5 CORE DRILLING

A. Core drilling shall be avoided in new construction. Set sleeves prior to installation of structure for passage of pipes, conduit and ducts. Where core drilling is unavoidable (e.g. when individual sleeves are not installed or incorrectly located) or required by renovation projects, locate required openings prior to coring and submit locations for review.

B. Coordinate openings with other Divisions.

C. Do not disturb existing systems. Protect areas from damage.

D. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.

3.6 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 23 0517

SECTION 23 0523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Angle valves.

D. Globe valves.

E. Ball valves.

F. Butterfly valves.

G. Check valves.

H. Gate valves.

I. Plug valves.

J. Chainwheels.

1.2 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. SWP: Steam working pressure.

I. TFE: Tetrafluoroethylene.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. API STD 594 - Check Valves: Flanged, Lug Wafer, and Butt-Welding.

B. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250;.

D. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard.

E. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves.

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

G. ASME B16.34 - Valves - Flanged, Threaded and Welding End.

H. ASME B31.1 - Power Piping.

I. ASME B31.9 - Building Services Piping.

J. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications.

K. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

L. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

M. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.

N. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

O. ASTM A536 - Standard Specification for Ductile Iron Castings.

P. ASTM A582/A582M - Standard Specification for Free-Machining Stainless Steel Bars;.

Q. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings.

R. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

S. AWWA C606 - Grooved and Shouldered Joints.

T. MSS SP-45 - Bypass and Drain Connections.

U. MSS SP-67 - Butterfly Valves.

V. MSS SP-68 - High Pressure Butterfly Valves with Offset Design.

W. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.

X. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.

Y. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service.

Z. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.

AA. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

BB. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.

CC. MSS SP-108 - Resilient-Seated Cast Iron Eccentric Plug Valves.

DD. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

EE. MSS SP-125 - Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves.

1.4 SUBMITTALS

A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

C. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

1.5 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Welding Materials and Procedures: Conform to ASME BPVC-IX.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
   4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.

5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:
1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.
   b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C. Exercise the following precautions for handling:
1. Handle large valves with sling, modified to avoid damage to exposed parts.
2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.1 GENERAL

A. See Drawings for specific valve locations.

B. Refer to Part 3 for applications.

C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

2.2 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
1. Gear Actuator: Quarter-turn valves 8 NPS and larger.
2. Handwheel: Valves other than quarter-turn types.
3. Hand Lever: Quarter-turn valves 6 NPS and smaller except plug valves.
4. Wrench: Plug valves with square heads.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

D. Valves in Insulated Piping: Provide 2 inch stem extensions and the following features:
1. Gate Valves: Rising stem.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: Extended neck.

4. Memory Stops: Fully adjustable after insulation is installed.

E. Memory Stops: Fully adjustable after insulation is installed.

F. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

G. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Power Piping Valves: ASME B31.1.
3. Building Services Piping Valves: ASME B31.9.

H. Bronze Valves:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Valve Bypass and Drain Connections: MSS SP-45.

J. Source Limitations: Obtain each valve type from a single manufacturer.

2.3 BRONZE GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:.
1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded or solder joint.
4. Stem and Disc: Bronze or PTFE
5. Packing: Asbestos free.
6. Handwheel: Malleable iron or bronze.
7. Manufacturers:
a. Nibco Inc.
b. Grinnell
c. Crane Co.
d. Milwaukee Valve Co.

2.4 IRON GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:, and Class 250: CWP Rating: 500 psig:.
1. Comply with MSS SP-85, Type I.
2. Body: Gray iron; ASTM A126, with bolted bonnet.
3. Ends: Flanged.
4. Trim: Bronze.
5. Packing and Gasket: Asbestos free.
6. Operator: Handwheel or chainwheel.
7. Manufacturers:

a. Nibco Inc.
b. Grinnell
c. Crane Co.
d. Milwaukee Valve Co.

2.5 BRASS BALL VALVES

A. Two Piece, Full Port, Ball Valves with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Forged brass.
5. Ends: Threaded.
6. Seats: PTFE
7. Stem: Stainless Steel.
8. Ball: Chrome-plated brass or Stainless steel, vented
9. Manufacturers:
a. Apollo
b. Nibco
c. Watts

B. Three Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Forged brass.
5. Ends: Threaded.
6. Seats: PTFE
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.
9. Manufacturers:
a. Apollo
b. Nibco
c. Watts

2.6 BRONZE BALL VALVES

A. Two Piece, Full Port, Bronze Ball Valves with Stainless-Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Bronze, brass or stainless steel
8. Ball: Chrome plated brass or stainless steel, vented
9. Manufacturers:
a. Apollo
b. Nibco

c. Watts
d. Bray International

B. Three Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.
9. Manufacturers:
a. Apollo
b. Nibco
c. Watts
d. Bray International

2.7 CARBON STEEL BALL VALVES

A. Class 300, Full Port, Stainless Steel Trim:
1. Comply with MSS SP-72.
2. CWP Rating: 720 psig.
3. Body: Carbon steel, ASTM A216/A216M, Type WCB.
4. Ends: Flanged.
5. Seats: PTFE.
6. Stem: Stainless steel.
7. Ball: Stainless steel, vented.
8. Manufacturers:
a. Apollo
b. Nibco
c. Watts
d. Bray International
e. Substitutions: See Division 01 - General Requirements.

2.8 IRON BALL VALVES

A. Split Body, Full Port:
1. Comply with MSS SP-72.
2. CWP Rating: 200 psig.
3. Body: ASTM A126, gray iron.
4. Ends: Flanged.
5. Seats: PTFE.
6. Stem: Stainless steel.
7. Ball: Stainless steel.
8. Manufacturers:
a. Apollo
b. Nibco
c. Watts

d. Bray International
e. Substitutions: See Division 01 - General Requirements.

2.9 IRON, GROOVED-END BALL VALVES

A. Class 200:
1. CWP Rating: 600 psig.
2. Body: Ductile iron; ASTM A536, Grade 65-45-12.
3. Ends: Grooved.
4. Seats: Teflon.
5. Stem: Nickel plated carbon steel.
6. Ball: Nickel plated carbon steel, Type 304 stainless steel.
7. Manufacturers:
a. Apollo
b. Nibco
c. Watts
d. Substitutions: See Division 01 - General Requirements.

2.10 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead end service without downstream flange.
1. Comply with MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig.
3. Body Material: ASTM A126 cast iron, ASTM A536 ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: NBR.
6. Disc: Coated ductile iron.
7. Manufacturers:
a. Nibco, Inc.
b. Crane Co.
c. Grinnell
d. Hammond Valve
e. Milwaukee Valve Co.
f. Bray International

2.11 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig, 300 psig: 8 NPS or smaller, 200 psig: 10 NPS or larger.
1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
3. Stem: Stainless steel.
4. Disc: Coated ductile iron.
5. Disc Seal: EPDM.
6. Manufacturers:
a. Nibco, Inc.
b. Crane Co.
c. Grinnell
d. Hammond Valve
e. Milwaukee Valve Co.

f. Bray International

2.12 HIGH-PERFORMANCE SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead end service without downstream flange.
1. Comply with MSS SP-68.
2. Class 150: CWP Rating: 285 psig, Class 300: CWP Rating: 720 psig.
3. Body: Provide carbon steel, cast iron, ductile Iron, stainless steel.
4. Seat: Metal or reinforced PTFE.
5. Offset stem: Stainless steel.
6. Disc: 316 Stainless Steel
7. Manufacturers:
a. Nibco, Inc.
b. Crane Co.
c. Grinnell
d. Hammond Valve
e. Milwaukee Valve Co.
f. Bray International

2.13 BRONZE LIFT CHECK VALVES

A. Class 125:
1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat, Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 200 psig.
3. Design: Vertical flow.
4. Body: Bronze.
5. Ends: Threaded.
6. Disc (Type 1): Bronze.
7. Disc (Type 2): NBR or PTFE.
8. Manufacturers:
a. Crane Co.
b. Nibco, Inc.
c. Milwaukee Valve Co.
d. Mueller Steam Specialty

2.14 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig, Class 150: CWP Rating: 300 psig.
1. Comply with MSS SP-80, Type 3.
2. Body Design: Horizontal flow.
3. Body Material: Bronze, ASTM B62.
4. Ends: Threaded.
5. Disc: Bronze.
6. Manufacturers:
a. Crane Co.
b. Nibco, Inc.
c. Milwaukee Valve Co.

2.15 IRON SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig with Metal Seats, Class 125: CWP Rating: 150 psig with Metal Seats, Class 250: CWP Rating: 500 psig with Metal Seats, Class 250: CWP Rating: 300 psig with Metal Seats, Class 125: CWP Rating: 200 psig with Nonmetallic-to-Metal Seats.
   1. Comply with MSS SP-71, Type I.
   2. Design: Clear or full waterway with flanged ends.
   3. Body: Gray iron with bolted bonnet in accordance with ASTM A126.
   4. Trim: Bronze.
   5. Disc Holder: Bronze.
   6. Disc: PTFE or TFE.
   7. Gasket: Asbestos free.

B. Manufacturers:
   a. Crane Co.
   b. Nibco, Inc.
   c. Milwaukee Valve Co.

2.16 IRON, CENTER-GUIDED SILENT CHECK VALVES

A. Class 125, Globe:
   1. Comply with MSS SP-125.
   2. 2-1/2 NPS to 12 NPS, CWP Rating: 200 psig.
   3. 14 NPS to 24 NPS, CWP Rating: 150 psig.
   4. Body Material: ASTM A126, gray iron.
   5. Style: Spring loaded.
   6. Ends: Flanged.
   7. Metal Seat: Bronze.
   8. Resilient Seat: EPDM, NBR
   9. Manufacturers:
      a. Nibco, Inc
      b. Mueller Steam Specialty
      c. Watts

B. Class 150, Globe:
   1. Comply with MSS SP-125.
   2. 2-1/2 NPS to 12 NPS, CWP Rating: 300 psig.
   3. 14 NPS to 24 NPS, CWP Rating: 250 psig.
   4. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
   5. Style: Spring loaded.
   6. Ends: Flanged.
   7. Metal Seat: Bronze.
   8. Resilient Seat: EPDM, NBR
   9. Manufacturers:
      a. Nibco, Inc.
      b. Mueller Steam Specialty
      c. Watts

2.17 BRONZE GATE VALVES

A. Non-Rising Stem (NRS), Rising Stem (RS):
1. Comply with MSS SP-80, Type I.
2. Class125: CWP Rating: 200 psig.
3. Class 150: CWP Rating: 300 psig.
4. Body Material: Bronze with integral seat and union-ring bonnet.
5. Ends: Threaded.
6. Stem: Bronze.
7. Disc: Solid wedge; bronze.
8. Packing: Asbestos free.
9. Handwheel: Malleable iron, bronze, or aluminum.
10. Manufacturers:
    a. Crane Co.
    b. Milwaukee Valve Co.
    c. Watts
    d. Nibco, Inc.

2.18 IRON GATE VALVES

A. NRS, OS & Y
1. Comply with MSS SP-70, Type I.
2. Class 125: 2-1/2 NPS to 12 NPS, CWP Rating: 200 psig.
3. Class 125: 14 NPS to 24 NPS, CWP Rating: 150 psig.
4. Class 250: 2-1/2 NPS to 12 NPS, CWP Rating: 500 psig.
5. Class 250: 14 NPS to 24 NPS, CWP Rating: 300 psig.
6. Body Material: Gray iron with bolted bonnet.
7. Ends: Flanged.
8. Trim: Bronze.
9. Disc: Solid wedge.
10. Packing and Gasket: Asbestos free.
11. Manufacturers:
    a. Crane Co.
    b. Milwaukee Valve Co.
    c. Watts
    d. Nibco, Inc.

2.19 ECCENTRIC PLUG VALVES

A. Resilient Seating with Flanged Ends.
1. Comply with MSS SP-108.
2. CWP Rating: 175 psig minimum.
3. Body and Plug: Gray or ductile iron.
4. Bearings: Oil-impregnated bronze or Stainless Steel.
5. Stem-Seal Packing: Asbestos free.
6. Plug, Resilient-Seating Material: Approved for potable water service.
7. Manufacturers:
    a. Mueller
    b. Stockham

c. DeZurik

2.20 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to ball, butterfly, plug valve stems.
3. Sprocket Rim with Chain Guides: Ductile iron include zinc coating.
4. Chain: Hot-dip galvanized steel. Sized to fit sprocket rim.
5. Manufacturers:
a. Babbitt Steam Specialty Co.
b. Roto Hammer Industries
c. Trumbull Industries

PART 3 EXECUTION

3.1 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 VALVE APPLICATION

A. Valves on condenser water, chilled water, hot water and glycol services shall be as shown in the following tables. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball, butterfly, or gate valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service except Steam: Globe or butterfly valves.
4. Pump-Discharge Check Valves:
a. NPS 2 and Smaller: Spring wafer check valve with bronze disc.
b. NPS 2-1/2 and Larger: Iron, center-guided, metal -seat check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves with end connections as indicated in the tables. For applications not listed in the tables select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.
2. For Steel Piping, NPS 2 and Smaller: Threaded ends.
3. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends.
4. For Steel Piping, NPS 5 and Larger: Flanged ends.

GLYCOL, CHILLED AND CONDENSER WATER SERVICE Maximum 150°F and 150 psig (1/2 inch - 12 inches), 125 psig (14 inches - 24 inches)					
Specialty	Application	Type	Size (inches)	Body/Seat Body/Trim	Minimum Rating[1,2]
Ball Valve	Isolation (with locking handle) and Modulation	Full Port 3-pc.	1/2 - 2	Bronze/Teflon	400 psig WOG
		Full Port 2 pc.	1/2 - 2	Bronze/Teflon	400 psig WOG
Gate Valve	Not Used				
Globe Valve	ATC Modulation	Control Valve	1/2 - 2	Bronze/Metal	400 psig WOG
			2-1/2 - 6	Bronze/Metal	400 psig WOG
Butterfly Valve	Isolation and Modulation	General Service	2-1/2 - 12	Ductile Iron/EPDM	175 psig CWP 150 psig bi-directional shutoff 150 psig dead end service
		General Service	14 - 24	Ductile Iron/EPDM	150 psig CWP 150 psig bi-directional shutoff 150 psig dead end service
Plug Valve	Manual Balancing	Non-lubricated	3 - 12	Steel/Iron	Class 125
Check Valve	Pumps	Silent	1/2 - 2	Bronze/Bronze	200 psig WOG
		Silent Globe	2-1/2 - 24	Iron/Bronze	Class 125
	Piping	Y-Pattern Swing	1/2 - 2	Bronze/Bronze	200 psig WOG
			2-1/2 - 24	Iron/Bronze	Class 125
Strainer	Control Valves and Flow Meters	Y-Type	1/2 -2	Bronze/Stainless (1/16 inch dia.)	200 psig WOG
			2-1/2 - 4	Iron/Stainless (1/16 inch dia.)	Class 125
			5 - 24	Iron/Stainless (1/8 inch dia.)	Class 125
	Pump Suction	In-Line Y-Type	1/2 - 2	Bronze/Stainless (1/16 inch dia.)	200 psig WOG
			2-1/2 - 4	Iron/Stainless (3/16 inch dia.)[3]	Class 125
			5 - 24	Iron/Stainless (1/4 inch dia.)[3]	Class 125
		Angle Suction Diffuser End Suction Pumps	2 - 12	Iron/Stainless (3/16 inch dia.)[3] Start Up Strainer = 16 Mesh Bronze	Class 125

1. These are minimum ratings for ASTM A126, Class B and ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables and "Adjusted Pressure Ratings" for copper tube, soldered end valves [and strainers].
2. SWP=Steam Working Pressure CWP=Cold Water Working Pressure
   WSP=Working Steam Pressure WOG=Water, Oil or Gas
   Class=ANSI Standard
3. Use 1/8 inch dia for plate heat exchanger application.
4. Coordinate connection type with piping system.

GLYCOL, CHILLED AND CONDENSER WATER SERVICE Maximum 150°F and 275 psig (1/2 inch - 24 inches)					
Specialty	Application	Type	Size (inches)	Body/Seat Body/Trim	Minimum Rating[1,2]
Ball Valve	Isolation (with locking handle) and Modulation	Full Port 2 pc.	1/2 - 2	Bronze/Teflon	600 psig WOG
Gate Valve	Not Used				
Globe Valve	ATC Modulation	Control Valve	1/2 - 2	Bronze/Metal	600 psig WOG
			2-1/2 - 6	Bronze/Metal	600 psig WOG
Butterfly Valve	Isolation and Modulation	High Performance	2-1/2 - 24	Carbon Steel/PTFE	285 psig CWP
Plug Valve	Manual Balancing	Non-lubricated	3 - 12	Steel/Iron	Class 300
Check Valve	Pumps	Silent	1 - 2	Bronze/Bronze	Class 300
		Silent Globe	2-1/2 - 24	Iron/Bronze	Class 250
	Piping	Y-Pattern Swing	1/2 - 2	Bronze/Bronze	Class 300
			2-1/2 - 24	Iron/Bronze	Class 250
Strainer	Control Valves and Flow Meters	Y-Type	1/2 - 2	Bronze/Stainless (1/16 inch dia.)	Class 250
			2-1/2 - 4	Iron/Stainless (1/16 inch dia.)	Class 250
			5 - 24	Iron/Stainless (1/8 inch dia.)	Class 250
	Pump Suction	In-Line Y-Type	1/2 - 2	Iron/Stainless (1/16 inch dia.)	Class 250
			2-1/2 - 4	Iron/Stainless (3/16 inch dia.)[3]	Class 250
			5 - 24	Iron/Stainless (1/4 inch dia.)[3]	Class 250
		Angle Suction Diffuser End Suction Pumps	2 - 12	Iron/Stainless (3/16 inch dia.)[3] Start Up Strainer = 16 Mesh Bronze	Class 250

1. These are minimum ratings. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables.
2. SWP=Steam Working Pressure CWP=Cold Water Working Pressure
   WSP=Working Steam Pressure WOG=Water, Oil or Gas
   Class=ANSI Standard
3. Use 1/8 inch dia for plate heat exchanger application.
4. Coordinate connection type with piping system.

GLYCOL, CHILLED AND CONDENSER WATER SERVICE Maximum 150°F and 500 psig (½" - 24")/300 psig (14"-24")					
Specialty	Application	Type	Size (inches)	Body/Seat Body/Trim	Minimum Rating[1,2]
Ball Valve	Isolation (with locking handle) and Modulation	Full Port 2 pc.	1/2 - 2	Bronze/Teflon	600 psig WOG
Gate Valve	Not Used				
Globe Valve	ATC Modulation	Control Valve	1/2 - 2	Bronze/Metal	600 psig WOG
			2-1/2 - 6	Bronze/Metal	600 psig WOG
Butterfly Valve	Isolation and Modulation	High Performance	2-1/2 - 24	Carbon Steel/PTFE	740 psig CWP
Plug Valve	Manual Balancing	Non-lubricated	3 -12	Steel/Iron	Class 300
Check Valve	Pumps	Silent	1 - 2	Bronze/Bronze	Class 300
		Silent Globe	2-1/2 - 24	Iron/Bronze	Class 250
	Piping	Y-Pattern Swing	1/2 - 2	Bronze/Bronze	Class 300
			2-1/2 - 24	Iron/Bronze	Class 250
Strainer	Control Valves and Flow Meters	Y-Type	1/2 - 2	Bronze/Stainless (1/16" dia.)	Class 250
			2-1/2 - 4	Iron/Stainless (1/16" dia.)	Class 250
			5 - 24	Iron/Stainless (1/8" dia.)	Class 250
	Pump Suction	In-Line Y-Type	1/2 - 2	Iron/Stainless (1/16" dia.)	Class 250
			2-1/2 - 4	Iron/Stainless (3/16" dia.)[3]	Class 250
			5 - 24	Iron/Stainless (¼" dia.)[3]	Class 250
		Angle Suction Diffuser End Suction Pumps	2 - 12	Iron/Stainless (3/16" dia.)[3] Start Up Strainer = 16 Mesh Bronze	Class 250

1. These are minimum ratings. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables.
2. SWP=Steam Working Pressure CWP=Cold Water Working Pressure
   WSP=Working Steam Pressure WOG=Water, Oil or Gas
   Class=ANSI Standard
3. Use 1/8 inch dia for plate heat exchanger application.
4. Coordinate connection type with piping system.

GLYCOL AND HOT WATER SERVICE Maximum 250°F and 175 psig (½"-12")/125 psig (14"-24")					
Specialty	Application	Type	Size (inches)	Body/Seat, Body/Trim	Minimum Rating1,2
Ball Valve	Isolation (with locking handle) and Modulation	Full Port 3-pc.	1/2 - 2	Bronze/Teflon	400 psig WOG
		Full Port 2 pc.	1/2 - 2	Bronze/Teflon	400 psig WOG
Gate Valve	Not Used				
Globe Valve	ATC Modulation	Control Valve	1/2 - 2	Bronze/Metal	400 psig WOG
			2-1/2 - 6	Bronze/Metal	400 psig WOG
Butterfly Valve	Isolation and Modulation	General Service	2-1/2 - 12	Ductile Iron/EPDM	200 psig CWP 200 psig bi-directional shutoff 200 psig dead end service
			14 - 24	Ductile Iron/EPDM	150 psig CWP 150 psig bi-directional shutoff 150 psig dead end service
Plug Valve	Manual Balancing	Non-lubricated	3 -12	Steel/Iron	Class 125
Check Valve	Pumps	Silent	1/2 - 2	Bronze/Bronze	200 psig WOG
		Silent Globe	2-1/2 - 24	Iron/Bronze	Class 125
	Piping	Y-Pattern Swing	1/2 - 2	Bronze/Bronze	200 psig WOG
			2-1/2 - 24	Iron/Bronze	Class 125
Strainer	Control Valves and Flow Meters	Y-Type	1/2 - 2	Bronze/Stainless (1/16" dia.)	200 psig WOG
			2-1/2 - 4	Iron/Stainless (1/16" dia.)	Class 125
			5 - 24	Iron/Stainless (1/8" dia.)	Class 125
	Pump Suction	In-Line Y-Type	1/2 - 2	Bronze/Stainless (1/16" dia.)	200 psig WOG
			2-1/2 - 4	Iron/Stainless (3/16" dia.)[3]	Class 125
			5 -24	Iron/Stainless (¼" dia.)[3]	Class 125
		Angle Suction Diffuser End Suction Pumps	2 - 12	Iron/Stainless (3/16" dia.)[3] Start Up Strainer = 16 Mesh Bronze	Class 125

1. These are minimum ratings for ASTM A126, Class B and ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables and "Adjusted Pressure Ratings" for copper tube, soldered end valves [and strainers].
2. SWP=Steam Working Pressure CWP=Cold Water Working Pressure
   WSP=Working Steam Pressure WOG=Water, Oil or Gas
   Class=ANSI Standard
3. Use 1/8 inch dia for plate heat exchanger application.
4. Coordinate connection type with piping system.

GLYCOL AND HOT WATER SERVICE Maximum 225°F and 250 psig (½"-24")					
Specialty	Application	Type	Size (inches)	Body/Seat, Body/Trim	Minimum Rating1,2
Ball Valve	Isolation (with locking handle) and Modulation	Full Port 3-pc.	1/2 - 2	Bronze/Teflon	400 psig WOG
		Full Port 2 pc.	1/2 - 2	Bronze/Teflon	400 psig WOG
Gate Valve	Not Used				
Globe Valve	ATC Modulation	Control Valve	1/2 - 2	Bronze/Metal	400 psig WOG
			2-1/2 - 6	Bronze/Metal	600 psig WOG
Butterfly Valve	Isolation and Modulation	High Performance	2-1/2 - 24	Carbon Steel/PTFE	285 psig CWP
Plug Valve	Manual Balancing	Non-lubricated	3 - 12	Steel/Iron	Class 250
Check Valve	Pumps	Silent	1 - 2	Bronze/Bronze	Class 250
		Silent Globe	2-1/2 - 24	Iron/Bronze	Class 250
	Piping	Y-Pattern Swing	1 -2	Bronze/Bronze	Class 250
			2-1/2 - 24	Iron/Bronze	Class 250
Strainer	Control Valves and Flow Meters	Y-Type	1/2 - 2	Bronze/Stainless (20 mesh)	400 psi WOG
			2-1/2 - 4	Iron/Stainless (1/16" dia.)	Class 250
			5 - 24	Iron/Stainless (1/8" dia.)	Class 250
	Pump Suction	In-Line Y-Type	1/2 - 2	Bronze/Stainless (1/16" dia.)	400 psig WOG
			2-1/2 - 4	Iron/Stainless (3/16" dia.)[3]	Class 250
			5 - 24	Iron/Stainless (¼" dia.)[3]	Class 250
		Angle Suction Diffuser End Suction Pumps	2 - 12	Iron/Stainless (3/16" dia.)[3] Start Up Strainer = 16 Mesh Bronze	Class 250

1. These are minimum ratings for ASTM A126, Class B and ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables and "Adjusted Pressure Ratings" for copper tube, soldered end valves [and strainers].
2. SWP=Steam Working Pressure CWP=Cold Water Working Pressure
   WSP=Working Steam Pressure WOG=Water, Oil or Gas
   Class=ANSI Standard
3. Use 1/8 inch dia for plate heat exchanger application.
4. Coordinate connection type with piping system.

HOT WATER SERVICE Maximum 250°F and 400 psig (½"-12")/250 psig (14"-24")					
Specialty	Application	Type	Size (inches)	Body/Seat, Body/Trim	Minimum Rating1,2
Ball Valve	Isolation (with locking handle) and Modulation	Full Port 3-pc.	1/2 - 2	Bronze/Teflon	Do not use
		Full Port 2 pc.	1/2 - 2	Bronze/Teflon	600 psig WOG
Gate Valve	Not Used				
Globe Valve	ATC Modulation	Control Valve	1/2 = 2	Bronze/Metal	600 psig WOG
			2-1/2 - 6	Bronze/Metal	600 psig WOG
Butterfly Valve	Isolation and Modulation	High Performance	2-1/2 - 24	Carbon Steel/PTFE	740 psig CWP
Plug Valve	Manual Balancing	Non-lubricated	3 - 12	Steel/Iron	Class 250
Check Valve	Pumps	Silent	1 - 2	Bronze/Bronze	Class 250
		Silent Globe	2-1/2 - 24	Iron/Bronze	Class 250
	Piping	Y-Pattern Swing	1 - 2	Bronze/Bronze	Class 250
			2-1/2 - 24	Iron/Bronze	Class 250
Strainer	Control Valves and Flow Meters	Y-Type	1/2 - 2	Bronze/Stainless (20 mesh)	600 psig WOG
			2-1/2 - 4	Iron/Stainless (1/16" dia.)	Class 250
			5 - 24	Iron/Stainless (1/8" dia.)	Class 250
	Pump Suction	In-Line Y-Type	1/2 - 2	Bronze/Stainless (1/16" dia.)	600 psig WOG
			2-1/2 - 4	Iron/Stainless (3/16" dia.)[3]	Class 250
			5 - 24	Iron/Stainless (¼" dia.)[3]	Class 250
		Angle Suction Diffuser End Suction Pumps	2 -12	Iron/Stainless (3/16" dia.)[3] Start Up Strainer = 16 Mesh Bronze	Class 250

1. These are minimum ratings for ASTM A126, Class B and ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables and "Adjusted Pressure Ratings" for copper tube, soldered end valves [and strainers].
2. SWP=Steam Working Pressure CWP=Cold Water Working Pressure
   WSP=Working Steam Pressure WOG=Water, Oil or Gas
   Class=ANSI Standard
3. Use 1/8 inch dia for plate heat exchanger application.
4. Coordinate connection type with piping system.

3.4 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. Install check valves where necessary to maintain direction of flow as follows:
   1. Lift Check: Install with stem plumb and vertical.
   2. Swing Check: Install horizontal maintaining hinge pin level.
   3. Orient plate-type, center-guided into horizontal or vertical position, between flanges.

E. Provide chainwheels on operators for valves 4 NPS and larger where located 96 NPS or more above finished floor, terminating 60 NPS above finished floor.

END OF SECTION 23 0523

SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe hangers and supports.

B. Duct hangers and supports

C. Hanger rods.

D. Inserts.

E. Flashing.

F. Formed steel channel.

G. Equipment bases and supports.

1.2 RELATED REQUIREMENTS

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

1.3 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B31.1 - Power Piping.
   2. ASME B31.5 - Refrigeration Piping.
   3. ASME B31.9 - Building Services Piping.

B. ASTM International:
   1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   2. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
   3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
   4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

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. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.4 PERFORMANCE REQUIREMENTS

A. Contractor shall design supports for multiple pipes and/or ducts, including pipe and duct stands, capable of supporting combined weight of supported systems, system contents, and fluid.

B. Contractor shall design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

B. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

C. 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.

D. Welding certificates.

E. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." and AWS D1.3, "Structural Welding Code--Sheet Steel."

B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.7 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 3 years documented experience.

1.8 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 damage, by storing in original packaging.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following::
1. B-Line Systems, Inc.
2. National Pipe Hanger Corporation
3. Empire Industries, Inc.
4. Globe Pipe Hanger Products Inc.
5. Michigan Hanger Co.
6. PHD Manufacturing, Inc.
7.

C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 DUCT HANGERS AND SUPPORTS

A. Shall be in accordance with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" except non-engineered wire hangers are not permitted. Engineered cable support systems may be used if they meet SMACNA, Ductmate or approved equal.

B. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

C. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

D. Strap and Rod Sizes: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct.

E. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

F. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

G. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

H. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

I. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate

2.3 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.4 THERMAL SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield. Insert shall be capable of supporting weight of pipe, insulations and fluid without crushing.

B. Manufacturers:
   1. Carpenter & Paterson, Inc.
   2. ERICO/Michigan Hanger Co.

3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Empire Industries, Inc.
3. Hilti, Inc.
4. ITW Ramset/Red Head.
5. MKT Fastening, LLC.
6. Powers Fasteners.

2.6 MISCELLANEOUS MATERIALS

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

B. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

C. Equipment Supports: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

D. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division
4. Unistrut Corp.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 EXECUTION

3.1 PIPE HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in other Division 23 Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system specific sections, install the following types:
1. MSS Type 1 - Adjustable, Steel Clevis Hangers: For suspension of non-insulated or insulated stationary pipes, 2 inch to 30 inch size.
2. MSS Type 2 - Yoke-Type Pipe Clamps: For suspension of 120 to 450 deg F pipes, 4 inch to 16 inch size, requiring up to 4 inches of insulation.
3. MSS Type 3 - Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps: For suspension of pipes, 3/4 inch to 24 inch size, requiring clamp flexibility and up to 4 inches of insulation.
4. MSS Type 4 - Steel Pipe Clamps: For suspension of cold and hot pipes, 1/2 inch to 24 inch size, if little or no insulation is required.
5. MSS Type 5 - Pipe Hangers: For suspension of pipes, 1/2 inch to 4 inch size, to allow off-center closure for hanger installation before pipe erection.
6. MSS Type 12 - Extension Hinged or 2-Bolt Split Pipe Clamps: For suspension of non-insulated stationary pipes, 3/8 inch to 3 inch size.
7. MSS Type 24 - U-Bolts: For support of heavy pipes, 1/2 inch to 30 inch.

8. MSS Type 26 - Clips: For support of insulated pipes not subject to expansion or contraction.
9. MSS Type 36 - Pipe Saddle Supports: For support of pipes, 4 inch to 36 inch size, with steel pipe base stanchion support and cast-iron floor flange.
10. MSS Type 37 - Pipe Stanchion Saddles: For support of pipes, 4 inch to 36 inch size, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
11. MSS Type 38 - Adjustable, Pipe Saddle Supports: For stanchion-type support for pipes, 2-1/2 inch to 36 inch size, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
12. MSS Type 41 - Single Pipe Rolls: For suspension of pipes, 1 inch to 30 inch size, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
13. MSS Type 43 - Adjustable Roller Hangers: For suspension of pipes, 2-1/2 inch to 20 inch size, from single rod if horizontal movement caused by expansion and contraction might occur.
14. MSS Type 44 - Complete Pipe Rolls: For support of pipes, 2 inch to 42 inch size, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
15. MSS Type 45 - Pipe Roll and Plate Units: For support of pipes, 2 inch to 24 inch, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
16. MSS Type 46 - Adjustable Pipe Roll and Base Units: For support of pipes, 2 inch to 30 inch size, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 8 - Extension Pipe or Riser Clamps: For support of pipe risers, ¾ inch to 20 inch size.
2. MSS Type 42 - Carbon- or Alloy-Steel Riser Clamps: For support of pipe risers, 3/4 inch to 20 inch size, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 13 - Steel Turnbuckles: For adjustment up to 6 inches for heavy loads.
2. MSS Type 14 - Steel Clevises: For 120 to 450 deg F piping installations.
3. MSS Type 15 - Swivel Turnbuckles: For use with MSS Type 11, split pipe rings.
4. MSS Type 16 - Malleable-Iron Sockets: For attaching hanger rods to various types of building attachments.
5. MSS Type 17 - Steel Weldless Eye Nuts: For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 18 - Steel or Malleable Concrete Inserts: For upper attachment to suspend pipe hangers from concrete ceiling.

2. MSS Type 19 - Top-Beam C-Clamps: For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. MSS Type 20 - Side-Beam or Channel Clamps: For attaching to bottom flange of beams, channels, or angles.
4. MSS Type 21 - Center-Beam Clamps: For attaching to center of bottom flange of beams.
5. MSS Type 22 - Welded Beam Attachments: For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. MSS Type 23 - C-Clamps: For structural shapes.
7. MSS Type 25 - Top-Beam Clamps: For top of beams if hanger rod is required tangent to flange edge.
8. MSS Type 27 - Side-Beam Clamps: For bottom of steel I-beams.
9. MSS Type 28 - Steel-Beam Clamps with Eye Nuts: For attaching to bottom of steel I-beams for heavy loads.
10. MSS Type 29 - Linked-Steel Clamps with Eye Nuts: For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. MSS Type 30 - Malleable Beam Clamps with Extension Pieces: For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. MSS Type 34 - Side-Beam Brackets: For sides of steel or wooden beams.
14. MSS Type 57 - Plate Lugs: For attaching to steel beams if flexibility at beam is required.
15. MSS Type 58 - Horizontal Travelers: For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 39 - Steel Pipe-Covering Protection Saddles: To fill interior voids with insulation that matches adjoining insulation.
2. MSS Type 40 - Protection Shields: Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 47 - Restraint-Control Devices: Where indicated to control piping movement.
2. MSS Type 48 - Spring Cushions: For light loads if vertical movement does not exceed 1-1/4 inches.
3. MSS Type 49 - Spring-Cushion Roll Hangers: For equipping Type 41 roll hanger with springs.
4. MSS Type 50 - Spring Sway Braces: To retard sway, shock, vibration, or thermal expansion in piping systems.

5. MSS Type 51 - Variable-Spring Hangers: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. MSS Type 52 - Variable-Spring Base Supports: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. MSS Type 53 - Variable-Spring Trapeze Hangers: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.2 PIPE HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System for Multiple Hangers: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:
   1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
   3. Floor Support: concrete pier or steel support.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

N. Design hangers for pipe movement without disengagement of supported pipe.

O. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 23 07 00 Provide supplemental angles, channels and formed steel supports to support piping, ductwork, equipment, etc. from building's structure. Piping, ductwork, equipment, etc. shall not be supported from the roof deck.

3.3 DUCT HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5- 2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports to suspend equipment from structure overhead or to support equipment above floor. Fabricate supports from welded-structural steel shapes. 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.

3.5 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.6 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.7 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches
1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	7	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2 (Note 2)	9	11	1/2	1/2
3	10	12	1/2	1/2
4	12	14	1/2	5/8
5	13	16	1/2	5/8
6	14	17	5/8	3/4
8	16	19	3/4	3/4

B. Plastic and Ductile Iron Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8
FRP (All Sizes)	4	3/8
Ductile Iron (Note 2)		
PVC (All Sizes)	4	3/8

C. Note 1: Refer to manufacturer's recommendations for grooved end piping systems.

D. Note 2: 20 feet maximum spacing, minimum of one hanger for each pipe section close to joint behind bell. Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents, limit span to maximum spacing for water service steel pipe.

END OF SECTION 23 0529

SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment support bases.

B. Vibration isolators.

C. Seismic snubber assemblies.

D. Seismic restraints for suspended components and equipment.

E. Roof curbs.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements.

B. Division 03 - Concrete.

C. Section 23 04 00 – General Conditions for Mechanical Trades.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications.

C. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment.

D. FEMA 413 - Installing Seismic Restraints for Electrical Equipment.

E. FEMA 414 - Installing Seismic Restraints for Duct and Pipe.

F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage.

G. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.

H. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

A. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.Shop Drawings:
   1. Provide schedule of vibration isolator type with location and load on each.
   2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
   3. Include auxiliary motor slide bases and rails, base weights, inertia bases, concrete weights, equipment static loads, support points, vibration isolators, and detailed layout of isolator location and orientation with static and dynamic load on each isolator.
   4. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the vibration isolator manufacturer's requirements.
      Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.

B. Seismic Certification and Analysis:
   1. Include the calculations that indicate compliance with the applicable building code for seismic controls and the vibration isolator manufacturer's requirements.
   2. Include the seal of the Professional Structural Engineer registered where the Project is located, on the drawings and calculations which at a minimum include the following:
      a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.
      b. Equipment Seismic Qualification Certification: Certification by the manufacturer or responsible party that each piece of equipment provided will withstand seismic force levels as specified in the applicable building code for seismic controls.
         1) Basis for Certification: Indicate whether the withstand certification is based on actual testing of assembled components, on calculations, or on historic data.
         2) Indicate equipment to be sufficiently durable to resist design forces and or remain functional after the seismic event.
      c. Dimensioned outline drawings of equipment identifying center of gravity, locations, and provisions for mounting and anchorage.
      d. Detailed description of the equipment anchorage devices on which the certifications are based.
      e. Statement of Special Inspections: Prepared by the registered design professional in responsible charge.

C. Delegated-Design Submittal:
   1. For each vibration isolation device.
      a. Include design calculations and details for selecting vibration isolators, vibration isolation bases, and appropriate attachment methods for all equipment.

b. Design Calculations: Calculate static and dynamic loading due to equipment weight and required to select vibration isolators and for designing vibration isolation bases.
   1) Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

c. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

2. Mechanical equipment, appliances, ductwork, and supports that are exposed to wind shall be designed to resist the wind pressures determined in accordance with the International Building Code.
   a. Design Calculations: Calculate loading due to wind pressure and required to select vibration isolators and for designing vibration isolation bases.
   b. Include the seal of the Professional Structural Engineer registered where the Project is located, on the drawings and calculations.

D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.5 QUALITY ASSURANCE

A. Perform design and installation in accordance with applicable codes.

B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
   1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

D. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
   1. See Division 01 – General Requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Mason Industries.

B. Novia Associates (Seismic Control Products)

C. Vibration Eliminator Company, Inc.

D. Vibro-Accoustics Ltd

E. Pate

F. Substitutions: See Division 01 - General Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. General:
1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
2. Steel springs to function without undue stress or overloading.
3. Steel springs to operate in the linear portion of the load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
4. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.
5. All equipment mounted on vibration isolated bases to have minimum operating clearance of 2 inches between the base and floor or support beneath unless noted otherwise.

2.3 EQUIPMENT SUPPORT BASES

A. Structural Bases:
1. Construction: Engineered, structural steel frames with welded brackets for side mounting of the isolators.
2. Frames: Square, rectangular or T-shaped.
3. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
4. Applications: Adjustable motor slide rails for centrifugal fans.

B. Concrete Inertia Bases:
1. Construction: Engineered, steel forms, with integrated isolator brackets and anchor bolts, welded or tied reinforcing bars running both ways in a single layer.
2. Size: 6 inches minimum depth and sized to accommodate elbow supports.
3. Mass: Minimum of 1.5 times weight of isolated equipment.
4. Connecting Point: Reinforced to connect isolators and snubbers to base including template and fastening devices for equipment.
5. Concrete: Filled on site with minimum 3000 psi concrete. See Section 03 3000 for additional requirements.
6. Applications: Adjustable motor slide rails for centrifugal fans.

2.4 VIBRATION ISOLATORS

A. Non-Seismic Type:
1. All Elastomeric-Fiber Glass Pads:

a. Configuration: Flat or molded.
b. Thickness: 0.25 inch minimum.
c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.

2. Elastomeric Mounts:
   a. Material: Oil, ozone, and oxidant resistant compounds.
   b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
3. Steel Springs:
   a. Assembly: Freestanding, laterally stable without housing.
   b. Leveling Device: Rigidly connected to equipment or frame.
4. Restrained Steel Springs:
   a. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction.
   b. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.
5. Elastomeric Hangers:
   a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
   b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
6. Spring Hanger:
   a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
   b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
7. Combination Elastomeric-Spring Hanger:
   a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
   b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
8. Thrust Restraints:
   a. Housing: Steel construction containing stable steel spring and integral elastomeric element installed in pairs to resist air pressure thrusts.
   b. Bottom Openings: Sized to allow plus/minus 15 degrees rod misalignment.

B. Seismic Type:
1. Coil Springs Consisting of Single Elements:
   a. Housing Manufactured from cast iron material.
   b. Ductile Material: Designed and rated for seismic applications.
   c. Spring: Restrained by housing without significant degradation of vibration isolation capabilities during normal equipment operating conditions.

d. Resilient Snubbing Grommet System: Incorporated and designed with clearances of no more than 0.25 inch in any direction preventing direct metal-to-metal contact between supported member and fixed restraint housing.
e. Resilient Pad: Located in series with spring.
f. Coil Springs: Color coded elements to have a lateral stiffness greater than 0.8 times the rated vertical stiffness with 50 percent overload capacity.
g. Finish: Suitable for the application.

2. All Directional Elastomeric:
a. Material: Molded from oil, ozone, and oxidant resistant compounds.
b. Operating Parameters: Designed to operate within the isolator strain limits providing maximum performance and service life.
c. Attachment Method: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
d. Rating: Cast iron and aluminum housings rated for seismic restraint applications.
e. Minimum Operating Static Deflections: Deflections indicated in project documents are not to exceed published load capacities.

2.5 SEISMIC SNUBBER ASSEMBLIES

A. Comply with:
1. ASHRAE (HVACA) Handbook - HVAC Applications.
2. FEMA 412.
3. FEMA 413.
4. FEMA 414.
5. FEMA E-74.
6. SMACNA (SRM).

B. All Directional External:
1. Application: Minimum three (3) snubbers are required for each equipment installation, oriented properly to restrain isolated equipment in all directions.
2. Construction: Interlocking steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

C. Lateral External:
1. Application: Minimum three (3) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.

3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

D. Omni Directional External:
1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

E. Horizontal Single Axis External:
1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

2.6 SEISMIC RESTRAINTS FOR SUSPENDED COMPONENTS AND EQUIPMENT

A. Comply with:
1. ASHRAE (HVACA) Handbook - HVAC Applications.
2. FEMA 412.
3. FEMA 413.
4. FEMA 414.
5. FEMA E-74.
6. SMACNA (SRM).

B. Cable Restraints:
1. Wire Rope: Steel wire strand cables sized to resist seismic loads in all lateral directions.
2. Protective Thimbles: Eliminates potential for dynamic cable wear and strand breakage.
3. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
4. Connections:

a. Use overlapping wire rope U clips, cable clamping bolts, swaged sleeves or seismically rated tool-less wedge insert lock connectors.
b. Internally brace clevis hanger bracket cross bolt to prevent deformation.

5. Vertical Suspension Rods: Attach required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

C. Rigid Restraints:
1. Structural Element: Sized to resist seismic loads in all lateral directions and carry both compressive and tensile loading.
2. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
3. Connections: Internally brace clevis hanger bracket cross bolt to prevent deformation.
4. Static Support System: Anchorage capable of carrying additional tension loads generated by the vertical component of the rigid brace compression which is additive to any static load requirements on the system.
5. Vertical Suspension Rods: Attached required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

2.7 ROOF CURBS

A. Vibration Isolation Curbs:
1. Non-Seismic Curb Rail:
a. Location: Between existing roof curb and rooftop equipment.
b. Construction: Aluminum.
c. Integral vibration isolation to conform to requirements of this section.
d. Weather exposed components consist of corrosion resistant materials.
2. Non-Seismic Curb:
a. Location: Between structure and rooftop equipment.
b. Construction: Aluminum.
c. Integral vibration isolation to conform to requirements of this section.
d. Weather exposed components consist of corrosion resistant materials.
3. Seismic Curb:
a. Location: Between structure and rooftop equipment.
b. Construction: Steel.
c. Integral vibration isolation to conform to requirements of this section.
d. Snubbers consist of minimum 0.25 inch thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
e. Weather exposed components consist of corrosion resistant materials.

B. Seismic Type Non-Isolated Curb and Fabricated Equipment Piers:
1. Location: Between structure and rooftop equipment.
2. Construction: Steel.
3. Weather exposed components consist of corrosion resistant materials.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Bases:
1. Set steel bases for one inch clearance between housekeeping pad and base.
2. Set concrete inertia bases for 2 inches clearance between housekeeping pad and base.
3. Adjust equipment level.

C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

E. Provide pairs of horizontal limit springs on fans with more than 6.0 inches WC static pressure, and on hanger supported, horizontally mounted axial fans.

F. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
1. Up to 4 Inches Pipe Size: First three points of support.
2. 5 to 8 Inches Pipe Size: First four points of support.
3. 10 inches Pipe Size and Over: First six points of support.
4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.2 INSTALLATION - SEISMIC

A. Comply with:
1. ASHRAE (HVACA) Handbook - HVAC Applications.
2. FEMA 412.
3. FEMA 413.
4. FEMA 414.
5. FEMA E-74.
6. SMACNA (SRM).

B. Seismic Snubbers:
1. Provide on all isolated equipment, piping and ductwork.
2. Provide minimum of four seismic snubbers located close to isolators.
3. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance.
4. Snub all other equipment between 0.15 inch and 0.25 inch clearance.

C. Floor and Base-Mounted Equipment, Vibration Isolated Equipment and associated Vibration and Seismic Controls for Connections:
   1. Install equipment anchorage items designed to resist seismic design force in any direction.
   2. Install vibration and seismic controls designed to include base and isolator requirements.
   3. Provide flexible connections between equipment and interconnected piping.
   4. Provide isolators and restraints designed for amplified code forces per ASCE 7 and with demonstrated ability to resist required forces including gravity, operational and seismic forces.
   5. Where equipment is not designed to be point loaded, provide base capable of transferring gravity and seismic demands from equipment to isolator base plate anchorage.
   6. Where concrete floor thickness is less than required for expansion anchor installation, install through bolt in lieu of expansion anchor.
   7. Where timber/wood floor or other substrate is inadequate for installation of lag bolts, screws or other mechanical fasteners, install supplemental framing or blocking to transfer loads to structural elements.

D. Suspended Mechanical Equipment:
   1. Provide supports and bracing to resist seismic design force in any direction.
   2. Provide flexible connections between equipment and interconnected piping.
   3. Brace equipment hung from spring mounts using cable or other bracing that will not transmit vibration to the structure.
   4. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an accredited inspection body is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.

E. Wall mounted Mechanical Equipment:
   1. Provide support and bracing to resist seismic design force in any direction.
   2. Install backing plates or blocking as required to deliver load to primary wall framing members.
   3. Anchoring to gypsum wallboard, plaster or other wall finish that has not been engineered to resist imposed loads is not permitted.

F. Piping:
   1. Provide seismic bracing in accordance ASCE 7.
   2. Provide supports, braces, and anchors to resist gravity and seismic design forces.
   3. Provide flexible connections between floor mounted equipment and suspended piping; between unbraced piping and restrained suspended items; as required for thermal movement; at building separations and seismic joints; and wherever relative differential movements could damage pipe in an earthquake.
   4. Brace resiliently supported pipe with cable bracing or alternate means designed to prevent transmission of vibrations and noise to the structure.
   5. Brace every run 5.0 feet or more in length with two transverse and one longitudinal bracing locations.
   6. Pipes and Connections Constructed of Ductile Materials (copper, ductile iron, steel or aluminum and brazed, welded or screwed connections):

a. Provide transverse bracing at spacing not more than 40.0 feet on center.
b. Provide longitudinal bracing at spacing not more than 80.0 feet on center.

7. Pipes and Connections Constructed of Non Ductile Materials (cast iron, no-hub, plastic or non-UL listed grooved coupling pipe):
   a. Provide transverse bracing at spacing not more than 20.0 feet on center.
   b. Provide longitudinal bracing at spacing not more than 40.0 feet on center.
8. Provide lateral restraint for risers at not more than 30 feet on center or as required for horizontal runs, whichever is less.
9. Piping Explicitly Exempt from Seismic Bracing Requirements:
   a. Provide flexible connections between piping and connected equipment, including in-line devices such as VAV boxes and reheat coils.
   b. Install piping consistent with ASCE 7, such that swinging of the pipes will not cause damaging impact with adjacent components, finishes, or structural framing while maintaining clear horizontal distance of 67 percent of the hanger length between subject components.
   c. Provide swing restraints as required to control potential impact due to limited space between subject components.
10. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an accredited inspection body is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.
11. Re-use of Existing Hangers:
    a. Re-using existing hangers at locations of seismic bracing are to be judged on a case-by-case basis by the registered project design professional.
    b. Unless otherwise shown on the drawings, it is assumed all hangers supporting new piping, located at a seismic brace, will be new.

G. Ductwork:
1. Provide seismic bracing for ducts with cross sectional area greater than 6 sq ft (independent of duct contents).
2. Provide seismic bracing for all ducts containing hazardous materials.
3. Provide supports, braces, and anchors to resist gravity and seismic design forces.
4. Install ducts and duct risers designed to accommodate interstory drift.
5. Independently support in-line devices weighing more than 20 pounds.
6. Independently support and brace all in-line devices weighing more than 75 pounds.
7. Provide unbraced piping attached to braced in-line equipment with adequate flexibility to accommodate differential displacements.
8. Positively attach dampers, louvers, diffusers and similar appurtenances to ductwork with mechanical fasteners.
9. Install duct supports designed to resist not less than 150 percent of the duct weight.
10. 1The use of power driven fasteners is prohibited in the hanging of ducts weighing over 10 pounds per lineal foot for seismic design categories D, E, and F.

11. 1Use of proprietary restraint systems with a certificate of compliance, verified and listed by an IAS AC172 accredited inspection body or otherwise accepted by applicable codes is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.

H. Tanks:
1. Install tank anchorage, tank legs and/or supporting structure designed to resist design force.
2. Provide flexible connections between tank and interconnected piping.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - Quality Requirements, for additional requirements.

B. Inspect isolated equipment after installation and submit report. Include static deflections.

C. Perform testing and inspections of the installation in accordance with Division 01.

3.4 SCHEDULE

A. Pipe Isolation Schedule.
1. 1 Inch Pipe Size: Isolate 120 diameters from equipment.
2. 2 Inch Pipe Size: Isolate 90 diameters from equipment.
3. 3 Inch Pipe Size: Isolate 80 diameters from equipment.
4. 4 Inch Pipe Size: Isolate 75 diameters from equipment.
5. 6 Inch Pipe Size: Isolate 60 diameters from equipment.
6. 8 Inch Pipe Size: Isolate 60 diameters from equipment.
7. 10 Inch Pipe Size: Isolate 54 diameters from equipment.
8. 12 Inch Pipe Size: Isolate 50 diameters from equipment.
9. 16 Inch Pipe Size: Isolate 45 diameters from equipment.
10. 24 Inch Pipe Size: Isolate 38 diameters from equipment.
11. Over 24 Inch Pipe Size: As indicated.

B. Equipment Isolation Schedule.
1. Direct Fired Air Units.
   a. Base: Structural steel base.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.
2. Fuel Fired Unit Heaters.
   a. Base: Structural steel base.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Type: _____.
   e. Isolator Deflection: _____ inches.
3. Air Cooled Condensing Units.
   a. Base: Structural steel base.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.

d. Isolator Deflection: _____ inches.

4. Air Cooled Refrigerant Condensers.
   a. Base: Structural steel base.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.
5. Packaged Roof Top Air Conditioning Units.
   a. Base: Structural steel base.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.
6. Computer Room Air Conditioning Units.
   a. Base: Structural steel base.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.

END OF SECTION 23 0548

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Duct Markers.

D. Pipe markers.

E. Warning Signs and Labels

F. Warning Tags

G. Ceiling Tacks

1.2 RELATED REQUIREMENTS

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

B. Division 09- Finishes.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials.

1.4 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents:

1. Valve Schedules: For each piping system. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or

space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

2. Equipment Schedules: For each item of equipment to be labeled. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

PART 2 PRODUCTS

2.1 EQUIPMENT NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC
   2. Brimar Industries, Inc;
   3. Kolbi Pipe Marker Co.
   4. Seton Identification Products
   5. Substitutions: See Division 01-General Requirements.

B. Metal Labels for Equipment:

   1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inchor anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   4. Fasteners: Stainless-steel rivets or self-tapping screws.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Plastic Labels for Equipment:

   1. Material and Thickness: Conform to ASTM D709. Multilayer, multicolor, plastic labels for mechanical engraving, minimum 1/16 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: White.
   3. Background Color: Black.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
   6. Minimum Letter Size: 1/4 inchfor name of units if viewing distance is less than 24 inches, 1/2 inchfor viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

D. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 TAGS

A. Manufacturers:
1. Advanced Graphic Engraving
2. Brady Corporation
3. Brimar Industries, Inc
4. Kolbi Pipe Marker Co
5. Seton Identification Products, a Tricor Company
6. Substitutions: See Division 01-General Requirements.

B. Metal Tags: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware. Brass wire-link, beaded chain or S-hook fasteners. Minimum 1-1/2 inch diameter with smooth edges.

2.3 DUCT MARKERS

A. Manufacturers:
1. Brimar Industries, Inc
2. Kolbi Pipe Marker Co
3. Seton Identification Products

B. General Requirements for Manufactured Duct Labels: Preprinted self-adhesive, premium grade vinyl, color-coded, with lettering indicating service, and showing flow direction.

C. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch printed with UV and chemical resistant inks.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

F. Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: Prepared with letter sizes according to ASME A13.1, at least 1-1/2 incheshigh.

2.4 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation
2. Brimar Industries, Inc
3. Kolbi Pipe Marker Co
4. MIFAB, Inc
5. Seton Identification Products
6. Substitutions: See Division 01-General Requirements.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Prepared with letter sizes according to ASME A13.1, at least 1-1/2 incheshigh.

2.5 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inchthick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inchfor name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Red, white, black.

2.7 CEILING TACKS

A. Manufacturers:
1. Brimar
2. Craftmark
3. Seton Identification Products
4. Substitutions: See Division 01-General Requirements.

B. Description: Steel with 3/4 inch diameter color coded head.

C. Color code as follows:
1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment, including all scheduled equipment on the drawings, air terminal units, automatic control devices, control panels, instruments, relays and major control components.

B. Locate equipment labels where accessible and readable from the floor.

C. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

3.3 VALVE TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application:

1. Valve-Tag Size and Shape: 1-1/2 inches, round.

2. Valve-Tag Color: Natural

3. Letter Color: Black

3.4 PIPE LABEL INSTALLATION

A. Install plastic pipe markers in accordance with manufacturer's instructions.

B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Pipe Label Color Schedule:

1. Potable, Cooling, Heating and Other Water Piping:

a. Background Color: Green.
b. Letter Color: White.

2. Combustible Fluid Piping:

a. Background Color: Brown.
b. Letter Color: White.

3. Flammable & Oxidizing Fluid Piping:

a. Background Color: Yellow.
b. Letter Color: Black.

4. Toxic & Corrosive Piping:

a. Background Color: Orange.
b. Letter Color: Black.

F. Identify valves in main and branch piping with tags.

3.5 DUCT LABEL INSTALLATION

A. Install duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 CEILING TACK INSTALLATION

A. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 0553

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Vibration measurement of equipment operating conditions.

1.2 RELATED REQUIREMENTS

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

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. AABC (NSTSB) - AABC National Standards for Total System Balance

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems;.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing;.

1.4 SUBMITTALS

A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit to the Commissioning Authority.
   3. Submit to Engineer of Record.
   4. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   5. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.

6. Include at least the following in the plan:
   a. Preface: An explanation of the intended use of the control system.
   b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
   c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
   d. Identification and types of measurement instruments to be used and their most recent calibration date.
   e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
   f. Final test report forms to be used.
   g. Detailed step-by-step procedures for TAB work for each system and issue, including:
      1) Terminal flow calibration (for each terminal type).
      2) Diffuser proportioning.
      3) Branch/submain proportioning.
      4) Total flow calculations.
      5) Rechecking.
      6) Diversity issues.
   h. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
   i. Details of how TOTAL flow will be determined; for example:
      1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
      2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
   j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
   k. Confirmation of understanding of the outside air ventilation criteria under all conditions.
   l. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
   m. Method of checking building static and exhaust fan and/or relief damper capacity.
   n. Methods for making coil or other system plant capacity measurements, if specified.
   o. Time schedule for TAB work to be done in phases (by floor, etc.).
   p. Description of TAB work for areas to be built out later, if any.
   q. Time schedule for deferred or seasonal TAB work, if specified.
   r. False loading of systems to complete TAB work, if specified.
   s. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
   t. Interstitial cavity differential pressure measurements and calculations, if specified.
   u. differential pressure measurements and calculations between the building and its exterior.

v. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
w. Procedures for formal progress reports, including scope and frequency.
x. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit under provisions of Division 01 – General Conditions.
2. Submit to the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
3. Revise TAB plan to reflect actual procedures and submit as part of final report.
4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and Engineer of Record and for inclusion in operating and maintenance manuals.
5. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index 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.
6. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
7. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
8. Units of Measure: Report data in both I-P (inch-pound) units.
9. Include the following on the title page of each report:
    a. Name of Testing, Adjusting, and Balancing Agency.
    b. Address of Testing, Adjusting, and Balancing Agency.
    c. Telephone number 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.

E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
   4. SMACNA (TAB)Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a 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 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 and fans are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers and control providers whose work will be tested, adjusted, or balanced.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent 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.

3.5 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure 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. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

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.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

H. Check and adjust systems approximately two seasons after final acceptance and submit report.

3.6 AIR SYSTEM PROCEDURE

A. Work with Control vendor to establish minimum setpoints necessary to satisfy contract documents. Iterative testing to determine these minimum setpoints will be expected to be in the submittals.

B. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

C. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

D. Measure air quantities at air inlets and outlets.

E. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

F. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

G. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the 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. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.7 WATER SYSTEM PROCEDURE

A. Work with Control vendor to establish minimum setpoints necessary to satisfy contract documents. Iterative testing to determine these minimum setpoints will be expected in the submittals.

B. Adjust water systems to provide required or design quantities.

C. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages 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 the system.

D. Adjust systems to provide 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.

E. Effect system balance with automatic control valves fully open to heat transfer elements.

F. 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.

G. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.8 COMMISSIONING

A. See Division 01- General Requirements for additional requirements.

3.9 SCOPE

A. Test, adjust, and balance the following:
1. Plumbing Pumps.
2. Boiler Feedwater Pumps.
3. HVAC Pumps.
4. Boilers
5. Air Cooled Refrigerant Condensers.
6. Packaged Roof Top Heating/Cooling Units.
7. Packaged Terminal Air Conditioning Units.
8. Variable Refrigerant Volume/Flow Systems (VRF or VRV)
9. Computer Room Air Conditioning Units.
10. Air Coils.
11. Terminal Heat Transfer Units.
12. Air Handling Units.
13. Dedicated Outdoor Air Units.
14. Fans.
15. Air Filters.

16. Air Terminal Units.
17. Air Inlets and Outlets.

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.
9. VFD Setpoints.
10. ECM Setpomts.

B. V-Belt Drives:
1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:
1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Combustion Equipment:
1. Boiler manufacturer.
2. Model number.
3. Serial number.
4. Firing rate.
5. Overfire draft.
6. Gas meter timing dial size.
7. Gas meter time per revolution.
8. Gas pressure at meter outlet.

9. Gas flow rate.
10. Heat input.
11. Burner manifold gas pressure.
12. Percent carbon monoxide (CO).
13. Percent carbon dioxide (CO2).
14. Percent oxygen (O2).
15. Percent excess air.
16. Flue gas temperature at outlet.
17. Ambient temperature.
18. Net stack temperature.
19. Percent stack loss.
20. Percent combustion efficiency.
21. Heat output.

E. Air Cooled Condensers:
1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

F. Cooling Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Saturated suction temperature, design and actual.
15. Air pressure drop, design and actual.

G. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.

7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

H. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

I. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

J. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.

10. Number of Belts/Make/Size.
11. Fan RPM.

K. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

L. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
    a. Blower.
    b. Orifice, tube size.
    c. Orifice size.
    d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

M. Air Monitoring Stations:
1. Identification/location.
2. System.
3. Size.
4. Area.
5. Design velocity.
6. Design air flow.
7. Test velocity.
8. Test air flow.

N. Flow Measuring Stations:
1. Identification/number.
2. Location.
3. Size.
4. Manufacturer.
5. Model number.
6. Serial number.
7. Design Flow rate.

8. Design pressure drop.
9. Actual/final pressure drop.
10. Actual/final flow rate.
11. Station calibrated setting.

O. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

P. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION 23 0593

SECTION 23 0700 - HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. HVAC piping insulation, jackets and accessories.
2. HVAC equipment insulation, jackets and accessories.
3. HVAC ductwork insulation, jackets, and accessories.

B. Related Sections:
1. Division 01- General Requirements
2. Division 07 – Firestopping
3. Division 09- Finishes
4. Section 23 0553- Identification of HVAC Piping and Equipment
5. Section 23 3100- HVAC ducts and casings
6. Section 23 2113 – Hydronic Piping

1.2 REFERENCES

A. ASTM International:
1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
2. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
3. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
4. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
5. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
6. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
7. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
8. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
9. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
10. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
11. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
12. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
13. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

14. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
15. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
16. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
17. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
18. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
19. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
20. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
21. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors':
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. Underwriters Laboratories Inc.:
   1. UL 1978 - Standard for Safety for Grease Ducts.

1.3 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Duct insulation, Coverings, and Linings: Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E 2231.

E. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

F. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.5 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements:

B. Convene minimum one week prior to commencing work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping. Store all insulation materials in a clean, dry environment.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements.

1.10 SCHEDULING

A. Schedule insulation application after pressure and leak testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive,

mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

2.2 MANUFACTURER

A. Manufacturers for Flexible Glass Fiber (FGF), Pre-Molded Glass Fiber (PGF) and Rigid Glass Fiber (RGF) Insulation Products:
   1. Knauf Insulation
   2. Johns Manville Corporation
   3. Owens-Corning.
   4. Substitutions: Division 01.

B. Manufacturers for Closed Cell Elastomeric (CCE) Insulation Products:
   1. Aeroflex. USA, Inc.
   2. Armacell, LLC (Interior- ArmaFlex, Exterior- ArmaTuff)
   3. K-Flex USA LLC
   4. Substitutions: Division 01.

C. Manufacturers for Polyisocyanurate Foam Insulation Products: (steam only)
   1. Dow Chemical Company.
   2. Owens-Corning
   3. Johns Manville Corporation
   4. Substitutions: Division 01.

D. Manufacturers for Fire Rated (FR) Insulation Products:
   1. 3M Fire Barrier Duct Wrap 615+.
   2. Morgan Theramal Ceramics Pyroscat DuctWrap XL.
   3. Unifrax FyreWrap Elite 1.5.
   4. Substitutions: Division 01.

E. Manufacturers for Jacketing (PVC):
   1. Johns Manville
   2. P.I.C. Plastics Inc.
   3. Proto Corporation
   4. Substitutions: Division 01.

F. Manufacturers for Jacketing (ALM):
   1. Childers Brand
   2. ITW Insulation Systems
   3. RPR Products
   4. Substitutions: Division 01.

G. Manufacturers for exterior pipe/ duct waterproof jacketing (WJ):
   1. Polyguard Products, Inc.; Alumaguard 60.
   2. Venture Tape Corporation; VentureClad Plus.

3. MFM Building Products Corp: Flex Clad 400
4. Substitutions: Division 01.

2.3 PIPE INSULATION

A. Pre-Molded Glass Fiber (PGF) Insulation:
1. ASTM C547 and ASTM C795, rigid molded, noncombustible.
2. 'K' ('Ksi') Value: ASTM C177, 0.24 at 75°F.
3. Maximum Service Temperature: 850°F.
4. Maximum Moisture Absorption: 0.2 percent by volume.
5. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; self-sealing lap, moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (ASJ-SSL).

B. Closed Cell Elastomeric (CCE) Insulation:
1. Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
2. Minimum Service Temperature: Minus 40°F.
3. Maximum Service Temperature: 220°F.
4. Connection: Waterproof vapor barrier adhesive.

2.4 PIPE INSULATION JACKETS

A. Polyvinyl-chloride (PVC): Plastic Pipe Jacket.
1. Product Description: ASTM D1785, One piece molded type fitting covers and sheet material, off-white color.
2. Thickness: 10 mil.
3. Connections: Brush on welding adhesive.

B. Aluminum (ALM): Self-Adhesive Waterproofing Jacket. Minimum 12 mil thick, vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; UV resistant, zero permeability with textured aluminum-foil facing, impact and tear resistant.

2.5 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: hydrous calcium silicate. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.

F. Valve insulation Wraps: White, noncombustible, conforming to ASTM E 84. Match insulation thickness to pipe size. Valve covers shall be easily removable.

2.6 EQUIPMENT INSULATION

A. Closed Cell Elastomeric (CCE) Insulation:
1. Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3, in sheet form.
2. Minimum Service Temperature: -40°F.
3. Maximum Service Temperature: 220°F.
4. Connection: Waterproof vapor barrier adhesive.

B. PVC Plastic Equipment Jacket:
1. Product Description: ASTM D1785, sheet material, off-white color.
2. Minimum Service Temperature: -40°F.
3. Maximum Service Temperature: 150°F.
4. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
5. Thickness: 10 mil.
6. Connections: Pressure sensitive color matching vinyl tape.

C. Aluminum Equipment Jacket:
1. ASTM B209
2. Thickness: 0.020 inch thick sheet.
3. Finish: Smooth.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.02 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.02 inch thick aluminum.

2.7 EQUIPMENT INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

E. Adhesives: Compatible with insulation. Refer to manufacturers' installation manual.

2.8 DUCTWORK INSULATION

A. Flexible Glass Fiber (FGF) Insulation: ASTM C553 Type I, II, or III, ASTM C1290 Type III, in accordance to NFPA 90A and NFPA 90B for duct coverings, with ASTM C1136 foil scrim kraft (FSK).
1. Thermal performance: 1.0 lb/ft^3, 7.4 ft^2 hr °F/btu minimum R-value for 2" thick at 75°F mean temperature per ASTM C177 and ASTM C518.
2. Operating temperature range: 40°F to 250°F.

3. Water vapor permeance: 0.02 perms maximum per ASTM E96.
4. Water vapor sorption: 5% by weight maximum per ASTM C1104.
5. Corrosiveness: Does not accelerate per ASTM C665.
6. Fungi growth: No fungi growth per ASTM C1338.

B. Rigid Glass Fiber (RGF) Insulation: Glass fiber board, ASTM C 612 Type 1A or 1B, in accordance to NFPA 90A and NFPA 90B for duct coverings, with ASTM C 1136 foil scrim kraft (FSK).
1. Thermal performance: 8.7 ft^2 hr °F/btu minimum R-value for 2" thick at 75°F mean temperature per ASTM C177 and ASTM C518.
2. Operating temperature range: 0°F to 450°F.
3. Water vapor permeance: 0.02 perms maximum per ASTM E96.
4. Water vapor sorption: 5% by weight maximum per ASTM C1104.
5. Corrosiveness: Does not accelerate per ASTM C665.
6. Fungi growth: No fungi growth per ASTM C1338.

C. Closed Cell Elastomertic (CCE) Insulation:
1. Thermal performance: 8.0 ft^2 hr °F/btu minimum R-value for 2" thick at 75°F mean temperature per ASTM C177 and ASTM C518.
2. Operating temperature range: -40°F to 220°F.
3. Water absorption: 0.2% by volume per ASTM C 209 or ASTM C1763.
4. Water vapor permeability: 0.08 perm-in per ASTM E 96.
5. Ultraviolet (UV) resistance: Excellent per ASTM G 53 or ASTM G 90.
6. Weatherability: Excellent per ASTM D 471.

D. Fire Rated (FR) Insulation:
1. Inorganic blanket encapsulated with scrim reinforced foil meeting UL 1978
2. Thermal Conductivity: 0.42 at 500°F.
3. Weight: 1.4 pound per square foot.
4. Surface Burning Characteristics: Maximum 0/0 flame spread/smoke developed index when tested in accordance with ASTM E84.

E. Technical Data:
1. Insulation shall pass when tested in accordance with the following:
   a. Non-combustibility per ASTM E136.
   b. Fire resistance (wall) per ASTM E119.
   c. Durability test per ASTM C518.
   d. Internal fire test per ASTM E2336.
   e. Fire engulfment (duct) per ASTM E814.
   f. ULC grease duct test protocol.
   g. Grease duct clearances per UL1978.
   h. Air duct ventilation enclosure per ISO6944.
2. Thermal performance: 6.3 ft^2 hr °F/btu minimum R-value for 1-1/2" thick at 75°F mean temperature per ASTM C177 and ASTM C518.

2.9 DUCTWORK JACKETS

A. Aluminum (ALM): Self-Adhesive Waterproofing Jacket: Minimum 12 mil thick, vapor barrier and waterproofing membrane for installation over insulation located aboveground

outdoors; UV resistant, zero permeability with textured aluminum-foil facing, impact and tear resistant.

2.10 DUCTWORK INSULATION ACCESSORIES

A. Vapor Retarder Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

B. Vapor Retarder Lap Adhesive: Compatible with insulation.

C. Adhesive: Waterproof, ASTM E162 fire-retardant type.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with head.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.

H. Adhesives: Compatible with insulation.

I. Membrane Adhesives: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Protect insulation from exposure to moisture prior to and after installation. All insulation other than flexible elastomeric that becomes wet shall be replaced at no cost to the project.

B. Verify piping, equipment and ductwork has been tested before applying insulation materials.

C. Verify piping, equipment and ductwork surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Piping Exposed to View in Finished Spaces Provide with PVC Plastic pipe jacketing for additional protection. Locate insulation and cover seams in least visible locations.

D. Piping Exposed to view in mechanical spaces. Provide with PVC Plastic pipe jacketing for additional protection. Locate insulation and cover seams in least visible locations.

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 07 for penetrations of assemblies with fire resistance rating greater than one hour.

F. Piping Systems Conveying Fluids Below Ambient Temperature:
1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

G. For all hot piping conveying fluids, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature.
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
1. Application: Piping 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 the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Insulation Terminating Points:
1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
3. Condensate Piping: Insulate entire piping system and components to prevent condensation.

K. Closed Cell Elastomeric Insulation:
1. Push insulation on to piping.
2. Miter joints at elbows.

3. Seal seams and butt joints with manufacturer's recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

M. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

N. Install valve bags on all chilled water valves unless otherwise indicated. Valve bags shall be easily removable for servicing of valves.

O. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Below Ambient Temperature:
1. Insulate entire equipment surfaces.
2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
4. Finish insulation at supports, protrusions, and interruptions.

E. Equipment Containing all Fluids Above Ambient Temperature:
1. Insulate flanges and unions with removable sections and jackets.
2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
3. Finish insulation at supports, protrusions, and interruptions.

F. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 INSTALLATION - DUCTWORK SYSTEMS

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Protect insulation from exposure to moisture prior to and after installation. All insulation other than flexible elastomeric that becomes wet shall be replaced at no cost to the project.

D. Duct dimensions indicated on Drawings are finished inside dimensions.

E. 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.

F. 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.

G. External Elastomeric Duct Insulation:
1. Adhere to clean oil-free surfaces with full coverage of adhesive.
2. Seal seams and butt joints with manufacturer’s recommended adhesive.
3. When application requires multiple layers, apply with joints staggered.
4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
5. Lift ductwork off trapeze hangers and insert spacers.

H. Ducts Exterior to Building:
1. Install insulation according to external duct insulation paragraph above.
2. Provide external insulation with vapor retarder jacket. Cover with outdoor jacket finished with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
3. Finish with aluminum duct jacket.
4. Calk seams at flanges and joints. Located major longitudinal seams on bottom side of horizontal duct sections.

I. Duct Acoustical Liner
1. Ductwork shall still be insulated per this specification even if the ductwork is acoustically lined. Acoustically lined ductwork does not negate the use of wrap as insulation.

J. Prepare duct insulation for finish painting. Refer to Division 09.

3.5 SCHEDULES

3.6 DUCTWORK SCHEDULES

A. Items Not Insulated:
1. Fibrous-glass ducts.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.
6. Stair pressurization supply ductwork.

B. Provide insulation materials and thicknesses identified below. If more than one material is listed for a duct location, selection from materials listed is Division 23 option.

Heating and Cooling Supply and Heat/Energy Recovery System Exhaust Ducts Climate Zone 4A				
Description	Minimum As-Installed R-Value	Insulation Type	Minimum Thickness (inches)	Jacketing
Exterior to building envelope	R-8.0	Closed Cell Elastomeric (CCE)	2.0	ALM
Concealed within thermal envelope of building	R-6.0	Flexible Glass Fiber (FGF)	2.0	FSK
Exposed in mechanical rooms	R-6.0	Rigid Glass Fiber (RGF)	2.0	FSK

Unconditioned Outside Air Intake Ducts and Exhaust/Relief Duct Inside Building Envelope Climate Zones 4A				
Description	Minimum As-Installed R-Value	Insulation Type	Minimum Thickness (inches)	Jacketing
For outside air intakes, all ductwork between the building envelope and the first system heating coil, cooling coil or air handling unit connection.	R-12.0	Flexible Glass Fiber (FGF)	3.0	FSK
		Rigid Glass Fiber (RGF)	3.0	FSK
For exhaust/relief ducts, all ductwork between the building envelope and first system isolation damper.	R-12.0	Flexible Glass Fiber (FGF)	3.0	FSK
		Rigid Glass Fiber (RGF)	3.0	FSK

3.7 DUCT LINER

A. See Section 23 3100 - HVAC Ducts and Casings, for duct liner specifications

3.8 PIPE INSULATION SCHEDULE

A. Provide insulation materials and thicknesses scheduled for each system type and pressure/temperature range. If more than one material is listed for a system, selection from materials listed is Division 23 option.

B. For dual temperature systems (heating and cooling), provide thickness equal to greater of heating or cooling scheduled value. Dual temperature piping shall also meet all vapor barrier requirements for cooling insulation (perm rating).

C. Insulation for pre-insulated piping shall meet all specified requirements.

D. Insulate piping operating at temperatures below 40°F and systems operating between 40°F to 65°F in accordance with NAIMA Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation. Comply with all recommendations including but not limited to the requirement for vapor dams every fourth section of insulation.

Heating Hot Water Systems						
Insulation Type		Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Outdoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
E. F.	Pre-Molded Glass Fiber (PGF)	Less than 1 to 1.5	1.5	3.0	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms. Outdoor: ALM
		1.5 and Larger	2.0	4.0		

All Outdoor Heat Traced Piping					
Insulation Type		Pipe Size (inch)	Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
G.	Pre-Molded Glass Fiber (PGF)	Less than 1	1.25*	ASJ-SSL	Outdoor: ALM
		1 to Less than 1.5	1.5*		
		1.5 to 2	2.0*		
		2.5 to 3	3.0*		
		4	4.0*		

1. *Insulation thickness to be determined by heat trace manufacturer installation instructions

Cooling Coil Condensate Piping, Outdoor Cooling Tower Makeup Water Piping and Equipment Drain Piping: All					
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Outdoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
H. Closed Cell Elastomeric (CCE)	All Sizes	0.75	2.0	N/A	Indoor (CCE): N/A Outdoor (CCE): ALM

Refrigerant Piping					
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Outdoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Closed Cell Elastomeric (CCE)	Less than 3	1.0	1.0	N/A	Indoor: N/A Outdoor: ALM

3.9 EQUIPMENT INSULATION SCHEDULE

A. Provide insulation materials and thicknesses scheduled for each system type and pressure/temperature range. If more than one material is listed for a system, selection from materials listed is Division 23 option.

END OF SECTION 23 0700

SECTION 23 0923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section includes control equipment and software.

B. Related Sections:
1. Section 23 04 00 – General Conditions for Mechanical Trades
2. Section 23 09 00 - Instrumentation and Control for HVAC: Control system components.
3. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation implemented using products specified in this section.
4. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI MC85.1 - Terminology for Automatic Control.

1.3 SYSTEM DESCRIPTION

A. Automatic temperature controls field monitoring and control system using field programmable microprocessor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Provide computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Provide controls for variable refrigerant volume terminals, radiation, unit heaters, split system air conditioning units, and Dedicated Outdoor Air Systems when directly connected to control units.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories to operate mechanical systems, and to perform functions specified.

F. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate the following:
   1. Trunk cable schematic showing programmable control-unit locations and trunk data conductors.
   2. Connected data points, including connected control unit and input device.
   3. System graphics showing monitored systems, data (connected and calculated) point addresses, and operator notations.
   4. System configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
   5. Description and sequence of operation for operating, user, and application software.
   6. Use terminology in submittals conforming to ASME MC85.1.
   7. Coordinate submittals with information requested in Section 23 09 93.

C. Product Data: Submit data for each system component and software module.

D. Manufacturer's Installation Instructions: Submit installation instruction for each control system component.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Submit data specified in "Submittals" in final "Record Documents" form.

C. Operation and Maintenance Data:
   1. Submit interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Submit keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Submit inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

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.

B. Installer: Company specializing in performing Work of this section with minimum three years experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for direct digital controls.

1.10 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Furnish service and maintenance of control systems for one years from Date of Substantial Completion.

C. Furnish complete service of controls systems, including callbacks. Make minimum of 2 complete normal inspections of approximately 4 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls. Submit written report after each inspection.

D. Furnish two complete inspections per year, one in each season, to inspect, calibrate, and adjust controls. Submit written report after each inspection.

E. Examine unit components monthly. Clean, adjust, and lubricate equipment.

F. Include systematic examination, adjustment, and lubrication of unit, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.

G. Perform work without removing units from service during building normal occupied hours.

H. Provide emergency call back service at all hours for this maintenance period.

I. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

J. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.

K. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

PART 2 PRODUCTS

2.1 DIRECT DIGITAL CONTROLS

A. Manufacturers:
1. Alerton
2. Schneider Electric as provided by SNE
3. Siemens Apogee
4. Automated Logic
5. Substitutions: Division 01 - Product Requirements.

2.2 OPERATOR WORKSTATION

A. Manufacturers:
1. Dell Corporation
2. Acer
3. HP
4. Substitutions: Division 01 - Product Requirements.

B. Furnish each operator workstation consisting of the following:

C. Personal Computer: PC compatible with sufficient memory and hard drive storage to support graphics, reports, and communication requirements. Furnish with the following minimum configuration requirements:
1. Processor: Intel i5 4.0 GHz.
2. Hard Drive: 1 TB
3. Memory: 8 Gigabyte DDR4 SDRAM.
4. Drive 1: DVD-RW
5. Wireless: 802.11 bgn + Blueooth 4.0
6. Ports: Required serial, parallel, network communications, USB, and cables for proper system operation.
7. Expansion Slots: 1 used for LAN card, 1 available.
8. LAN Card: EtherNet - RJ45 (100 base-T minimum).
9. Mouse: two-button optical type wireless.
10. Keyboard: 104 key.

D. Monitor: Minimum of 24 inch color, flat panel display.

E. Operating System: Minimum Windows 10

F. Printer: Furnish each operator workstation with color ink jet printer and associated cables. Printer capable of minimum of 14 pages per minute (PPM) operation and compatible with standard parallel or USB communications or network capable.

2.3 PORTABLE OPERATOR'S TERMINAL

A. Manufacturers:
1. Dell Corporation
2. Acer
3. HP
4. Substitutions: Division 01 - Product Requirements.

B. Furnish device capable of accessing system data and capable of being connected to any point on system network or connected directly to any controller for programming, set-up, and troubleshooting. Portable Operators Terminal uses Read (Initiate) and Write (Execute) Services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135, to communicate with BACnet objects in internetwork. Objects supported include: Analog input, analog output, analog value, binary input, binary output, binary value, device.

C. Furnish notebook-style PC including software and hardware required with:

1. Processor: Intel i5 4.0 GHz.
2. Hard Drive: 1 TB
3. Memory: 8 Gigabyte DDR4 SDRAM.
4. Drive 1: DVD-RW
5. Wireless: 802.11 bgn + Blueooth 4.0
6. Ports: Required serial, parallel, network communications, USB, and cables for proper system operation.
7. Expansion Slots: 1 used for LAN card, 1 available.
8. LAN Card: EtherNet - RJ45 (100 base-T minimum).
9. Mouse: two-button optical type wireless.
10. Keyboard: 104 key.

2.4 CONTROL UNITS

A. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.

B. Provide controllers required to operate perimeter heating at first stage and/or second stage heating.

C. Battery Backup: For minimum of 48hours for complete system including RAM without interruption, with automatic battery charger.

D. Control Units Functions:
1. Monitor or control each input/output point.
2. Completely independent with hardware clock/calendar and software to maintain control independently.
3. Acquire, process, and transfer information to operator station or other control units on network.

4. Accept, process, and execute commands from other control unit's or devices or operator stations.
5. Access both data base and control functions simultaneously.
6. Record, evaluate, and report changes of state or value occurring among associated points. Continue to perform associated control functions regardless of status of network.
7. Perform in stand-alone mode:
    a. Start/stop.
    b. Duty cycling.
    c. Automatic Temperature Control.
    d. Demand control via a sliding window, predictive algorithm.
    e. Event initiated control.
    f. Calculated point.
    g. Scanning and alarm processing.
    h. Full direct digital control.
    i. Trend logging.
    j. Global communications.
    k. Maintenance scheduling.

E. Global Communications:
1. Broadcast point data onto network, making information available to other system controls units.
2. Transmit input/output points onto network for use by other control units and use data from other control units.

F. Input/output Capability:
1. Discrete/digital input (contact status).
2. Discrete/digital output.
3. Analog input.
4. Analog output.
5. Pulse input (5 pulses/second).
6. Pulse output (0-655 seconds in duration with 0.01-second resolution).

G. Monitor, control, or address data points. Include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs. Furnish control units with minimum 30percent spare capacity.

H. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

I. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard-wired LAN

J. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:

1. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from workstation.
2. Control output points but change only database state or value; leave external field hardware unchanged.
3. Enable control-actions on output points but change only data base state or value.

K. Local display and adjustment panel: Integral to control-unit containing digital display, and numerical keyboard. Display and adjust:
1. Input/output point information and status.
2. Controller set points.
3. Controller tuning constants.
4. Program execution times.
5. High and low limit values.
6. Limit differential.
7. Set/display date and time.
8. Control outputs connected to the network.
9. Automatic control outputs.
10. Perform control unit diagnostic testing.

L. Points in "Test" mode.

2.5 LOCAL AREA NETWORKS (LAN):

A. Furnish communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 25Mbps.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, less than 3 seconds. Furnish automatic reconfiguration when station is added or lost. In event transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.6 OPERATING SYSTEM SOFTWARE

A. Input/output Capability From Operator Station:
1. Request display of current values or status in tabular or graphic format.
2. Command selected equipment to specified state.

3. Initiate logs and reports.
4. Change analog limits.
5. Add, delete, or change points within each control unit or application routine.
6. Change point input/output descriptors, status, alarm descriptors, and unit descriptors.
7. Add new control units to system.
8. Modify and set up maintenance scheduling parameters.
9. Develop, modify, delete or display full range of color graphic displays.
10. Automatically archive select data even when running third party software.
11. Capability to sort and extract data from archived files and to generate custom reports.
12. Support two printer operations.
13. Alarm printer: Print alarms, operator acknowledgments, action messages, system alarms, operator sign-on and sign-off.
14. Data printer: Print reports, page prints, and data base prints.
15. Select daily, weekly or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.
16. Print selected control unit database.

B. Operator System Access: Via software password with minimum 30access levels at work station and minimum 3access levels at each control unit.

C. Data Base Creation and Support: Use standard procedures for changes. Control unit automatically checks workstation data base files upon connection and verify data base match. Include the following minimum capabilities:
1. Add and delete points.
2. Modify point parameters.
3. Change, add, or delete English language descriptors.
4. Add, modify, or delete alarm limits.
5. Add, modify, or delete points in start/stop programs, trend logs, and other items.
6. Create custom relationship between points.
7. Create or modify DDC loops and parameters.
8. Create or modify override parameters.
9. Add, modify, and delete applications programs.
10. Add, delete, develop, or modify dynamic color graphic displays.

D. Dynamic Color Graphic Displays:
1. Utilizes custom symbols or system supported library of symbols.
2. Sixteen (16) colors.
3. Sixty (60) outputs of real-time live dynamic data for each graphic.
4. Dynamic graphic data.
5. 1,000 separate graphic pages.
6. Modify graphic screen refresh rate between 1 and 60 seconds.

E. Operator Station:
1. Accept data from LAN as needed without scanning entire network for updated point data.
2. Interrogate LAN for updated point data when requested.

3. Allow operator command of devices.
4. Allow operator to place specific control units in or out of service.
5. Allow parameter editing of control units.
6. Store duplicate data base for every control unit and allow down loading while system is on line.
7. Control or modify specific programs.
8. Develop, store and modify dynamic color graphics.
9. Data archiving of assigned points and support overlay graphing of this data using up to four (4) variables.

F. Alarm Processing:
1. Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state or value and alarms causing automatic dial-out.
2. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
3. Print on line changeable message, up to 60characters in length, for each alarm point specified.
4. Display alarm reports on video. Display multiple alarms in order of occurrence.
5. Define time delay for equipment start-up or shutdown.
6. Allow unique routing of specific alarms.
7. Operator specifies when alarm requires acknowledgment.
8. Continue to indicate unacknowledged alarms after return to normal.
9. Alarm notification:
10. Print automatically.
11. Display indicating alarm condition.
12. Selectable audible alarm indication.

G. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change of state, specified state, or alarm occurrence or return to normal.

H. Automatic Restart: Automatically start field equipment on restoration of power. Furnish time delay between individual equipment restart and time of day start/stop.

I. Messages:
1. Automatically display or print user-defined message subsequent to occurrence of selected events.
2. Compose, change, or delete message.
3. Display or log message at any time.
4. Assign any message to event.

J. Reports:
1. Manually requested with time and date.
2. Long term data archiving to hard disk.
3. Automatic directives to download to transportable media including floppy diskettes for storage.

4. Data selection methods to include data base search and manipulation.
5. Data extraction with mathematical manipulation.
6. Data reports to allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
7. Generating reports either normally at operator direction, or automatically under workstation direction.
8. Either manually display or print reports. Automatically print reports on daily, weekly, monthly, yearly or scheduled basis.
9. Include capability for statistical data manipulation and extraction.
10. Capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

K. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

L. Data Collection:
1. Automatically collect and store in hard drive.
2. Daily electrical energy consumption, peak demand, and time of peak demand for up to electrical meters over 2-year period.
3. Daily consumption for up to 30 meters over a 2 year period.
4. Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.
5. Archiving of stored data for use with system supplied custom reports.

M. Graphic Display: Support graphic development on work station with software features:
1. Page linking.
2. Generate, store, and retrieve library symbols.
3. Single or double height characters.
4. Sixty (60) dynamic points of data for each graphic page.
5. Pixel level resolution.
6. Animated graphics for discrete points.
7. Analog bar graphs.
8. Display real time value of each input or output line diagram fashion.

N. Maintenance Management:
1. Run time monitoring, for each point.
2. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
3. Equipment safety targets.
4. Display of maintenance material and estimated labor.
5. Target point reset, for each point.

O. Advisories:
1. Summary containing status of points in locked out condition.
2. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
3. Report of power failure detection, time and date.

4. Report of communication failure with operator device, field interface unit, point and programmable control unit.

2.7 LOAD CONTROL PROGRAMS

A. General: Support inch-pounds and S.I. metric units of measurement.

B. Demand Limiting:
1. Monitor total power consumption for each power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.
2. Input: Pulse count from incoming power meter connected to pulse accumulator in control unit.
3. Forecast demand (kW): Predicted by sliding window method.
4. Automatically shed loads throughout the demand interval selecting loads with independently adjustable on and off time of between one and 255 minutes.
5. Demand Target: Minimum of 3 for each demand meter; change targets based upon (1) time, (2) status of pre-selected points, or (3) temperature.
6. Load: Assign load shed priority, minimum "ON" time and maximum "OFF" time.
7. Limits: Include control band (upper and lower limits).
8. Output advisory when loads are not available to satisfy required shed quantity, advise shed requirements [and requiring operator acknowledgment].

C. Duty Cycling:
1. Periodically stop and start loads, based on space temperature, and according to various On/Off patterns.
2. Modify off portion of cycle based on operator specified comfort parameters. Maintain total cycle time by increasing on portion of cycle by equal quantity off portion is reduced.
3. Set and modify following parameters for each individual load.
   a. Minimum and maximum off time.
   b. On/Off time in one-minute increments.
   c. Time period from beginning of interval until cycling of load.
   d. Manually override the DDC program and place a load in an On or Off state.
   e. Cooling Target Temperature and Differential.
   f. Heating Target Temperature and Differential.
   g. Cycle off adjustment.

D. Automatic Time Scheduling:
1. Self-contained programs for automatic start/stop/scheduling of building loads.
2. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.
3. Special day’s schedule supporting up to 30 unique date/duration combinations.
4. Number of loads assigned to time program; with each load having individual time program.

5. Each load assigned at least 16 control actions for each day with 1 minute resolution.
6. Furnish the following time schedule operations:
    a. Start.
    b. Optimized Start.
    c. Stop.
    d. Optimized Stop.
    e. Cycle.
    f. Optimized Cycle.
7. Capable of specifying minimum of 30 holiday periods up to 100 days in length for the year.
8. Create temporary schedules.
9. Broadcast temporary "special day" date and duration.

E. Start/Stop Time Optimization:
1. Perform optimized start/stop as function of outside conditions, inside conditions, or both.
2. Adaptive and self-tuning, adjusting to changing conditions unattended.
3. For each point under control, establish and modify:
    a. Occupancy period.
    b. Desired temperature at beginning of occupancy period.
    c. Desired temperature at end of occupancy period.

F. Night Setback/Setup Program: Reduce heating space temperature set point or raise cooling space temperature set-point during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.

G. Calculated Points: Define calculations and totals computed from monitored points (analog/digital points), constants, or other calculated points.
1. Employ arithmetic, algebraic, Boolean, and special function operations.
2. Treat calculated values like any other analog value; use for any function where a "hard wired point" might be used.

H. Event Initiated Programming: Any data point capable of initiating event, causing series of controls in a sequence.
1. Define time interval between each control action between 0 to 3600 seconds.
2. Output may be analog value.
3. Provide for "skip" logic.
4. Verify completion of one action before proceeding to next action. When not verified, program capable of skipping to next action.

I. Direct Digital Control: Furnish with each control unit Direct Digital Control software so operator is capable of customizing control strategies and sequences of operation by defining appropriate control loop algorithms and choosing optimum loop parameters.
1. Control loops: Defined using "modules" are analogous to standard control devices.
2. Output: Paired or individual digital outputs for pulse width modulation, and analog outputs.

3. Firmware:
   a. PID with analog or pulse-width modulation output.
   b. Floating control with pulse-width modulated outputs.
   c. Two-position control.
   d. Primary and secondary reset schedule selector.
   e. Hi/Low signal selector.
   f. Single pole double-throw relay.
   g. Single pole double throw time delay relay with delay before break, delay before make and interval time capabilities.
4. Direct Digital Control loop: Downloaded upon creation or on operator request. On sensor failure, program executes user defined failsafe output.
5. Display: Value or state of each of lines interconnecting DDC modules.

J. Fine Tuning Direct Digital Control PID or floating loops:
1. Display information:
   a. Control loop being tuned.
   b. Input (process) variable.
   c. Output (control) variable.
   d. Set-point of loop.
   e. Proportional band.
   f. Integral (reset) Interval.
   g. Derivative (rate) Interval.
2. Display format: Graphic, with automatic scaling; with input and output variable superimposed on graph of "time" versus "variable".

K. Trend logging:
1. Each control unit capable of storing samples of control unit's data points.
2. Update file continuously at operator assigned intervals.
3. Automatically initiate upload requests and then stores data on hard disk.
4. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
5. Co-ordinate sampling with specified on/off point- state.
6. Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time versus data.

2.8 HVAC CONTROL PROGRAMS

A. General:
1. Support Inch-pounds and S.I. metric units of measurement.
2. Identify each HVAC Control system.

B. Optimal Run Time:
1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.

3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.
5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
6. Operator commands:
    a. Define term schedule.
    b. Add/delete fan status point.
    c. Add/delete outside air temperature point.
    d. Add/delete mass temperature point.
    e. Define heating/cooling parameters.
    f. Define mass sensor heating/cooling parameters.
    g. Lock/unlock program.
    h. Request optimal run-time control summary.
    i. Request optimal run-time mass temperature summary.
    j. Request HVAC point summary.
    k. Request HVAC saving profile summary.
7. Control Summary:
    a. HVAC Control system begin/end status.
    b. Optimal run time lock/unlock control status.
    c. Heating/cooling mode status.
    d. Optimal run time schedule.
    e. Start/Stop times.
    f. Selected mass temperature point ID.
    g. Optimal run-time system normal start-times.
    h. Occupancy and vacancy times.
    i. Optimal run time system heating/cooling mode parameters.
8. Mass temperature summary:
    a. Mass temperature point type and ID.
    b. Desired and current mass temperature values.
    c. Calculated warm-up/cool-down time for each mass temperature.
    d. Heating/cooling season limits.
    e. Break point temperature for cooling mode analysis.
9. HVAC point summary:
    a. Control system identifier and status.
    b. Point ID and status.
    c. Outside air temperature point ID and status.
    d. Mass temperature point ID and status.
    e. Calculated optimal start and stop times.
    f. Period start.

C. Supply Air Reset:
    1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.

2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
   a. Raising cooling temperatures to highest possible value.
   b. Reducing heating temperatures to lowest possible level.
3. Operator commands:
   a. Add/delete fan status point.
   b. Lock/unlock program.
   c. Request HVAC point summary.
   d. Add/Delete discharge controller point.
   e. Define discharge controller parameters.
   f. Add/delete air flow rate.
   g. Define space load and load parameters.
   h. Request space load summary.
4. Control summary:
   a. HVAC control system status (begin/end).
   b. Supply air reset system status.
   c. Optimal run time system status.
   d. Heating and cooling loop.
   e. High/low limits.
   f. Deadband.
   g. Response timer.
   h. Reset times.
5. Space load summary:
   a. HVAC system status.
   b. Optimal run time status.
   c. Heating/cooling loop status.
   d. Space load point ID.
   e. Current space load point value.
   f. Control heat/cool limited.
   g. Gain factor.
   h. Calculated reset values.
   i. Fan status point ID and status.
   j. Control discharge temperature point ID and status.
   k. Space load point ID and status.
   l. Airflow rate point ID and status.

D. Enthalpy Switchover:
1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.
2. Operator commands:
   a. Add/delete fan status point.
   b. Add/delete outside air temperature point.
   c. Add/delete discharge controller point.
   d. Define discharge controller parameters.
   e. Add/delete return air temperature point.
   f. Add/delete outside air dewpoint/humidity point.
   g. Add/delete return air dewpoint/humidity point.
   h. Add/delete damper switch.

i. Add/delete minimum outside air.
j. Add/delete atmospheric pressure.
k. Add/delete heating override switch.
l. Add/delete evaporative cooling switch.
m. Add/delete air flow rate.
n. Define enthalpy deadband.
o. Lock/unlock program.
p. Request control summary.
q. Request HVAC point summary.

3. Control summary:
   a. HVAC control system begin/end status.
   b. Enthalpy switchover optimal system status.
   c. Optimal return time system status.
   d. Current outside air enthalpy.
   e. Calculated mixed air enthalpy.
   f. Calculated cooling cool enthalpy using outside air.
   g. Calculated cooling cool enthalpy using mixed air.
   h. Calculated enthalpy difference.
   i. Enthalpy switchover deadband.
   j. Status of damper mode switch.

2.9 PROGRAMMING APPLICATION FEATURES

A. Trend Point:
1. Sample up to 100 points, real or computed, with each point capable of collecting 100 samples at intervals specified in minutes, hours, days, or month.
2. Output trend logs as line-graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique pattern and color, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

B. Alarm Messages:
1. Allow definition of minimum of 100 messages, each having minimum length of 50 characters for each individual message.
2. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totaled point's warning limit, hardware elements advisories.
3. Output assigned alarm with "message requiring acknowledgment".
4. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

C. Weekly Scheduling:
1. Automatically initiate equipment or system commands, based on selected time schedule for points specified.
2. Program times for each day of week, for each point, with one minute resolution.
3. Automatically generate alarm output for points not responding to command.
4. Allow for holidays, minimum of 366 consecutive holidays.
5. Operator commands:

a. System logs and summaries.
b. Start of stop point.
c. Lock or unlock control or alarm input.
d. Add, delete, or modify analog limits and differentials.
e. Adjust point operation position.
f. Change point operational mode.
g. Open or close point.
h. Enable/disable, lock/unlock, or execute interlock sequence or computation profile.
i. Begin or end point totals.
j. Modify total values and limits.
k. Access or secure point.
l. Begin or end HVAC or load control system.
m. Modify load parameter.
n. Modify demand limiting and duty cycle targets.

6. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

D. Interlocking:
1. Permit events to occur, based on changing condition of one or more associated master points.
2. Binary contact, high/low limit of analog point or computed point capable of being used as master. Master capable of monitoring or commanding multiple slaves.
3. Operator commands:
a. Define single master/multiple master interlock process.
b. Define logic interlock process.
c. Lock/unlock program.
d. Enable/disable interlock process.
e. Execute terminate interlock process.
f. Request interlock type summary.

PART 3 EXECUTION

3.1 EXAMINATION

A. Divsion 01 - Administrative Requirements: Coordination and project conditions.

B. Verify conditioned power supply is available to control units and to operator workstation.

C. Verify field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator workstation. Implement features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.

C. Install with 120 volts alternating current, 15 amp dedicated emergency power circuit to each programmable control unit.

D. Install conduit and electrical wiring in accordance with Section 26 05 03.

E. Install electrical material and installation in accordance with appropriate requirements of Division 26.

3.3 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Quality Requirements: Manufacturers' field services.

B. Start and commission systems. Allow adequate time for start-up and commissioning prior to placing control systems in permanent operation.

C. Furnish service technician employed by system installer to instruct Owner's representative in operation of systems plant and equipment for 3day period.

3.4 DEMONSTRATION AND TRAINING

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Furnish basic operator training for up to 12 persons on data display, alarm and status descriptors, requesting data, execution commands and log requests. Include a minimum of 40 hours instructor time. Furnish training on site.

C. Demonstrate complete and operating system to Owner.

END OF SECTION 23 0923

SECTION 23 0993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sequence of operation for:
   1. Cabinet Heaters.
   2. Unit heaters.
   3. Radiant ceiling panels.
   4. Radiation.
   5. Variable Refrigerant Flow Units.
   6. Dedicated Outdoor Air Units.
   7. Split System Air Conditioning Units.

B. Related Sections:
   1. Section 23 04 00 – General Conditions for Mechanical Trades
   2. Section 23 09 00 - Instrumentation and Control for HVAC: For equipment, devices, and system components to implement sequences of operation.
   3. Section 23 09 23 - Direct-Digital Control System for HVAC: For equipment, devices, system components, and software to implement sequences of operation.
   4. Section 23 09 53 - Pneumatic and Electric Control System for HVAC: For equipment, devices, and system components to implement sequences of operation.
   5. Section 25 50 00 - Integrated Automation Facility Controls: For equipment, devices, system components, and software to implement sequences of operation.

1.2 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
   2. Submit flow diagrams for each control system, graphically depicting control logic.
   3. Submit draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
   4. Coordinate submittals with information requested in Section 23 09 23.

1.3 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CABINET UNIT HEATERS

A. General: Each CUH shall have fan status provided at the DDC display. Each CUH shall have stainless steel sheath thermistor double tie wrapped to return piping adjacent to CUH control valve, temperature reading from thermistor shall be displayed at the central personal computer (PC) for monitoring/troubleshooting purposes, thermistor reading shall not be used for control.

B. Warm-up (morning): On call for heating, the control valves shall be open and the fan shall be on.

C. Occupied: On call for heating, the control valves shall be open and the fan shall be on.

D. Cool-down (evening): The control valve shall be closed and the fan shall be off.

E. Unoccupied: On call for heating, the control valves shall be open and the fan shall be on.

3.2 UNIT HEATERS

A. General: Each UH shall have fan status provided at the DDC display. Each UH shall have stainless steel sheath thermistor double tie wrapped to return piping adjacent to UH control valve, temperature reading from thermistor shall be displayed at the central personal computer (PC) for monitoring/troubleshooting purposes, thermistor reading shall not be used for control.

B. Warm-up (morning): On call for heating, the control valve shall be open and the fan shall be on.

C. Occupied: On call for heating, the control valve shall be open and the fan shall be on.

D. Cool-down (evening): The control valve shall be closed and the fan shall be off.

3.3 Unoccupied: On call for heating, the control valve shall be open and the fan shall be on

3.4 DOA SEQUENCE OF OPERATIONS (DOA-1 & DOA-2)

A. Enabling: DOA will be controlled by the building automation system (BAS) unless otherwise noted. DOA factory furnished controller will control compressor and condenser functions for cooling mode and dehumidification mode. BAS unit controller to operate in occupied mode or unoccupied mode if any of the following devises are not activated.

1. Internal safety devices.
2. Smoke Detector.
3. Low temperature limit.
4. High static pressure.

B. Unoccupied and Occupied Mode:
   1. Based on a timed schedule, BAS shall index unit to either unoccupied or occupied mode.

C. Unoccupied Mode
   1. Unoccupied damper actuator control. BAS controller shall command the following control sequence:
      a. Outside air damper shall be fully closed.
      b. Exhaust air damper shall be fully closed.
      c. Return air damper fully opened.
      d. Exhaust air ERV wheel damper shall be fully closed.
      e. Outside air ERV wheel damper shall be fully closed.

D. Unoccupied Fan Control. BAS controller shall command the following control sequence:
      a. Supply fan VFD shall be off.
      b. Exhaust fan VFD shall be off.

E. Morning Warm-Up Control
   1. Morning warm-up damper actuator control. BAS controller shall command the following control sequence:
      a. Outside air damper shall be fully closed.
      b. Exhaust air damper shall be fully closed.
      c. Mixed air damper fully opened.
      d. Exhaust air ERV wheel damper shall be fully closed.
      e. Outside air ERV wheel damper shall be fully closed.
   2. Morning Warm-Up Fan Control. BAS controller shall command the following control sequence:
      a. Supply fan VFD shall modulate the supply fan as required to maintain ductwork static pressure only after all supply and exhaust dampers are 50% open.
      b. Exhaust fan VFD shall be off.
   3. Morning Warm-Up Heating Mode Control. BAS shall modulate hot water control valve as required to maintain discharge air temperature set point.

F. Occupied Mode:
   1. Occupied Damper Actuator Control. BAS controller shall command the following control sequence:
      a. Outside air damper shall be fully open.
      b. Exhaust air damper shall be fully open.
      c. Outside air ERV wheel bypass damper shall be fully closed unless economizer cooling is enabled.
      d. Exhaust air ERV wheel bypass damper shall be fully closed unless economizer cooling is enabled.

2. Air Flow measuring station (AFMS) serving OA intake and EA discharge. BAS controller shall monitor OA and EA airflow. OA and EA airflow shall be displayed on the operator work station.
3. Energy Wheel Control. BAS controller shall command the following control sequence:
   a. Energy wheel shall be enabled to start unless economizer cooling is enabled.
4. DOA Fan Control. BAS controller shall command the following control sequence:
   a. Supply fan VFD shall modulate the supply fan as required to maintain ductwork static pressure.
   b. Exhaust fan VFD shall modulate as required to maintain EA AFMS airflow. EA AFMS airflow shall track OA AFMS airflow.
5. Discharge air temperature control: BAS controller shall command the following control sequence:
   a. When discharge air temperature set point decreases below setpoint, BAS controller shall modulate hot water control valve as required to maintain discharge air temperature setpoint.
   b. When discharge air temperature increases above setpoint, and OA temperature and enthalpy is less than return air temperature and enthalpy, BAS controller shall enable economizer mode. BAS controller shall command the following economizer control sequence:
      1) Mechanical cooling and dehumidification mode locked-out
      2) Exhaust air ERV wheel damper shall be fully opened.
      3) Outside air ERV wheel damper shall be fully opened.
   c. BAS controller shall index RTU factory controller to mechanical cooling mode when space temperature increases above setpoint and economizer cooling is not enabled. Mechanical cooling control sequence listed below.
      1) BAS controller shall operate as required to maintain temperature after the DX coil.
6. Occupied Dehumidification Mode Control. BAS shall be index to dehumidification mode when the mixed air dewpoint temperature increases above setpoint and cooling or heating mode is not activated. Dehumidification control sequence listed below:
   a. DOA factory controller shall modulate DX coil as required to maintain DX coil discharge air temperature.
   b. DOA factory controller shall modulate hot gas coil as required to maintain hot gas coil discharge air temperature.

3.5 VRF AND HOT WATER HEAT SEQUENCE OF OPERATIONS

A. The BAS shall enable, disable, set operating modes and send setpoints to the VRF Controls System via BACnet Communication interface. For the VRF system, enable indicates the unit is on and disable indicates the unit is off. Setpoint temperature will define the occupied and unoccupied condition.

B. The Automatic Temperature Controls (ATC) contractor shall also be responsible for installation and communication wiring of all VRF control components to provide a complete and operational system including but not limited to return air thermistor, indoor units (air handlers and heat recovery boxes), and outdoor units. The VRF manufacturer will furnish (1) wall controller per indoor unit and associated cabling.

C. BAS shall index the VRF zone into off mode (unoccupied), fan mode, heat mode and cool mode. For heating or cooling mode, BAS shall send setpoint temperature to VRF control system

D. Morning Warm-up Control for VRF and perimeter heating control:
   1. BAS shall enable morning warm-up during optimal time scheduling when OA temperature is below 64 °F. BAS shall index the following heating stages:
      a. When space temperature decreases below 1st stage heating setpoint, BAS shall command the following control sequence.
         1) BAS shall command VRF to heating mode with morning space temperature setpoint.
         2) BAS shall command perimeter two-position hot water control valve to be fully closed.
      b. When space temperature decreases below 2nd stage heating setpoint, BAS shall command the following control sequence.
         1) VRF to remain in heating mode.
         2) BAS shall command perimeter two-position hot water control valve to be fully open.

E. Unoccupied heating control for VRF and perimeter heating control:
   1. BAS shall enable unoccupied heating mode when OA temperature is below 64 °F during unoccupied time schedule. BAS shall index the following heating stages:
      a. When space temperature decreases below 1st stage heating setpoint, BAS shall command the following control sequence.
         1) BAS shall command perimeter two-position hot water control valve to be fully open.
         2) BAS shall command VRF to off command.
      b. When space temperature decreases below 2nd stage heating setpoint, BAS shall command the following control sequence.
         1) Perimeter two-position hot water control valve shall remain fully open.
         2) BAS shall command VRF to heating mode with morning space temperature setpoint.

F. Occupied heating control for VRF and perimeter heating control:
   1. BAS shall enable occupied heating mode when OA temperature is below 64 °F during occupied time schedule. BAS shall index the following heating stages:
      a. When space temperature decreases below 1st stage heating setpoint, BAS shall command the following control sequence.
         1) BAS shall command VRF to heating mode with occupied heating space temperature setpoint.

2) BAS shall command perimeter two-position hot water control valve to be fully closed.

b. When space temperature decreases below 2nd stage heating setpoint, BAS shall command the following control sequence.
1) VRF to remain in heating mode.
2) BAS shall command perimeter two-position hot water control valve to be fully open.

G. Occupied / Unoccupied Cooling Mode Control:
1. When space temperature increases above cooling setpoint, BAS shall command VRF to cooling mode with either an occupied or unoccupied space temperature setpoint.

3.6 SPLIT SYSTEM AIR CONDITIONING UNITS

A. The Split System Air Conditioning units will be provided with integral controllers and wireless zone sensors by the unit manufacturer.

B. The Automatic Temperature Controls (ATC) contractor shall also be responsible for installation and communication wiring of all split system components to provide a complete and operational system including but not limited to communication wiring between the indoor and outdoor unit.

C. BAS shall monitor space temperature. If space temperature does not match setpoint for a predetermined time period, an alarm shall be generated at the Operator Workstation.

3.7 RADIANT CEILING PANEL HEAT (RCP) SEQUENCE OF OPERATIONS

A. BAS shall command the RCP into unoccupied heating mode or morning warm-up mode or heating mode.

B. Unoccupied Heating Mode Control:
1. BAS shall enable unoccupied heating mode when outside air temperature is less than or equal to 64°F and command the control sequence.
2. When space temperature decreases below unoccupied setpoint, the following sequence shall be performed:
a. Two-position hot water control valve shall fully open

C. Morning Warm-up Heating Mode Control:
1. BAS shall enable morning warm-up heating mode when outside air temperature is less than or equal to 64°F and command the control sequence.
2. Based on time schedule, the following sequence shall be performed when space temperature decreases below morning warm-up setpoint.
a. Two-position hot water control valve shall fully open

D. Occupied Heating Mode Control:

1. BAS shall enable occupied heating mode when outside air temperature is less than or equal to 64°F and command the control sequence.
2. When space temperature decreases below occupied setpoint, the following sequence shall be performed:
   a. Two-position hot water control valve shall fully open

3.8 ALARMS:

A. DOA Alarm.
1. BAS controller shall monitor DOA factory furnished internal safety alarms. Alarm shall be issued to BAS Operator Work Station if any internal safety alarms are activated.
2. BAS controller shall monitor high static pressure switch status. ATC to provide supply and exhaust fan hard-wired shut down. BAS shall command the following on a high static pressure alarm:
   a. Alarm shall be issued to BAS Operator Work Station
3. BAS controller shall monitor freeze stat status. ATC to provide supply and exhaust fan hard-wired shut down. BAS shall command the following on a freeze stat alarm:
   a. Alarm shall be issued to BAS Operator Work Station
   b. Fully open return air damper
   c. Fully close OA damper and EA damper
   d. Fully close bypass dampers
   e. Fully close HW control valve
4. BAS controller shall monitor Smoke detector alarm status. Alarm shall be issued to the BAS Operator Work Station if duct mounted smoke detector is activated. Associated unit and fans shall not operate.
5. BAS controller shall monitor fan status. If fan status does not match the command, DX compressors shall not operate and alarm shall be generated at the Operator Workstation.
6. DOA Factory furnished controller shall monitor (3) filter status per DOA. If filter status does not match setpoint, an alarm shall be generated at the Operator Workstation.
7. During unoccupied mode, BAS controller shall monitor case temperature status via the mixed air temperature sensor. When case temperature decreases below setpoint, BAS shall command the following:
   a. Fully open hot water
   b. An alarm shall be generated at the Operator Workstation.
8. BAS controller shall monitor duct exhaust air discharge temperature status after the plate heat exchanger. If duct discharge temperature does not match setpoint for a predetermined time period, BAS shall enable dehumidification mode and command the following:
   a. Fully open exhaust air plate heat exchanger bypass dampers such that 100% of the airflow is diverted to the plate heat exchanger.

b. Fully close OA plate heat exchanger bypass dampers such that 100% of the airflow is diverted to the bypass.
c. An alarm shall be generated at the Operator Workstation.

9. BAS controller shall monitor duct supply air discharge temperature status after the DX coil. If duct discharge temperature does not match setpoint for a predetermined time period, an alarm shall be generated at the Operator Workstation.
10. BAS controller shall monitor duct supply air discharge dewpoint status after the DX coil. If duct discharge dewpoint does not match setpoint for a predetermined time period, an alarm shall be generated at the Operator Workstation.
11. BAS controller shall monitor duct supply air discharge temperature status hot gas reheat coil. If duct discharge temperature does not match setpoint for a predetermined time period, an alarm shall be generated at the Operator Workstation.
12. DOA Factory furnished controller shall monitor filter status. If filter status does not match setpoint, an alarm shall be generated at the Operator Workstation.

B. Fan Alarm.
1. BAS controller shall monitor damper position. If damper position does not match the command, an alarm shall be generated at the BAS Operator Workstation and the associated fan shall be commanded to stop.
2. BAS controller shall monitor fan status. If fan status does not match the command, alarm shall be generated at the Operator Workstation.

C. VRF Alarm.
1. BAS shall monitor VRF control system internal safety alarms via BACnet interface. Alarm shall be issued to BAS Operator Work Station if any internal safety alarms are activated.
2. VRF control system shall monitor space temperature. Alarm shall be issued to BAS Operator Work Station if any space temperature does not match setpoint.
3. BAS shall monitor condensate auxiliary drain pan water detection. If sensor is activated, alarm shall be generated at the BAS Operator work station
4. BAS shall monitor space temperature status. If space temperature does not match setpoint for a predetermined time period, an alarm shall be generated at the Operator Workstation.
5. BAS shall monitor space dewpoint status where temperature and humidity sensor are noted on plan. If space dewpoint does not match setpoint for a predetermined time period, an alarm shall be generated at the Operator Workstation.

D. CUH/UH Alarm.
1. BAS controller shall monitor fan status. If fan status does not match the command, alarm shall be generated at the Operator Workstation.
2. BAS shall monitor space temperature status. If space temperature does not match setpoint for a predetermined time period, an alarm shall be generated at the Operator Workstation.

3. BAS shall monitor HWR pipe temperature via thermistor. If temperature does not match setpoint for a predetermined time period, an alarm shall be generated at the Operator Workstation.

E. RCP Alarm.
   1. BAS shall monitor space temperature status. If space temperature does not match setpoint for a predetermined time period, an alarm shall be generated at the Operator Workstation.
   2. BAS shall monitor HWR pipe temperature via thermistor. If temperature does not match setpoint for a predetermined time period, an alarm shall be generated at the Operator Workstation.

END OF SECTION 23 0993

SECTION 23 2113 - HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Heating water piping, above ground.

B. Glycol piping, above ground.

C. Coil condensate drain piping

D. Radiant heating piping.

E. Equipment drains and over flows.

F. Unions and flanges.

1.2 RELATED SECTIONS

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

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 B31.9 - Building Services Piping.
4. 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 A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM B32 - Standard Specification for Solder Metal.
4. ASTM B75 – Standard Specification for Seamless Copper Tube.
5. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
6. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
7. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
8. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
9. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

10. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
11. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
12. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
13. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
14. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
15. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
16. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
17. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
18. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
19. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
20. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
21. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot-and Cold-Water Distribution Systems.
22. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
   2. AWS D1.1 - Structural Welding Code - Steel.

1.4 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 Grooved coupling couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

1.5 SUBMITTALS

A. Shop Drawings: Indicate layout of piping system, including equipment, critical dimensions, and sizes.
   1. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable Grooved coupling style or series number.

B. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

C. Test Reports: Indicate results of piping system pressure test.

D. Welders' Certificates.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves equipment and accessories.

1.7 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.

B. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.

C. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

1.8 QUALIFICATIONS

A. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years documented experience.

B. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. 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 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A53/A53M., black steel with plain ends; welded and seamless, Grade B.
   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.
3. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

B. Steel Pipe, grooved joints: ASTM A53/A53M, black steel with grooved ends.
1. Fittings: ASTM A536 ductile iron, or ASTM A53 forged steel or fabricated from carbon steel pipe, grooved ends designed to accept Grooved coupling standard or AGS "W" series couplings.
2. Joints: Grooved mechanical couplings meeting ASTM F1476.
a. Housing Clamps: STM A536 ductile iron, enamel coated, compatible with steel piping sizes, rigid or flexible type.
1) Rigid Type: 2 inch through 12 inch: "Installation ready" rigid coupling with offsetting, angle pattern bolt pads designed for direct 'stab' installation onto grooved end pipe without prior disassembly of the coupling, no torque requirement and Grade "EHP" EPDM gasket.
2) Rigid Type: 14 inch through 24 inch: AGS grooves, wide housing key with flat bolt pads. Grade "E" EPDM FlushSeal® gasket.
3) Flexible Type: 2 inch through 24" inch: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors for vibration isolation at equipment connections. Three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration.
b. Grade "E" EPDM Gasket: Elastomer composition for operating temperature range from -30 degrees F to 230 degrees F.
c. Grade "EHP" EPDM Gasket: Elastomer composition for operating temperature range from -30 degrees F to 250 degrees F
d. Accessories: Steel bolts, nuts, and washers.

C. Stainless Steel Pipe: ASTM A312, Schedule 10S for 2 inch and smaller, Type 304/304L, full finish annealed pipe.
1. Fittings: Precision cold drawn austenitic stainless steel, Type 304/304L, complete with synthetic rubber O-rings.
2. Joints: Press-seal
a. O-rings: EPDM Elastomer composition for operating temperature range from -30 degrees F to 250degrees F.
b. 500 PSI rated

2.2 PRE-INSULATED PIPING SYSTEM

A. Pre-Insulated Steel Piping System:
1. Carrier Pipe: Steel Pipe: ASTM A53/A53M., Schedule 40, black steel with plain ends; welded and seamless, Grade B
2. Insulation: Closed Cellular Foam
3. Outer Jacket: PVC.

4. Joints: Welded
5. Manufacturers:
   a. Rovanco
   b. Perm-a-Pipe

B. Pre-Insulated Polyethylene Piping System:
1. Carrier Pipe: PEX A crosslinked polyethylene pipe for hot service, HDPE suitable for temperatures 180 Deg. F to -20 Deg. F for cold service.
2. Insulation: Flexible urethane
3. Outer Jacket: Polyethylene, corrugated to be flexible.
4. Joints: Electrofusion
5. Manufacturers:
   a. Rovanco Rhinoflex
   b. Uponor Ecoflex

2.3 COPPER PIPE AND FITTINGS

A. Drawn-Temper Copper Tubing, solder joints: ASTM B88, Type K, L, or M as specified in part 3 for application.
1. Fittings:
   a. ASME B16.22, solder wrought copper.
2. Prohibited Tee Connections: Mechanically extracted collars with notched and dimpled branch tube (T-Drill) fittings are prohibited.
3. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

B. Drawn-Temper Copper Tubing, press-seal joints: ASTM B88, Type L or M as specified in section 3 for application.
1. Press Fittings: IAPMO PS 117, ANSI LC1002, NSF61-G
2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

2.4 POLYETHYLENE PIPE AND FITTINGS

A. Polyethylene Pipe: ASTM F876 and ASTM F877, cross-linked polyethylene, 100 psig operating pressure at 180 degrees F.
1. Fittings: Brass and copper.
2. Joints: Mechanical compression fittings.

B. Composite Polyethylene Pipe: Aluminum tube laminated between two layers of cross-linked polyethylene, 125 psig operating pressure at maximum 140degrees F.
1. Fittings: Brass flared compression.
2. Joints: Fittings adapt to copper tubing or copper tube fittings, threaded pipe and fittings, and copper compression fittings.

2.5 PLASTIC PIPE AND FITTINGS

A. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement. Prime joints with a contrasting color.
      a. PVC solvent cement shall have a VOC content of 510 g/L or less.
      b. Adhesive primer shall have a VOC content of 550 g/L or less.

B. CPVC Pipe: ASTM F441/F441M, Schedule 40, chlorinated polyvinyl chloride (CPVC) material.
   1. Fittings: ASTM F438, CPVC, Schedule 40, socket type.
   2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement. Prime joints with a contrasting color.
      a. CPVC solvent cement shall have a VOC content of 490 g/L or less.
      b. Adhesive primer shall have a VOC content of 550 g/L or less.

C. Plastic-to-metal transition fittings: One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

2.6 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:
      a. Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
      b. Waterway fitting with zinc electroplated steel or ductile iron body, male thread, grooved, or plain end, water impervious isolation barrier.
   4. PVC Piping: PVC.
   5. Plastic-to-metal transition unions: Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping:
      a. Class 150 forged steel, slip-on flanges.
      b. Grooved joint flange adapter, flat face, for direct connection to ANSI Class 125 and 150 flanges. For direct connection to ANSI Class 300 flanges
      c. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
   2. Copper Piping:
      a. Class 150, slip-on bronze flanges.
      b. Grooved joint flange adapter, flat face, for direct connection to ANSI Class 125 and 150 flanges.
   3. PVC Piping: PVC flanges.

4. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

PART 3 EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, 2-inch and smaller, shall be the following:
1. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and press-seal joints where exposed and where installed above accessible ceilings only.

B. Hot-water heating piping aboveground, 2-1/2 inch and larger shall be any of the following:
1. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and press-seal joints where exposed and where installed above accessible ceilings only.
3. Schedule 40 steel pipe [0.375 inch wall for sizes 12 inch and larger,], wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
4. Schedule 40 steel pipe [0.375 inch wall for sizes 12 inch and larger,], grooved, mechanical joint coupling and fittings; and grooved, mechanical joints where exposed and where installed above accessible ceilings only.

C. Makeup-water piping installed aboveground shall be the following:
1. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

D. Condensate-Drain Piping: Type M (PVC for non-plenum applications), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

E. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

F. Air-Vent Piping:
1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

G. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with

metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel or groove 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.

E. After completion, fill, clean, and treat systems. Refer to Section 23 25 00.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install pipe hangers and supports in accordance with Section 23 05 29.

3.5 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install Work in accordance with Owner’s guidelines.

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. Refer to Section 23 05 29.

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. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.

J. Slope hydronic piping and arrange systems to drain at low points.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

L. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Division 09.

M. Install valves with stems upright or horizontal, not inverted.

N. Insulate piping and equipment; refer to Section 23 07 00.

3.6 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Grooved joint piping systems: Install in accordance with the manufacturer's guidelines and recommendations.
   1. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by the grooved coupling manufacturer. Grooved end shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing.
   2. A factory trained field representative shall provide on-site training to contractor's field personnel in the installation of grooved piping products. Factory trained

representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

3. Use roll sets or cut groovers compatible with the pipe material and wall thickness per manufacturer's installation instructions.

I. Press connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) recommended by the manufacturer. Contractor shall be trained on the use and installation of the system by manufacturer's representative.

3.7 FIELD QUALITY CONTROL

A. Comply with Division 01.

B. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated 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 testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
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.

C. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is 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 air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. 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 runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping." Pressure test for press-seal fittings shall not exceed 85 psi. If there is a significant drop in pressure, the system shall be walked to check for un-pressed fittings. Should an un-pressed fitting be located, the pressure should be released from the system and the un-pressed fitting shall be pressed.

5. 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.
6. Prepare written report of testing.

D. Perform the following before operating the system:
1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

E. Test hydronic piping systems in accordance with ASME B31.9.

F. Pressure test to identify un-pressed fittings: Utilizing air or water, the system shall be pressurized, not to exceed 85 psi. If there is a significant drop in pressure, the system shall be walked to check for un-pressed fittings. Should an un-pressed fitting be located, the pressure should be released from the system and the un-pressed fitting shall be pressed. If no un-pressed fitting is identified the system shall be pressurized to test pressures required by code, not to exceed 600 psi.

G. HANGERS AND SUPPORTS
1. Comply with requirements in Division 23 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches
1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	7	7	3/8	3/8

1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2 (Note 1)	9	11	1/2	1/2
3	10	12	1/2	1/2

H. Plastic and Ductile Iron Pipe Hanger Spacing:

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8
FRP (All Sizes)	4	3/8
Ductile Iron (Note 2)		
PVC (All Sizes)	4	3/8

I. Note 1: Refer to manufacturer's recommendations for grooved end piping systems.

J. Note 2: 20 feet maximum spacing, minimum of one hanger for each pipe section close to joint behind bell. Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents, limit span to maximum spacing for water service steel pipe.

END OF SECTION 23 2113

SECTION 23 2114 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air vents.

B. Pressure-temperature test plugs.

C. Balancing valves.

D. Combination flow controls.

E. Flow meters.

F. Radiator valves.

G. Relief valves.

H. Thermometers

I. Pressure Gauges

J. Glycol system.

1.2 RELATED REQUIREMENTS

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

B. Section 22 - Plumbing Piping Specialties: Backflow preventers.

C. Section 23 - Hydronic Piping.

D. Section 23 - HVAC Water Treatment: Pipe cleaning.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

B. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard.

C. ASME B16.11 - Forged Fittings, Socket-welding and Threaded.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of work of this section with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

B. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Maintenance Contract.

E. Project Record Documents: Record actual locations of flow controls.

F. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Glycol Solution: One container, 1 gallon size.
   2. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flow meter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. 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 AIR VENTS

A. Manufacturers:
1. Armstrong International, Inc.
2. ITT Bell & Gossett
3. Taco, Inc.

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.
2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:
1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.2 STRAINERS

A. Manufacturers:
1. Armstrong International, Inc.
2. Watts
3. Grinnell Products

B. Size 2 inch and Under:
1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:
1. Provide flanged iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

D. Size 5 inch and Larger:
1. Provide flanged iron body for 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.3 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:
1. Ferguson Enterprises Inc

2. Peterson Equipment Company Inc
3. Sisco Manufacturing Company Inc
4. Substitutions: See Section 01 - Product Requirements.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F .

C. Application: Use extended length plugs to clear insulated piping.

2.4 BALANCING VALVES - MANUAL

A. Manufacturers:
1. Armstrong Fluid Technology
2. ITT Bell & Gossett
3. Taco, Inc
4. Nexus
5. Grisworld
6. Tour & Anderson

B. Brass or Bronze, Calibrated-Orifice, Balancing Valves:
1. Construction: Bronze or brass alloy housing, ball or plug type with calibrated orifice or venturi. The valve shall come fully assembled and be permanently marked to show direction of flow.
2. CWP rating: 400PSI/250°F.
3. Pressure gauge connections: dual pressure/temperature test valves for flow reading, and a union end which will accept various end pieces.
4. The body design shall allow inspection or repair of handle operated stem without disturbing piping connections. The repairable stem shall include two Teflon seals and one EPDM O-ring for protection against chemicals and modulating temperature.

C. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
1. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
2. Ball: Brass or stainless steel.
3. Stem Seals: EPDM O-rings.
4. Disc: Manufacturer standard construction.
5. Seat: PTFE.
6. End Connections: Flanged or grooved.
7. Pressure Gauge Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig 860 kPa.
10. Maximum Operating Temperature: 250 deg F 121 deg C.

2.5 BALANCING VALVES AUTOMATIC

A. Manufacturers:

1. Nexus UltraMatic UM Series
2. Grisworld Isolator R Series
3. Flow Design AC Series
4. Victaulic 76B Series

B. Description:
1. Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with combination blow-down and back-flush drain.
2. Calibration: Control within 10 percent of design flow over entire operating pressure with a maximum operating temperature of at least 232 deg F.
3. Control Mechanism: Either piston and spring or diaphragm and orifice plates are acceptable types. For piston and spring types: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring. For diaphragm and orifice plate types: elastomeric polymer diaphragm with polyphenylsulfone orifice seat.
4. Accessories: In-line strainer on inlet and ball valve on outlet.
5. Manufacturer shall be able to provide certified independent laboratory tests verifying accuracy of performance. (Consult the factory for details).
6. All flow control valve cartridges shall be warranted by the manufacturer for five years from date of sale.
7. The body design shall allow inspection or removal of 20 mesh stainless steel strainer without disturbing piping connections.
8. Ball Valve shall be made of brass. Maximum pressure rating of 400 PSI. Ball Valve shall include a union end which will accept various end pieces.
9. The body design shall allow inspection or repair of handle operated stem without disturbing piping connections. The repairable stem shall include two Teflon seals and one EPDM O-ring for protection against chemicals and modulating temperature.
10. A pressure/temperature test valve, manual air vent and drain valve shall be included.
11. Dual pressure or pressure/temperature test valves for verifying accuracy of flow performance shall be provided for all valve sizes.
12. Valve shall have a body tag to indicate model number and a hanging tag showing Cv and flow/delta P reading required for specific flow rate.

2.6 COMBINATION FLOW CONTROLS

A. Manufacturers:
1. Armstrong Fluid Technology
2. ITT Bell & Gossett
3. Taco, Inc
4. Nexus
5. Grisworld

B. Size 2 inch and Under:
1. 300 psi, threaded or soldered ends; non-ferrous Ametal® brass copper alloy body, EPDM o-ring seals. 4-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting. Victaulic / TA Hydronics Series 787, 78K STAD or 786 STAS.

C. Size 2-1/2 inch and Larger:
   1. 250 psi Flanged or 350 psi Grooved ends, ASTM A536 ductile iron body, all other metal parts of Ametal® brass copper alloy, EPDM O-ring seals. 8, 12 or 16 turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting. Victaulic / TA Hydronics Series 789 STAG or 788 STAF
   2. Coil hook-up assemblies may be used to reduce installation time and space requirements. Victaulic TA Series 799 or 79V Koil Kit coil pack assembly. Coil pack can include; Victaulic Series 78U union port fitting, Series 78Y strainer/ball valve or Series 78T union/ball valve combination, and two flexible hoses

2.7 FLOW METERS (stand-alone type) Refer to 230900 for BAS flow meters

A. Manufacturers:
   1. Dwyer Instruments, Inc
   2. EMCO Flow Systems
   3. Davis Instruments

B. Orifice principle by-pass circuit with direct reading gauge, soldered or flanged piping connections for 125 psi working pressure, with shut off valves, and drain and vent connections.

C. Direct reading with insert pitot tube, threaded coupling, for 150 psi working pressure, maximum 240 degrees F, 5 percent accuracy.

D. Cast iron, wafer type, orifice insert flow meter for 250 psi working pressure, with read-out valves equipped with integral check valves with gasketed caps.

E. Calibrated, plug type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer.

F. Cast iron or bronze, globe style, balance valve with handwheel with vernier type ring setting and memory stop, drain connection, readout valves equipped with integral check valves and gasketed caps.

G. Portable meter consisting of case containing one, 3 percent accuracy pressure gauge with 0-60 feet pressure range for 500 psi maximum working pressure, color coded hoses for low and high pressure connections, and connectors suitable for connection to read-out valves.

H. Portable meter consisting of case containing two, 3 percent accuracy pressure gauges with 0-135 inches and 0-60 feet pressure ranges for 500 psi maximum working pressure, color coded hoses for low and high pressure connections, and connectors suitable for connection to read-out valves.

2.8 RADIATOR VALVES

A. Manufacturers:
   1. Armstrong International, Inc

2. ITT Bell & Gossett
3. Danfos
4. Watts

B. Angle or straight pattern, rising stem, inside screw globe valve for 125 psi working pressure, with bronze body and integral union for screwed connections, renewable composition disc, plastic wheel handle for shut-off service, and lockshield key cap and set screw memory bonnet for balancing service.

2.9 DIAPHRAGM-OPERATED SAFETY VALVES: ASME LABELED.

A. Manufacturers:
1. AMTROL, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump.
4. Conbraco Industries, Inc.
5. Spence Engineering Company, Inc.
6. Watts Regulator Co.

B. Construction:
1. Body: Bronze or brass.
2. Disc: Glass and carbon-filled PTFE.
3. Seat: Brass.
4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Wetted, Internal Work Parts: Brass and rubber.
7. Inlet Strainer: 304 or 316 stainless steel, removable without system shutdown.
8. Valve Seat and Stem: Noncorrosive.

C. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

2.10 THERMOMETERS

A. Manufacturers:
1. Trerice
2. Winters
3. Weiss

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: Minimum 7 inch scale.
2. Window: Clear glass or Lexan.
3. Stem: Aluminum or Brass, length to suit installation.
4. Accuracy: ASTM E77 2 percent.
5. Calibration: Degrees F, or both degrees F and degrees C.

2.11 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.12 PRESSURE GAUGES

A. Manufacturers:
1. Trerice
2. Winters
3. Weiss

B. Gauge: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
1. Case: Sealed types, Aluminum or Stainless steel.
2. Movement: Mechanical, with link to pressure element and connection to pointer.
3. Dial Size: Minimum 4-1/2 inch diameter.
4. Mid-Scale Accuracy: Grade A, plus or minus one percent.
5. Scale: Psi, or both psi and kPa.

2.13 GLYCOL SOLUTION

A. Manufacturers:
1. DowFrost - Model - HD.
2. Houghton Chemical – Model – Safe-T-Therm.
3. Interstate Chemicals – Model – InterCool P300.
4. Substitutions: See Section 01 - Product Requirements.

B. Inhibited propylene glycol and water solution mixed 30 percent glycol - 70 percent water, suitable for operating temperatures from -40 degrees F to 250 degrees F.

PART 3 EXECUTION

3.1 INSTALLATION – HYDRONIC PIPING SPECIALTIES

A. Install specialties in accordance with manufacturer's instructions.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes. Install thermowells with extension on insulated piping. Fill thermowells with heat-transfer medium.

C. Install gauges and thermometers in locations where they are easily read from normal operating level.

D. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

E. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

F. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position. Install valve and snubber in piping for each pressure gauge for fluids (except steam).

G. Install thermowells with socket extending one-third of pipe diameter or to center of pipe and in vertical position in piping tees.

H. Where large air quantities can accumulate, provide enlarged air collection standpipes.

I. Provide manual air vents at system high points and as indicated.

J. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

K. Provide valved drain and hose connection on strainer blow down connection.

L. Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.

M. Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.

N. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

O. Pipe relief valve outlet to nearest floor drain.

P. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

Q. Clean and flush glycol system before adding glycol solution. Refer to Section 23 25 00 - HVAC Water Treatment.

R. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set to fill at 40 times .433psi/ft + 5 psi.

S. Perform tests determining strength of glycol and water solution and submit written test results.

3.2 INSTALLATION - THERMOMETERS AND GAUGES

A. Install one pressure gauge for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gauge.

B. Install pressure gauges with pulsation dampers. Provide needle valve or ball valve to isolate each gauge. Extend nipples to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

D. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

E. Coil and conceal excess capillary on remote element instruments.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.3 THERMOMETER SCALE RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 20 to 240 deg F

B. Scale Range for Air Ducts: 0 to 150 deg F

3.4 PRESSURE GAUGE SCALE RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 0 to 200

3.5 MAINTENANCE

A. Provide service and maintenance of glycol system for one year from date of Substantial Completion at no extra charge to Owner.

B. Perform monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Report findings in detail in writing, including analysis and amounts of glycol or water added.

C. Explain corrective actions to Owner's maintenance personnel in person.

END OF SECTION 23 2114

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Duct Materials.

B. Duct Liner

C. Non-Insulated Flexible ducts.

D. Insulated flexible ducts.

E. Single wall spiral round ducts.

F. Single wall spiral flat oval ducts.

G. Double wall spiral insulated round ducts.

H. Double wall spiral insulated flat oval ducts.

I. Transverse duct connection system.

1.2 RELATED SECTIONS

1. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.3 REFERENCES

A. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
5. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
6. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
7. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

8. A1011/A1011M-07 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
9. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
10. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
11. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
12. 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.
2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

C. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - Fibrous Glass Duct Construction Standards.
2. SMACNA - HVAC Air Duct Leakage Test Manual.
3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" beef up duct hanger and support in this section.

C. 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.

1.5 SUBMITTALS

A. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, 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, coil, and humidifier installations.
8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

B. Product Data: Submit data for duct materials, duct liner, duct connectors.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A, NFPA 90B and NFPA 96 standards as applicable.

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 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealant.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90/A90M.

B. Steel Ducts: ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.

C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength. Mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

D. Stainless Steel Ducts: ASTM A480/A480M, Type [304.] [316.] Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article

E. Fasteners: Rivets, bolts, or sheet metal screws.

F. Hanger Rod: ASTM A36/A36M; steel , galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 DUCT LINER

A. Fibrous-Glass Duct Liner
   1. Manufacturers:
      a. CertainTeed Corporation; Insulation Group.
      b. Johns Manville.
      c. Knauf Insulation.
      d. Owens Corning.
   2. Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
      a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Elastomeric Duct Liner:
   1. Manufacturers:
      a. Aeroflex USA Inc.
      b. Armacell LLC
      c. K-Flex
   2. Description: Elastomeric foam duct liner, integral EPA registered antimicrobial agent, complying with NFPA 90A or NFPA 90B.

3. Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
   a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 NON-INSULATED FLEXIBLE DUCTS

A. Manufacturers:
1. Thermaflex Technaflex
2. Tuttle + Bailey
3. Flexmaster

B. Product Description: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helical-wound spring steel wire.
1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
2. Maximum Velocity: 4000 fpm.
3. Temperature Range: -20 degrees F to 210 degrees F.

2.4 INSULATED FLEXIBLE DUCTS

A. Manufacturers:
1. Thermaflex
2. Technaflex
3. Tuttle + Bailey
4. Flexmaster

B. Product Description: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helical wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.
1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
2. Maximum Velocity: 4000 fpm.
3. Temperature Range: -20 degrees F to 210 degrees F.
4. Thermal Resistance: 6square feet-hour-degree F per BTU.
5. Vapor Barrier Permeance: 0.05 perm per ASRM E96, Procedure A

2.5 SEALANTS AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. General: Brush-on, water-resistant, mold and mildew resistant, indoor and outdoor use, compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. VOC: Maximum 75 g/L (less water).
5. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

C. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
2. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.

2.6 SINGLE WALL SPIRAL ROUND DUCTS

A. Manufacturers include, but are not limited to:
1. McGill AirFlow Corporation
2. Semco Incorporated
3. Tangent Air Corp
4. Spiral Mfg. Co., Inc.

B. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

C. Construct ducts and fittings gauge per the latest edition of SMACNA.

2.7 SINGLE WALL SPIRAL FLAT OVAL DUCTS

A. Manufacturers include, but are not limited to:
1. McGill AirFlow Corporation
2. Semco Incorporated
3. Tangent Air Corp
4. Spiral Mfg. Co., Inc.

B. Product Description: Machine made from round spiral lockseam duct constructed of galvanized steel; rated for 10 inches wg pressure.

C. Joints: Either fully welded or bolted flange with gasket material in accordance with manufacturer’s recommendations.

D. Construct duct with the following minimum gauges:

Major Axis Dimension	Gauge
7 inches to 24 inches	24
25 inches to 48 inches	22
50 inches to 70 inches	20
72 inches to 82 inches	18
84 inches and larger	16

E. Construct fittings with the following minimum gauges:

Major Axis Fitting Dimension	Gauge
7 inches to 36 inches	20
37 inches to 60 inches	18
62 inches and larger	16

2.8 DOUBLE WALL SPIRAL INSULATED ROUND DUCTS

A. Manufacturers include, but are not limited to:
1. McGill AirFlow Corporation
2. Semco Incorporated
3. Tangent Air Corp
4. Spiral Mfg. Co., Inc.

B. Product Description: Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 2 inch thick glass fiber insulation, perforated galvanized steel inner wall; fittings manufactured with perforated inner wall.

C. Construct round duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

D. Construct round fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.9 DOUBLE WALL SPIRAL INSULATED FLAT OVAL DUCTS

A. Manufacturers include, but are not limited to:
1. McGill AirFlow Corporation
2. Semco Incorporated
3. Tangent Air Corp
4. Spiral Mfg. Co., Inc.
5. United McGill

B. Product Description: Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 2 inch thick glass fiber insulation, perforated galvanized steel inner wall; fittings manufactured with perforated inner wall.

C. Construct flat oval duct with the following minimum gauges:

Major Axis Dimension	Gauge
7 inches to 24 inches	24
25 inches to 48 inches	22
50 inches to 70 inches	20
72 inches to 82 inches	18
84 inches and larger	16

D. Construct flat oval fittings with the following minimum gauges:

Major Axis Fitting Dimension	Gauge
7 inches to 36 inches	20
37 inches to 60 inches	18
62 inches and larger	16

2.10 TRANSVERSE DUCT CONNECTION SYSTEM

A. Manufacturers:
1. United McGill
2. Semco
3. ACME

4. Nufab

B. Product Description: SMACNA "E" rated, SMACNA "F" rated or SMACNA "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.11 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). Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. TDC connections on all ductwork where any dimension exceeds 12 inches. Slip and drive connection acceptable on duct sizes less than 12” x 12”.

D. 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 airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. 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.

G. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

H. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems.
   1. Sealants, Mastics: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
   2. Do not provide sealing products not bearing UL approval markings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. General:

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
2. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
3. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
4. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.
5. Install duct hangers and supports in accordance with Section 23 05 29.
6. Use double nuts and lock washers on threaded rod supports.
7. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
8. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
9. Do not route ducts through transformer vaults or electrical equipment rooms and enclosures.
10. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
11. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23, Air Duct Accessories for fire and smoke dampers.

B. Buried Ducts

1. Slope underground ducts to plenums or low pump out points at 1: 500. Install access doors for inspection.

C. Flexible ductwork

1. When located above ceilings, support flexible duct from above; flexible duct shall not touch the ceiling.
2. Minimize kinks and sags
3. Flexible duct shall be located only where concealed and accessible.
4. Non-insulated flexible ductwork: Provide when the metal ductwork connected to is not insulated.
5. Insulated flexible ductwork: Provide when the metal ductwork connected to is insulated. R-value of flexible ductwork insulation shall meet or exceed the R-value of the metal ductwork insulation.
6. Elbow supports: Provide above flexible ductwork connections to ceiling diffusers. Use cable ties as indicated in the manufacturer's installation instructions.
7. Connections to rigid ductwork: Provide both a drawband and two layers of duct tape lapped approximately 25% at each connection of flexible ductwork to rigid

ductwork. Drawbands shall be the non-metallic type listed and labeled in accordance with UL 181B. Duct tape shall be listed and labeled in accordance with UL 181B.

D. For outdoor ductwork, protect ductwork, ductwork supports, linings and coverings from weather.

3.3 DUCT SEALING

A. Duct Seal Level Description

Seal Level	Sealing Requirements*
A	All transverse joints, longitudinal seams, and duct wall penetrations. Pressure sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL-181A or UL0181B by an independent testing laboratory and the tape is used in accordance with that certification
B	All transverse joints, longitudinal seams. Pressure sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL-181A or UL0181B by an independent testing laboratory and the tape is used in accordance with that certification.
C	Transverse joints only.
Notes: Longitudinal seams are joints oriented in the direction of flow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod, or wire. Spiral lock seams in a round or flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to spin-ins, taps, and other branch connections, access door frames and jambs, duct connections to equipment, etc.	

B. Minimum Duct Seal Levels

Duct Type				
Duct Location	Supply		Exhaust	Return
	2-in. or less (1)	Greater than 2-in. (1)		
Outdoor	A	A	C	A
Unconditioned Space (2)	B	A	C	B
Conditioned Space	C	B	B	C
Notes: Duct design static pressure classification				

Includes indirectly conditioned spaces such as return air plenums

3.4 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 air terminal units to supply ducts directly or with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.5 CLEANING

1. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. Duct cleaning is required if test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems." do not meet the following criteria:
   1. Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

C. 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.

D. Clean duct systems with high power vacuum machines. Protect equipment with potential to be harmed by excessive dirt with filters, or bypass during cleaning. Install access openings into ductwork for cleaning purposes.

3.6 DUCTWORK LEAKAGE TESTING

A. The following ductwork systems shall be pressure/leakage tested:
   1. All ductwork to be concealed in a sheetrock, concrete block or other permanent chase shall be pressure tested before ductwork is concealed.
   2. 2012 IECC REQUIREMENTS
      a. Representative sections totaling no less than 25% of ductwork systems listed below that are constructed and installed for 3” w.c. or more (positive or negative).
   3. For ductwork leakage testing: “Ductwork main” shall be defined as all ductwork serving more than one grille or diffuser.
   4. All ductwork outside of the building insulation envelope shall be pressure tested.

B. Testing shall conform to the following:
   1. Test static pressure must be the lower of 125% of the external static pressure of the air moving equipment or the construction static pressure class of the ductwork.

2. Test in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Maximum Allowable Leakage shall be in accordance with Duct Pressure Class rating listed below and Leakage Class listed here-in.
3. For Ductwork Pressure Class 3" w.c: Leakage Class shall be 8.
4. For Ductwork Pressure Class 2" w.c or less: Leakage Class shall be 16.
5. Testing shall occur after ductwork has been cleaned, but before duct insulation is applied or ductwork is concealed.

C. Duct Leakage Test Report shall include:
1. Date of test.
2. Name of company and person conducting the test.
3. Name of company and person witnessing the test.
4. Description of ductwork tested. Provide drawings to indicate section of ductwork being tested. Labeling on the drawings shall correspond to labeling in the report.
5. Surface area (square feet) of section of ductwork being tested.
6. Duct design operating pressure (inches w.c.)
7. P = Duct design test static pressure (inches w.c.)
8. Duct capacity, air flow
9. CL= Specified Leakage Class.
10. F = Leakage factor (CFM / 100 sf of duct area)
11. Maximum allowable leakage (CFM)
12. Test apparatus
    a. Blower
    b. Orifice tube size
    c. Orifice size
    d. Calibrated
13. Test orifice differential pressure (inches w.c.)
14.

3.7 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply (Heating Systems)	Galvanized Steel, Aluminum,
Supply (System with Cooling Coils)	Galvanized Steel, Aluminum,
Return, exhaust and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Fume Hood Exhaust	Stainless Steel
Outside Air Intake	Galvanized Steel

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS

Supply Ductwork (upstream of VAV boxes terminal units and/or final balancing damper)	3 inch wg
Supply Ductwork (downstream of VAV boxes and terminal units)	1 inch wg regardless of velocity.
Return and Relief	2 inch wg regardless of velocity.
General Exhaust	1 inch wg regardless of velocity.
Fume Hood Exhaust	2 inch wg
All Others Not Identified	1.5x maximum anticipated system pressure

C. Ductwork Liner Schedule:

AIR SYSTEM	THICKNESS
10 ft downstream of VAV box	1 inch
10 ft upstream / downstream of fan coil unit	1 inch
First 10 ft of supply and return/ exhaust from AHU/ERV/DOAS	1 inch
Transfer air ducts	1 inch

END OF SECTION 23 3100

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Back-draft dampers.

B. Combination fire-and-smoke dampers.

C. Duct access doors.

D. Dynamic fire dampers.

E. Volume control dampers.

F. Flexible duct connections.

G. Duct test holes.

1.2 RELATED SECTIONS:

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

B. Section 23 05 19 – Meters and Gauges

C. Section 23 04 00 – General Conditions for Mechanical Trades

D. Section 23 09 23 - Direct-Digital Control System for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.

E. Section 23 31 00 - HVAC Ducts: Requirements for duct construction and pressure classifications.

F. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.

1.3 REFERENCES (follow the most currently adopted amended version)

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:
   1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. 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.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
   1. UL 555 - Standard for Safety for Fire Dampers.
   2. UL 555C - Standard for Safety for Ceiling Dampers.
   3. UL 555S - Standard for Safety for Smoke Dampers.

1.4 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 and hardware used.

C. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
   1. Fire dampers including locations and ratings.
   2. Smoke dampers including locations and ratings.
   3. Backdraft dampers.
   4. Flexible duct connections.
   5. Volume control dampers.
   6. Duct access doors.
   7. Duct test holes.

D. Product Data: For fire dampers, smoke dampers, combination fire and smoke dampers submit the following:
   1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
   2. Indicate materials, construction, dimensions, and installation details.
   3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

E. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of access doors test holes and dampers.

B. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.6 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

C. Storage: Store materials in a dry area indoor, protected from damage.

D. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Coordinate Work where appropriate with building control Work.

1.12 WARRANTY

A. Furnish five-year manufacturer warranty for duct accessories.

1.13 EXTRA MATERIALS

A. Fusible Links: Furnish quantity equal to 10 percent of number installed.

PART 2 PRODUCTS

2.1 BACK-DRAFT DAMPERS

A. Manufacturers:
1. Ruskin CB series
2. Price BDD Series
3. Greenheck EM Series

B. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, extruded aluminum. Blades, maximum 6 inch width, center pivoted, with 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.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
1. Ruskin
2. Price
3. Greenheck
4. Pottorff
5. Nailor

B. Type: Dynamic, fabricate in accordance with NFPA 90A, UL 555, and UL 555S.

C. Fire Resistance: 1-1/2 hours through penetrations with fire resistance ratings of less than 3 hours and 3 hours through penetrations with fire resistance ratings of 3 hours or more.

D. Leakage Rating: Class II, maximum of 20 cfm at 4 inches wg differential pressure.

E. Damper Temperature Rating: 250 degrees F for all except smoke control systems. Smoke control systems must be 350 degrees F rated.

F. UL 555S Differential Pressure Rating: 6 in. wg.

G. UL 555S Velocity Rating: 2000 fpm

H. Frame: minimum16 gage, galvanized steel.

I. Blades:
1. Style: Airfoil-shaped, single piece, double skin.
2. Action: Opposed or parallel.
3. Orientation: Horizontal.
4. Material: Minimum 16 gage equivalent thickness, galvanized steel.
5. Width: Maximum 6 inches.

J. Bearings: Stainless steel or Bronze Oilite pressed into frame.

K. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

L. Linkage: Concealed in frame.

M. Release Device: Electric resettable link to allow damper to be automatically reset with an open & closed indicator.

N. Actuator: shall be qualified in accordance with UL 555S to the temperature rating of the damper. Provide with damper

O. Operators: UL listed and labeled spring return electric type suitable for 120 volt, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

P. Fusible Link Release Temperature: 165 degrees F.

Q. Finish: Mill galvanized.

R. Factory installed sleeve provided with mounting angles. Furnish silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements. Provide out-of-partition type dampers with fire rated sleeve where conditions do not allow installation of damper within partition.

S. Smoke Detector: Duct mounted smoke detectors shall be furnished by Div. 28, installed by Div. 23. Power wiring by Div. 26, control wiring by Div. 28.

2.3 DUCT ACCESS DOORS

A. Manufacturers:
1. Ruskin
2. Elgen
3. Greenheck
4. Buckley
5. Kees
6. Pottorff

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

C. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch thick insulation with sheet metal cover.
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.
4. Larger Sizes: Furnish additional hinge.
5. Access panels with sheet metal screw fasteners are not acceptable.

D. Materials

1. Aluminum construction: Minimum 0.032" thick aluminum double wall door, minimum 0.032" thick aluminum frame. Provide for aluminum duct.
2. Steel construction: Minimum 24 gauge galvanized double wall door, minimum 24 gauge galvanized frame. Provide for galvanized steel duct.
3. Stainless steel construction: Minimum 24 gauge stainless steel double wall door, minimum 22 gauge stainless steel frame. Provide for stainless steel or aluminum duct.

E. Low Pressure Rectangular (Non-Grease-Ducts):
1. Door: For insulated ducts, provide double wall door with 1" or 2" insulation cavity – as necessary to accommodate required insulation. For non-insulated ducts, provide single wall door.
2. Gasket: Closed cell neoprene.
3. Hardware: Double (opposite side) cam latches or single cam latch with full length (piano style) hinge.
4. Insulation: Glass fiber type, 1" thick for ductwork with up to 1" thick acoustical lining or insulation wrap, 2" thick for ductwork with 1-1/2" and over acoustical lining or insulation wrap.

F. Low Pressure Round & Oval Duct (Non-Grease Ducts),
1. Insulated duct, low pressure (3" wg): Welded construction, 18 gauge galvanized steel, 24 gauge galvanized double wall door, double cam latches or single cam latch with full length (piano style) hinge, 2" thick glass fiber insulation.
2. Non-Insulated duct, low pressure (6" wg): 16 gauge galvanized door, plated steel full length (piano style) hinge, zinc plated draw latch(es) and keeper(s), closed cell neoprene gasket.

G. High pressure (10" wg): 18 gauge galvanized steel, 24 gauge galvanized double wall door, double cam latches or single cam latch with full length (piano style) hinge, 2" thick glass fiber insulation.
1. Hardware:
a. Cam latch type: Cam latches on (4) sides - (1) cam latch per side for 6"x6", (2) cam latches per side for 8"x8" and over.
b. Hinge type: Cam latches on (3) sides, (1) cam latch per side for up to 16"x16", (2) cam latches per side for 18"x18" and over.
2. Application: For ductwork rated over 3" pressure class positive or negative, provide high pressure access doors.

2.4 DYNAMIC FIRE DAMPERS

A. Manufacturers:
1. Ruskin
2. Price
3. Greenheck
4. Nailor
5. Pottorff

B. Fabricate in accordance with NFPA 90A and UL 555.

C. Fire Resistance: 1-1/2 hours through penetrations with fire resistance ratings of less than 3 hours and 3 hours through penetrations with fire resistance ratings of 3 hours or more.

D. Dynamic Closure Rating: Dampers classified for dynamic closure to 2000 fpm and 4 inches wg static pressure.

E. Construction:
   1. Integral Sleeve Frame- Galvanized steel in gauges required by manufacturer's UL listing. Length: Minimum 20 gage formed Sleeve length shall extend approximately 3" on either side of the wall or floor to facilitate joining the collar to the duct.
   2. Blades:
      a. Style: Curtain type, blades outside of airstream.
      b. Action: Spring or gravity closure upon fusible link release.
      c. Material: Minimum 24 gage roll formed, galvanized steel.
   3. Closure Springs: Type 301 stainless steel, constant force type, if required.

F. Fusible Link Release Temperature: 165 degrees F.

G. Mounting: Vertical or horizontal as indicated on Drawings.

H. Finish: Mill galvanized.

2.5 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Ruskin
   2. Nailor
   3. Greenheck
   4. Flexmaster
   5. McGill Airflow
   6. Nailor
   7. Pottorff

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches size in both dimensions, and two gages heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 3/8 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
   4. Single Blade Dampers: Fabricate for duct sizes up to 12 x 48 inch.

D. 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.

E. End Bearings: Except in round ductwork 12inches 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..

F. 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.

2.6 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
1. Ventfabrics Inc. Ventglas
2. United McGill
3. Elgen
4. DuroDyne
5. Ventfabrics
6. Ductmate Industries

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Materials: Flame-retardant or noncombustible fabrics.

D. Coatings and Adhesives: Comply with UL 181, Class 1.

E. Metal-Edged Connectors: Factory fabricated with a fabric strip minimum 3-1/2 inches wide attached to two strips of galvanized or aluminum sheet steel. Provide metal compatible with connected ducts.

F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inchin the warp and 360 lbf/inchin the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inchin the warp and 440 lbf/inchin the filling.
3. Service Temperature: Minus 50 to plus 250 deg F

H. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
1. Minimum Weight: 16 oz./sq. yd.
2. Tensile Strength: 285 lbf/inchin the warp and 185 lbf/inchin the filling.

3. Service Temperature: Minus 67 to plus 500 deg F

I. High-Corrosive-Environment System, Flexible Connectors:Glass fabric with chemical-resistant coating.
   1. Minimum Weight: 14 oz./sq. yd.
   2. Tensile Strength: 450 lbf/inchin the warp and 340 lbf/inchin the filling.
   3. Service Temperature: Minus 67 to plus 500 deg F

J. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs. per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.7 DUCT TEST HOLES

A. Manufacturers:
   1. Dwyer
   2. Flow Kinetics
   3. Air Balance
   4. Substitutions: Division 01 - General Requirements.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

2.8 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
   1. Pottorff.
   2. Ventfabrics, Inc.
   3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass, Copper or Aluminum.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Painted steel.

2.9 TURNING VANES

A. Manufacturers:
   1. Ductmate Industries, Inc.
   2. Duro Dyne Inc.
   3. Elgen Manufacturing.
   4. METALAIRE, Inc.
   5. SEMCO Incorporated.
   6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rated walls are ready for fire damper installation.

B. Verify ducts and equipment installation 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 motorized back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.

C. Access Doors: Install access doors of type suitable for application at the following locations:
1. Spaced every 50 feet of straight duct.
2. Upstream of each elbow.
3. Upstream of each reheat coil.
4. Before and after each duct mounted filter.
5. Before and after each duct mounted coil.
6. Before and after each duct mounted fan.
7. Before and after each automatic control damper.
8. Before and after each fire damper, smoke damper, combination fire and smoke damper.
9. Downstream of each VAV box.

D. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Install 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

1. Mark access doors for fire and smoke dampers on outside surface, with minimum 1/2 inch high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, OR FIRE DAMPER.

E. Install temporary duct test holes and 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.

F. Install fire dampers, combination fire and smoke dampers and smoke dampers at locations as indicated on Drawings and as indicated in specifications. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges. Install dampers and accessories with required clearance for access. Provide all power and control wiring for a complete and operable system.
1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
2. Install dampers square and free from racking with blades running horizontally.
3. Do not compress or stretch damper frame into duct or opening.
4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.3 DEMONSTRATION

A. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION 23 3300

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Door grilles.

1.2 RELATED REQUIREMENTS

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

B. Division 09: Painting

C. Section 23 04 00 – General Conditions for Mechanical Trades

D. Section 23 33 00 - Air Duct Accessories.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating

B. AMCA 511 - Certified Ratings Program for Air Control Devices.

C. AMCA 540 – Debris Impact Resistance

D. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers.

E. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

H. SMACNA (ASMM) - Architectural Sheet Metal Manual.

I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.4 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

B. Project Record Documents: Record actual locations of all air outlets and inlets.

C. Project Record Documents: Once the final Testing, Adjusting & Balancing Report is approved, record all typed airflow values on the as-built drawings.

D. Test Reports: Rating of air outlet and inlet performance.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

C. AMCA 540 – Debris Impact Resistance

D. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers; 2015.

E. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

F. Maintain two copies of each document on site.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.8 WARRANTY

A. Furnish five year manufacturer warranty for air outlets and inlets.

1.9 EXTRA MATERIALS

A. Furnish one of each type and size extra air outlets and inlets.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The following list of manufacturers applies to all air terminal units unless otherwise noted in sections below.
   1. Price Industries
   2. Titus
   3. Krueger
   4. Nailor Industries
   5. Anemostat

2.2 ROUND CEILING DIFFUSERS

A. Type: Round, adjustable pattern, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with directional baffles where indicated. Diffuser collar shall project not more than 1 inch above ceiling. In plaster ceilings, provide plaster ring and ceiling plaque.

B. Fabrication: Steel with baked enamel finish.

C. Color: As selected by Architect from manufacturer's standard range.

D. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.3 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square, stamped, multi-core, square, adjustable pattern, stamped, multi-core, square and rectangular, multi-louvered, square and rectangular, adjustable pattern, multi-louvered, and diffuser to discharge air in 360 degree, one way, two way, three way, four way, and pattern with directional baffles where indicated.

B. Connections: Round.

C. Frame: Provide surface mount, snap-in, inverted T-bar, spline type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel finish.

E. Color: As selected by Architect from manufacturer's standard range.

F. Accessories: Refer to schedule.

2.4 PERFORATED FACE CEILING DIFFUSERS

A. Type: Perforated face with fully adjustable pattern and removable face.

B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel with steel frame and baked enamel finish.

D. Color: As selected by Architect from manufacturer's standard range.

E. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.5 CEILING SLOT DIFFUSERS

A. Type: Continuous wide slot, , with adjustable vanes for left, right, or vertical discharge, , refer to schedule

B. Fabrication: Aluminum extrusions with factory clear lacquer finish.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Frame: Refer to schedule.

E. Plenum: Integral, galvanized steel, insulated.

2.6 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.

B. Frame: Refer to schedule.

C. Construction: Made of aluminum extrusions with factory enamel finish.

D. Color: As selected by Architect from manufacturer's standard range.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.7 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Frame: Refer to schedule.

B. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

E. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.8 CEILING LINEAR EXHAUST AND RETURN GRILLES

A. Type: Refer to schedule.

B. Frame: Refer to schedule.

C. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.9 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Refer to schedule.

B. Fabrication: Refer to schedule.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Frame: Refer to schedule.

E. Frame: Channel lay-in frame for suspended grid ceilings.

F. Accessories: Refer to schedule.

2.10 WALL SUPPLY REGISTERS/GRILLES

A. Type: Refer to schedule.

B. Frame: Refer to schedule.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

E. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.11 WALL SUPPLY REGISTERS/GRILLES

A. Type: Refer to schedule.

B. Frame: Refer to schedule.

C. Fabrication: Aluminum extrusions with factory clear lacquer finish.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.12 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: As shown on the drawings.

E. Color: To be selected by Architect from manufacturer's standard range.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

G. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.13 WALL GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Fixed grilles of 1/2 by 1/2 by 1/2 inch louvers.

B. Fabrication: Aluminum with factory clear lacquer finish.

C. Color: As shown on the drawings.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Frame: 1-1/4 inch margin with countersunk screw mounting.

F. Frame: Channel lay-in frame for suspended grid ceilings.

G. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.14 LINEAR WALL REGISTERS/GRILLES

A. Type: Streamlined blades with 0 degree deflection, 1/8 by 3/4 inch (3.2 by 19 mm) on 1/4 inch (6 mm) centers.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.

C. Fabrication: Aluminum extrusions, with factory baked enamel finish.

D. Color: As shown on the drawings.

E. Color: To be selected by Architect from manufacturer's standard range.

F. Damper: Integral gang-operated opposed blade damper with removable key operator, operable from face.

2.15 LINEAR FLOOR SUPPLY REGISTERS/GRILLES

A. Type: Streamlined blades with 0 degree deflection, 1/8 by 3/4 inch on 1/4 inch (6 mm) centers, assembled on expanded tubes mandrel construction.

B. Frame: 1-1/4 inch heavy margin frame with countersunk screw mounting, and mounting frame.

C. Fabrication: Aluminum extrusions with factory baked enamel finish.

D. Color: As shown on the drawings.

E. Color: To be selected by Architect from manufacturer's standard range.

F. Damper: Integral gang-operated opposed blade damper with removable key operator, operable from face.

2.16 FLOOR SUPPLY REGISTERS/GRILLES

A. Individually adjustable blades, wide stamped border, single or double blade damper with set screw adjustment.

B. Fabricate of steel, welded construction, with factory baked enamel finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify inlet and outlet locations.

C. Verify ceiling, wall systems are ready for installation.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly. Refer to Section 23 33 00.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Division 09.

3.3 AIR OUTLET AND INLET SCHEDULE

A. Refer to contract drawings/plans.

3.4 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 23 3700

SECTION 23 7413 - PACKAGED OUTDOOR CENTRAL-STATION 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 23 04 00 – General Conditions for Mechanical Trades
2. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for electric motors for placement by this section.
3. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.
4. Section 23 07 00 - HVAC Insulation: Product requirements for insulation for placement by this section.
5. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
6. Section 23 09 53 - Pneumatic and Electric Control System for HVAC: Product requirements for pneumatic controls to interface with air handling units.
7. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
8. Section 23 21 13 - Hydronic Piping: Product requirements for chilled water and hot water piping connections to air handling units.
9. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.
10. Section 23 22 13 - Steam and Condensate Heating Piping: Product requirements for steam supply and steam condensate piping connections to air handling units.
11. Section 23 22 16 - Steam and Condensate Piping Specialties: Product requirements for steam supply and steam condensate piping specialties for placement by this section.
12. Section 23 23 00 - Refrigerant Piping: Product requirements for refrigerant piping connections to air handling units.
13. Section 23 33 00 - Air Duct Accessories: Product requirements for flexible duct connections for placement by this section.
14. Section 23 84 00 - Humidity Control Equipment: Product requirements for humidifiers and dehumidifiers for placement by this section.
15. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.
16. Section 26 29 23 - Variable-Frequency Motor Controllers: Variable frequency controllers.

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 610 - Central System Humidifiers for Residential Applications.
4. ARI Guideline D - Application and Installation of Central Station Air-Handling Units.

D. ASTM International:
1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

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. Division 01 - Submittal Procedures: 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. Dampers: Include leakage, pressure drop, and sample calibration curves. Indicate materials, construction, dimensions, and installation details.

6. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring. Indicate factory installed and field installed wiring.

D. Samples: Submit two of each type of replacement filter media with frame.

E. Manufacturer's Installation Instructions: Submit.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout 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 QUALITY ASSURANCE

A. Outside Air Damper Leakage: Test in accordance with AMCA 500.

B. 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 [documented] experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.

C. Protect units from weather and construction traffic by storing in dry, roofed location.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for air handling units.

1.10 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one set of fan belts for each unit.

C. Furnish one set of filters for each unit.

PART 2 PRODUCTS

2.1 AIR HANDLING UNITS

A. Manufacturers:
1. Valent Air Corporation, LLC
2. Daikin
3. Trane
4. Aaon
5. Substitutions: Division 01 - Product Requirements.

B. Configuration: Fan section fan and coil section plus accessories, including:
1. DX evaporator Cooling coil section.
2. Packaged DX system.
3. Hot Gas reheat coil.
4. Indirect Gas fired heating section.
5. Filter assembly for exhaust air and intake air.
6. Combination filter/mixing box section.
7. Mixing box section.
8. Supply air blower assembly.
9. Face and bypass damper section.
10. Multi-zone damper section.
11. Motorized dampers.
12. Curb assembly. (with curb adaptor)
13. Energy Recovery Wheel.
14. Exhaust/relief air blower assembly.

C. Performance Base: Sea level pressure.

D. Fabrication: Conform to AMCA 99 and ARI 430.

E. Roof Curb: Refer to Section 23 05 48. Provide curb adaptor to transition from existing curb size to footprint of new DOAS-1 and DOAS-2.

2.2 CASING

A. Channel base and drain pan of welded steel. Assemble sections with gaskets and bolts.

B. Outside Casing:
   1. Unit's exterior shall be supplied from the manufacturer using G60 galvaneal steel with proprietary pre-painted material in the following finish color; Concrete Gray-RAL 7023. This has been subjected to a salt spray test per ASTM-B117 and evaluated using ASTM-D714 and ASTM-D610 showing no observable signs of rust or blistering until reaching 2,500 hours. Uncoated galvanized steel exterior is not acceptable.

C. Inside Casing:
   1. Internal assemblies: 22 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

D. Floor Plate:
   1. Galvanized Steel: [1.382] [_____] inch thick.
   2. Stainless Steel: [0.1406] [_____] inch thick.

E. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
   1. Materials: Rigid urethane injected foam. Foam board not acceptable.
      a. Thickness: 2 inch (50.8 mm)
      b. Thermal Resistance R13
      c. Thermally broken
      d. Meets UL94HF-1 flame requirements.
      e. Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.
   2. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
      a. Thickness: 2 inch (50.8 mm)
   3. Thermal Resistance R8
   4. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
   5. Location and application: Divider panels between outdoor air and return air/exhaust air streams.

F. Roof Insulation: 2 inch (50.8 mm) fiberglass located above the 1 inch (25.4 mm) foam panel.

G. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18 gauge galvanized G90 steel or painted galvannealed steel.

H. Lights: Located in accessible sections suitable for damp locations with wire guards, factory wired to weatherproof switch and duplex outlet mounted on casing exterior. In humidifier sections, furnish lights suitable for wet locations.

I. Bottom Inlet Units: Furnish steel or aluminum walking grate on structural supports.

J. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.

K. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.

L. Evaporator Coil: Evaporator coil shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.

M. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch.

N. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.

O. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.

P. Energy wheel: Unit energy wheel shall be sized for the full volume of outdoor and exhaust air without an energy wheel bypass damper(s). Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt or a link style belt with a five-year warranty. The wheel media shall be a polymer film matrix in a stainless-steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and is designed and constructed to permit cleaning and servicing. The energy wheel is to have a five-year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.

Q. Modulating frost control. Control system shall include an outdoor air thermostat and pressure sensor on the wheel assembly to initiate frost control sequence.

R. Reheat coil with factory installed modulating hot gas reheat valve.

S. Indirect gas furnace

1. Shall be ETL Certified as a component of the unit.

2. Shall have an integral combustion gas blower.

3. Shall be ETL Certified for installation downstream of a cooling coil.

4. Shall have fault sensors to provide fault conditions to optional digital controller or building controls.

5. Shall have 4-pass tubular heat exchangers, constructed of type 409 stainless steel. Heat exchanger tubes shall be installed on the vest plate by means of swaged assembly, welded connections are not acceptable. Heat exchanger tubes shall be supported by a minimum of two fabricated assemblies that support the tubes and also permit expansion and contraction of the tubes.

6. Heat exchanger shall have a 25 year extended warranty.

7. Furnace control shall be HighTurndown 12:1 Modulating.

8. Shall be encased in a weather-tight metal housing with intake air vents. Large, metal lift-off door shall provide easy access to the enclosed vest plate, control circuitry, gas train, burner assembly and exhaust blower.

9. Shall have solid state controls permitting stand-alone operation or control by building controllers.

T. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Lead condenser fan shall have EC motor to maintain condenser pressure at part load conditions. Motors shall be UL Recognized and CSA Certified. The lead refrigerant compressor(s) shall be digital hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant. Compressors shall be mounted within an insulated access compartment and on a raised cabinet shelf to reduce sound and vibration. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

U. Condenser Fans: Fan blades must be constructed of aluminum or a composite material and have a geometry designed and documented to reduce sound and energy when compared to a traditional rectangular blade fan. Traditional rectangular blade fans are not allowed due to increased noise generated and increase power utilized. Condenser fan motors shall be three phase, external rotor, type 56 frame, open air over and shaft up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Lead condenser fan(s) will have an electronically commutated (EC) motor that will modulate to maintain a head pressure set point.] Motors shall be UL Recognized and CSA Certified. Single condenser fan running

at max RPM and design static pressure shall not exceed an A-weighted sound power level of 75 db at free inlet/outlet test conditions.

V. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:

1. Global alarm condition (active when there is at least one alarm)
2. Supply Air Proving alarm
3. Compressor Trip alarm
4. Compressor Locked Out alarm
5. Supply Air Temperature Low Limit alarm
   a. Sensor #1 Out of Range (outside air temperature)
   b. Sensor #2 Out of Range (supply air temperature)
   c. Sensor #3 Out of Range (cold coil leaving air temperature)

W. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.

X. Motorized dampers / Intake Air, Motorized dampers of low leakage type shall be factory installed.

Y. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and return air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 14 in. Horizontal connections through unit only. Plenum curb for horizontal connections is not acceptable. Provide curb adaptor to transition from existing curb size to new footprint of unit.

Z. Service receptacle: 120 VAC GFCI service outlet shall be factory-provided and installed by this contractor in a location designated by the A / E. Service outlet requires a dedicated single phase electric circuit. Unit contains a 120 VAC transformer to provide power to service outlet.

AA. 24V/120V Smoke detector: Duct smoke detector is shipped loose for field mounting and wiring in the supply or return air duct. The air duct smoke detector housing shall be UL listed per UL 268A specifically for use in air handling systems. The air duct smoke detector housing shall be suitable for mounting indoors. The detector shall operate at air velocities of 100 feet per minute to 4000 feet per minute (0.5 to 20.32 meters/second). The power supply voltage shall be 20-29 VDC, 24 VAC 50-60 Hz, and 120 VAC 50-60 Hz. The detector shall consist of an alarm initiation contact and two DPDT auxiliary

contact closures. WARNING: Duct smoke detectors are NOT a substitute for open area smoke detectors; NOT a substitute for early warning detection; NOT a replacement for a building's regular fire detection system. Refer to NFPA 72 and 90A for additional information.

2.3 BLOWER

A. Blower section construction, Supply Air: direct drive motor and blower shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Fan: Direct drive, airfoil plenum fan with aluminum wheel statically and dynamically balanced. Prop or belt-drive fan not acceptable due to low static capabilities.

D. Blades: Welded aluminum blades only.

E. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

2.4 MOTORS

A. General: Blower motors greater than 1/2 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.

B. Motors shall be 60 cycle, 3 phase 208 volts.

2.5 UNIT CONTROLS

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

C. Unit supply fan shall be configured for Constant Volume (ON/OFF).

D. Unit exhaust fan shall be configured for Constant Volume (ON/OFF).

E. Outside Air / Return Air damper control shall be

F. Economizer control shall be temperature / enthalpy.

G. Operating protocol: The DDC shall be factory-programmed for BACNetIP.

H. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

I. Airflow monitoring required in the supply, and exhaust airstreams.

2.6 FILTERS

A. Unit shall have permanent 2 inch (50.8 mm) aluminum filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream. MERV 8 and MERV 13 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream

2.7 OUTSIDE AIR MEASURING AND MODULATION DEVICE

A. Factory mounted in outside air and return air openings.

B. Damper and airflow measurement assembly sized to accommodate minimum outside airflow as indicated on Drawings.

C. Construction:
   1. Frame: Extruded aluminum.
   2. Blades:
      a. Modulating Air Control:
         1) Style: Airfoil-shaped, single-piece.
         2) Action: Parallel.
         3) Orientation: Horizontal.
         4) Material: Heavy gage 6063-T5 extruded aluminum.
         5) Width: Maximum 5 inches.
      b. Stationary Sensing:
         1) Style: Airfoil-shaped, single-piece.
         2) Orientation: Horizontal.
         3) Material: Heavy gage 6063-T5 extruded aluminum.
         4) Width: Maximum 5-1/4 inches.
         5) Finish: Anodized.
   3. Bearings: Self-lubricating molded synthetic sleeve, turning in extruded hole in frame.

4. Seals:
   a. Blade: Extruded rubber. Mechanically attached to blade edge.
   b. Jamb: Stainless steel, flexible metal compression type.
   c. Linkage: Concealed in frame.
   d. Axles: Minimum 1/2 inch diameter plated steel, hex-shaped, mechanically attached to blade.
   e. Mounting: Vertical.
   f. Electric Actuator: 24 V, 60 Hz, modulating, with position feedback.
5. Digital Controller: Application specific controller. Programming logic and calibration in nonvolatile EPROM. Controller uses generic 0 - 10 vdc inputs and outputs for interface to building automation system.
6. Air Straightener Section: 3 inches deep section contained in 5 inch long sleeve attached to damper-airflow monitor frame.
7. Finish: Mill aluminum.

D. Performance Data:
1. Temperature Rating: Withstand -40 to 140 degrees F.
2. Accuracy: Plus or minus 5 percent.
3. Leakage: Maximum of 2.0 cfm per square foot at 1.0 inches wg pressure differential.
4. Measures from 15 percent to 100 percent of unit nominal air flow.
5. Adjusts air flow for temperature variations.
6. Provides 2 to 10 volt DC signal corresponding to actual air flow.

E. Accessories:
1. Actuator Heater: Allow actuator operation in ambient temperatures to -40 degrees F.

2.8 CAPACITY

A. As per schedules on Drawings.

2.9 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. As per schedules on Drawings.

B. Disconnect Switch: Factory mount on equipment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify roof curbs are installed and dimensions are as shown on shop drawings.

3.2 PREPARATION

A. Furnish roof curbs to Section 23 05 48 for installation.

3.3 INSTALLATION

A. Install in accordance with ARI 430.

B. 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 23 33 00.

C. Install assembled units with vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as required. Adjust snubbers to prevent tension in flexible connectors when fan is operating. Refer to Section 23 05 48.

D. Install condensate piping with trap and route from drain pan to splash block on roof [nearest roof drain. Refer to Section 23 21 13.

E. Provide fixed sheaves required for final air balance.

F. Insulate coil headers located outside airflow as specified for piping. Refer to Section 23 07 00.

G. Connect humidifiers to water supply. Install gate valve on water supply piping. Install 3/4 inch hose bibb accessible from interior. Pipe drain and overflow to nearest floor drain.

3.4 INSTALLATION REFRIGERANT COILS

A. Install sight glass in liquid line within 12 inches of coil. Refer to Section 23 23 00.

B. Install piping specialties in accordance with Section 23 23 00.

3.5 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Quality Requirements: Requirements for manufacturer’s field services.

B. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

C. Furnish services of factory trained representative for minimum of one days to leak test, refrigerant pressure test, evacuate, dehydrate, charge, start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.6 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.7 DEMONSTRATION

A. Division 01 - Execution and Closeout 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.

3.8 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout 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.

3.9 SCHEDULES

A. As per Drawings.

END OF SECTION 23 7413

SECTION 23 8126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Air handling unit.
   2. Condensing unit.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for concrete foundations specified by this section.
   2. Section 23 04 00 – General Conditions for Mechanical Trades
   3. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Vibration isolators.
   4. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
   5. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
   6. Section 23 21 13 - Hydronic Piping: Execution requirements for connection to hot water and drain piping specified by this section.
   7. Section 23 22 13 - Steam and Condensate Heating Piping: Execution requirements for connection to steam supply and steam condensate return piping specified by this section.
   8. Section 23 23 00 - Refrigerant Piping: Execution requirements for connection to refrigerant piping specified by this section.
   9. Section 23 33 00 - Air Duct Accessories: Flexible connections.
   10. Section 25 50 00 - Integrated Automation Facility Controls: Control systems remote from unit.
   11. Section 26 05 03 - Equipment 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. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating:
   1. Cooling and heating capacities.
   2. Dimensions.
   3. Weights.
   4. Rough-in connections and connection requirements.
   5. Duct connections.
   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.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

E. Manufacturer’s Field Reports: Submit start-up report for each unit.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout 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 Requirements: Energy Efficiency Rating (EER) not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils when tested in accordance with ARI 210/240 and ARI 340/360.

B. Cooling Capacity: Rate in accordance with ARI 210/240, ARI 340/360, ARI 365.

C. Sound Rating: Measure in accordance with ARI 270.

D. Insulation and adhesives: Meet requirements of NFPA 90A.

E. 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 documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - 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.

1.9 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of condensing units with roof structure.

C. Coordinate installation of air handling units with building structure.

1.10 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five year manufacturers warranty for compressors.

1.11 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Furnish service and maintenance of equipment for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including filter replacements, fan belt replacement, and controls checkout and adjustments.

C. Furnish 24-hour emergency service on breakdowns and malfunctions for this maintenance period. Furnish capability of response time within 4 hours.

1.12 MAINTENANCE MATERIALS

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Furnish one set for each unit of fan belts and filters.

PART 2 PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNITS

A. Manufacturers:
1. Daikin
2. The Trane Company
3. Mitsubishi
4. Substitutions: Division 01 - Product Requirements.

B. Product Description: Split system consisting of air handling unit and condensing unit including cabinet, evaporator fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, air filters, controls, air handling unit accessories, condensing unit accessories, and refrigeration specialties.

2.2 AIR HANDLING UNIT

A. Configuration: As indicated on Drawings.

B. Cabinet:
1. Panels: Constructed of galvanized steel with baked enamel finish. Access Panels: Located on both sides of unit. Furnish with duct collars on inlets and outlets.
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. Evaporator Fan: Forward curved centrifugal type, resiliently mounted with adjustable belt drive and high efficiency motor complying with NEMA MG1, Type 1. Motor permanently lubricated with built-in thermal overload protection.

D. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Factory leak tested under water. Removable, PVC construction, double-sloped drain pan with piping connections on both sides.

E. Refrigeration System: Dual (if available otherwise single) refrigeration circuits controlled by factory installed thermal expansion valve.

F. Air Filters: 1 inch thick glass fiber disposable media in metal frames. 25 to 30 percent efficiency based on ASHRAE 52.1.

2.3 CONDENSING UNIT

A. General: Factory assembled and tested air cooled condensing units, consisting of casing, compressors, condensers, coils, condenser fans and motors, and unit controls.

B. Unit Casings: Exposed casing surfaces constructed of galvanized steel with manufacturer's standard baked enamel finish. Designed for outdoor installation and complete with weather protection for components and controls, and complete with removable panels for required access to compressors, controls, condenser fans, motors, and drives.

C. Compressor: Single refrigeration circuit with rotary or hermetic or semi-hermetic reciprocating type compressors, resiliently mounted, with positive lubrication, and internal motor overload protection.

D. Condenser Coil: Constructed of copper tubing mechanically bonded to aluminum or copper fins, factory leak and pressure tested.

E. Controls: Furnish operating and safety controls including high and low pressure cutouts. Control transformer. Furnish magnetic contactors for compressor and condenser fan motors.

F. Condenser Fans and Drives: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Permanently lubricated ball bearing type motors with built-in thermal overload protection. [Furnish high efficiency fan motors.]

G. Condensing Unit Accessories: Furnish the following accessories:
1. Controls to provide low ambient cooling to 0 degrees F.
2. Time delay relay.
3. Anti-short cycle timer.
4. Disconnect switch.
5. Condenser Coil Guard: Condenser fan openings furnished with PVC coated steel wire safety guards.
6. Suction and discharge pressure gauges.

2.4 CONTROLS

A. Furnish interface to Building Automation and Control System and Direct Digital Control System specified in Section 23 09 23.

2.5 CAPACITY

A. Refer to Schedules

2.6 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Refer to Schedules

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. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify concrete pad for condensing unit is ready for unit installation.

3.2 INSTALLATION - AIR HANDLING UNIT

A. Install condensate piping with trap and route from drain pan to condensate drainage system.

B. Install components furnished loose for field mounting.

C. Install connection to electrical power wiring in accordance with Section 26 05 03.

3.3 INSTALLATION - CONDENSING UNIT

A. Install condensing units on vibration isolators. Refer to Section 23 05 48.

B. Install refrigerant piping from unit to condensing unit. Install refrigerant specialties specified in Section 23 23 00.

C. Evacuate refrigerant piping and install initial charge of refrigerant.

D. Install electrical devices furnished loose for field mounting.

E. Install control wiring between air handling unit, condensing unit, and field installed accessories.

F. Install connection to electrical power wiring in accordance with Section 26 05 03.

3.4 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Quality Requirements: Requirements for manufacturer’s field services.

B. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

3.5 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.6 DEMONSTRATION

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate air handling unit operation and maintenance.

C. Demonstrate starting, maintenance, and operation of condensing unit [including low ambient temperature operation].

D. 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.

3.7 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout 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.

3.8 SCHEDULES

A. See Drawings.

END OF SECTION 23 8126

SECTION 23 8129 - VARIABLE REFRIGERANT VOLUME (VRV/VRF) HVAC SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:
   1. Outdoor/condensing unit(s).
   2. Indoor/evaporator units.
   3. Branch selector units.
   4. Refrigerant piping.
   5. Control panels.
   6. Control wiring.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Section 22 1005 - Plumbing Piping: Condensate drain piping.

C. Section 22 3000 - Plumbing Equipment: Cooling condensate removal pumps.

D. Section 23 0400 – General Conditions for Mechanical Trades

E. Section 23 0800 - Commissioning of HVAC.

F. Section 26 2717 - Equipment Wiring: Power connections to equipment.
   1. Provide separate power connections for each unit of equipment.

G. Section23 0923: Direct Digital Control System for HVAC.

1.3 PRICE AND PAYMENT PROCEDURES

A. Alternates: See Division 01 - General Requirements.

B. Alternates: Owner requests a bid Alternate for a system designed and manufactured by a manufacturer other than that listed as the Basis of Design.
   1. Alternate systems will be considered only under the terms described for Substitutions in the article MANUFACTURERS in PART 2 of this section.
   2. Contractor shall include with his bid the amount to be deducted from the bid amount if the alternate is accepted by the Owner.

1.4 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. ITS (DIR) - Directory of Listed Products.

F. NFPA 70 - National Electrical Code.

G. UL 1995 - Heating and Cooling Equipment.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.6 SUBMITTALS

A. See Division 01 - General Requirements.

B. Pre-Bid Submittals: For proposed substitute systems/products, as defined in PART 2, and alternate systems/products, as defined above, proposer shall submit all data described in this article, under the terms given for substitutions stated in PART 2.

C. Product Data: Submit manufacturer's standard data sheets showing the following for each item of equipment, marked to correlate to equipment item markings shown in the contract documents:
   1. Outdoor/Central Units:
      a. Refrigerant Type and Size of Charge.
      b. Cooling Capacity: Btu/h.
      c. Heating Capacity: Btu/h.
      d. Cooling Input Power: Btu/h
      e. Heating Input Power: Btu/h .
      f. Operating Temperature Range, Cooling and Heating.
      g. Air Flow: Cubic feet per minute.
      h. Fan Curves.
      i. External Static Pressure (ESP): Inches WG (Pa).
      j. Sound Pressure Level: dB(A).
      k. Electrical Data:
         1) Maximum Circuit Amps (MCA).
         2) Maximum Fuse Amps (MFA).
         3) Maximum Starting Current (MSC).
         4) Full Load Amps (FLA).
         5) Total Over Current Amps (TOCA).
         6) Fan Motor: HP (W).
      l. Weight and Dimensions.
      m. Maximum number of indoor units that can be served.

n. Maximum refrigerant piping run from outdoor/condenser unit to indoor/evaporator unit.
o. Maximum height difference between outdoor/condenser unit to indoor/evaporator unit, both above and below.
p. Control Options.

2. Indoor/Evaporator Units:
   a. Cooling Capacity: Btu/h.
   b. Heating Capacity: Btu/h.
   c. Cooling Input Power: Btu/h.
   d. Heating Input Power: Btu/h.
   e. Air Flow: Cubic feet per minute (Cubic meters per second).
   f. Fan Curves.
   g. External Static Pressure (ESP): Inches WG (Pa).
   h. Sound Pressure level: dB(A).
   i. Electrical Data:
      1) Maximum Circuit Amps (MCA).
      2) Maximum Fuse Amps (MFA).
      3) Maximum Starting Current (MSC).
      4) Full Load Amps (FLA).
      5) Total Over Current Amps (TOCA).
      6) Fan Motor: HP (W).
   j. Maximum Lift of Built-in Condensate Pump.
   k. Weight and Dimensions.
   l. Control Options.
3. Control Panels: Complete description of options, control points, zones/groups.

D. Shop Drawings: Installation drawings custom-made for this project; include as-designed HVAC layouts, locations of equipment items, refrigerant piping sizes and locations, condensate piping sizes and locations, remote sensing devices, control components, electrical connections, control wiring connections. Include:
1. Detailed piping diagrams, with branch balancing devices.
2. Condensate piping routing, size, and pump connections.
3. Detailed power wiring diagrams.
4. Detailed control wiring diagrams.
5. Locations of required access through fixed construction.
6. Drawings required by manufacturer.
7. In addition to paper copies, submit shop drawings as CAD files in DXF format.
8. Architect will furnish CAD files for use in preparing shop drawings.

E. Design Data:
1. Provide design calculations showing that system will achieve performance specified.
2. Provide design data required by ASHRAE Std 90.1 I-P.

F. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

G. Operating and Maintenance Data:

1. Manufacturer's complete standard instructions for each unit of equipment and control panel.
2. Custom-prepared system operation, troubleshooting, and maintenance instructions and recommendations.
3. Identification of replaceable parts and local source of supply.

H. Warranty: Executed warranty, made out in Owner's name.

I. Specimen Warranty: Copy of manufacturer's warranties.

J. Project Record Documents: Record the following:
1. As-installed routing of refrigerant piping and condensate piping.
2. Locations of access panels.
3. Locations of control panels.

1.7 QUALITY ASSURANCE

A. A. Manufacturer Qualifications:
1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.
2. Company that provides system design software to installers.

B. Installer Qualifications: Trained and approved by manufacturer of equipment.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

1.9 WARRANTY

A. See Division 01 - General Requirements.

B. Compressors: Provide manufacturer's warranty for six (6) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of and according to the terms and conditions of the approved submitted manufacturer of this project. All warranty service work shall be performed by a factory trained service professional of the approved submitted manufacturer of this project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: The system design shown in the contract documents is based on equipment and system designed by Mitsubishi.

B. Systems manufactured by other than Mitsubishi, Trane or Daikin AC manufacturers will not be considered.

C. Systems designed and manufactured by other manufacturers will be considered by Owner under the terms described for substitutions with the following exceptions:
   1. Substitutions: See Division 01 - General Requirements.
   2. Substitution requests will be considered only if received at least 10 days prior to the bid date.
   3. Substitution requests will be considered only if required submittal data is complete; see article SUBMITTALS above.
   4. Contractor (not equipment supplier) shall certify that the use of the substitute system and equipment will not require changes to other work or re-design by Architect.
   5. Contractor or HVAC subcontractor shall certify that the substitute system will achieve the performance specified.
   6. Do not assume substitution has been accepted until formal written notice has been issued by Architect.

2.2 HVAC SYSTEM DESIGN

A. System Operation: Heating and cooling, simultaneously Heating or cooling.
   1. Zoning: Provide heating/cooling selection for each individual indoor/evaporator unit independently of all other units.
      a. Exception: Where indicated, multiple indoor/evaporator units may be controlled in groups.
   2. Zoning: Provide capability for temperature control for each individual indoor/evaporator unit independently of all other units.
   3. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.
   4. Conditioned spaces are shown on the drawings.
   5. Outdoor/Condenser unit locations are shown on the drawings.
   6. Indoor/Evaporator unit locations are shown on the drawings.
   7. Branch selector unit locations are not shown on the drawings.
   8. Required equipment unit capacities are shown on the drawings.
   9. Refrigerant piping sizes are not shown on the drawings.
   10. Connect equipment to condensate piping provided by others; condensate piping is shown on the drawings.

B. Cooling Mode Interior Performance:
   1. Daytime Setpoint: 75 degrees F, plus or minus 2 degrees F.
   2. Setpoint Range: 70 degrees F to 80 degrees F.
   3. Night Setback: 78 degrees F.
   4. Interior Relative Humidity: 60 percent, maximum.

C. Heating Mode Interior Performance:
   1. Daytime Setpoint: 68 degrees F, plus or minus 2 degrees F.
   2. Setpoint Range: 59 degrees F to 72 degrees F.

3. Night Setback: 60 degrees F.
4. Interior Relative Humidity: 0 percent, minimum.

D. Outside Air Design Conditions:
1. Summer Outside Air Design Temperature on the Building Roof: 105 degrees F dry-bulb.
2. Winter Outside Air Design Temperature: 99.6 percent heating design condition listed in ASHRAE Fundamentals Handbook - ASHRAE (FUND).

E. Energy Design Wind Speed: 100 mph.

F. Operating Temperature Ranges:
1. Simultaneous Heating and Cooling Operating Range: minus 4 degrees to 60 degrees F dry bulb.
2. Cooling Mode Operating Range: minus 4 degrees F to 110 degrees dry bulb.
3. Heating Mode Operating Range: 0 degrees F to 77 degrees F dry bulb; minus 4 degrees F to 60 degrees F wet bulb; without low ambient controls or auxiliary heat source.

G. Refrigerant Piping Lengths: Provide equipment capable of serving system with following piping lengths without any oil traps:
1. Minimum Piping Length from Outdoor/Central Unit(s) to Furthest Terminal Unit: 540 feet, actual; 620 feet, equivalent.
2. Total Combined Liquid Line Length: 3280 feet, minimum.
3. Maximum Vertical Distance Between Outdoor/Central Unit(s) and Terminal Units: 295 feet.
4. Minimum Piping Length Between Indoor Units: 49 feet.

H. Control Wiring Lengths:
1. Between Outdoor/Condenser Unit and Indoor/Evaporator Unit: 6,665 feet, minimum.
2. Between Outdoor/Condenser Unit and Central Controller: 3,330 feet, minimum.
3. Between Indoor/Evaporator Unit and Remote Controller: 1,665 feet.

I. Controls: Provide the following control interfaces:
1. For Each Indoor/Evaporator Unit: One wall-mounted wired "local" controller, with temperature sensor; locate where indicated.
2. Remote, multizone on/off control panels sufficient to control all units; locate where indicated.
3. One central remote control panel for entire system; locate where indicated.
4. One time clock control panel for entire system; locate where indicated.
5. LonWorks gateways sufficient to connect all units to building automation system by others; include wiring to gateways.
6. The building automation system by the VRV manufacturer is not specified in this section. Consult the manufacturer for details.
7. Building automation system by HVAC system manufacturer; provide one user stations located where indicated.

J. Local Controllers: Wall-mounted, wired, containing temperature sensor.

K. Remote Temperature Sensors: In addition to temperature sensors integral with indoor/evaporator units, provide wall-mounted, wired remote temperature sensors located in the same room for the following:
1. In-ceiling mounted units.
2. On-ceiling mounted units.
3. Wall mounted units mounted up high.
4. Air handling units.
5. Concealed console units.
6. Exposed console units.
7. Exception: Where a local controller with temperature sensor is provided for the particular unit and is located in the same space.

2.3 EQUIPMENT

A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
1. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
2. Refrigerant: R-410A.
3. Performance Certification: AHRI Certified; www.ahrinet.org.
4. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL, listed in ITS (DIR), and bearing the certification label.
5. Provide outdoor/condensing units capable of serving indoor unit capacity up to 200 percent of the capacity of the outdoor/condensing unit.
6. Provide units capable of serving the zones indicated.
7. Thermal Performance: Provide heating and cooling capacity as indicated, based on the following nominal operating conditions:
   a. Cooling: Indoor air temperature of 80 degrees F dry bulb, 67 degrees F wet bulb; outdoor air temperature of 95 degrees F dry bulb; and 25 feet
   b. Heating: Outdoor air temperature of 47 degrees F (8 degrees C) dry bulb, 43 degrees F wet bulb; indoor air temperature of 70 degrees F dry bulb; and 25 feet
8. Energy Efficiency: Report EER and COP based on tests conducted at “full load” in accordance with AHRI 210/240 or alternate test method approved by U.S. Department of Energy.
9. Outdoor Units: Units and their supports designed and installed to resist wind pressures defined in ASCE 7.

B. Electrical Characteristics:
1. Refer to schedules on contract documents.
2. Power - Indoor Units: 208 to 230 Volts, single phase, 60 Hz.
3. 208-230 Voltage Range: 187 to 253 volts.
4. Control: 16 volts DC.
5. Control: 18 volts DC.

C. System Controls:

1. Include self diagnostic, auto-check functions to detect malfunctions and display the type and location.

D. Remote Centralized Control Panel:

E. Remote On/Off Control Panel:

F. Time Clock Panel:

G. Unit Controls: As required to perform input functions necessary to operate system; provided by manufacturer of units.
   1. Provide interfaces to remote control and building automation systems as specified.
   2. Outside air capability.

H. Wiring:
   1. Control Wiring: 18 AWG, 2-conductor, non-shielded, non-polarized, stranded cable.
   2. Control Wiring Configuration: Daisy chain.

I. Refrigerant Piping:
   1. Provide three-pipe refrigerant system, including high/low pressure dedicated hot gas, liquid and suction lines; two-pipe systems utilizing lower temperature mixed liquid/gas refrigerant to perform heat recovery are not permitted due to reduced heating capabilities.
   2. Refrigerant Flow Balancing: Provide refrigerant piping joints and headers specifically designed to ensure proper refrigerant balance and flow for optimum system capacity and performance; T-style joints are prohibited.
   3. Insulate each refrigerant line individually between the condensing and indoor units.
   4. Copper Tube: ASTM B280, Type ACR hard drawn or annealed.
      a. Fittings: ASME B16.22 wrought copper.
      b. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.4 OUTDOOR/CONDENSING UNITS

A. Outdoor/Condensing Units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
   1. Refrigeration Circuit: Scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
   2. Refrigerant: Factory charged.
   3. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.

4. Capable of being installed with wiring and piping to the left, right, rear or bottom.
5. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted, due to potential reduction in space temperature.
6. Sound Pressure Level: As specified, measured at 3 feet from front of unit; provide night setback sound control as a standard feature; three selectable sound level steps of 55 dB, 50 dB, and 45 dB, maximum.
7. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
8. Provide refrigerant auto-charging feature and refrigerant charge check function.
9. Provide refrigerant auto-charging feature.
10. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
11. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to us indoor units.
12. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
13. Controls: Provide contacts for electrical demand shedding.

B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
   1. Designed to allow side-by-side installation with minimum spacing.
   2. Size: Module footprint of 37 inches by 31 inches , maximum.

C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
   1. Provide minimum of 2 fans for each condensing unit.
   2. External Static Pressure: Factory set at 0.12 in WG , minimum.
   3. Indoor Mounted Air-Cooled Units: External static pressure field set at 0.32 in WG, minimum; provide for mounting of field-installed ducts.
   4. Fan Airflow: As indicated for specific equipment.
   5. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.

D. Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.
   1. Copper Tube: Hi-X seamless copper tube.
   2. Coil Design: N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
   3. Corrosion Protection: Fins coated with anti-corrosion acrylic resin and hydrophilic film type E1; pipe plates coated with powdered polyester powder coating of 2.0 to 3.0 microns thickness.

E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven and fixed speed in combination to suit total capacity; minimum of one variable speed, inverter driven compressor per condenser unit; minimum of two compressors per condenser unit; capable of controlling capacity within range of 6 percent to 100 percent of total capacity.
   1. Variable Speed Control: Capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure; high/low pressures calculated by samplings of evaporator and condenser temperatures every 20 seconds, with compressor capacity adjusted to eliminate deviation from target value by changing inverter frequency or on/off setting of fixed speed compressors.
   2. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours.
   3. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
   4. Inverter Driven Compressors: PVM inverter driven, highly efficient reluctance DC (digitally commutating), hermetically sealed scroll "G2-type" with maximum speed of 7,980 rpm.
   5. Rotors: Incorporating neodymium magnets for higher torque and efficiency; at complete stop of compressor, position rotor into optimum position for low torque start.
   6. Provide each compressor with crankcase heater, high pressure safety switch, and internal thermal overload protector.
   7. Provide oil separators and intelligent oil management system.
   8. Provide spring mounted vibration isolators.

2.5 BRANCH SELECTOR UNITS

A. Branch Selector Units: Concealed boxes designed specifically for this type of system to control heating/cooling mode selection of downstream units; consisting of electronic expansion valves, subcooling heat exchanger, refrigerant control piping and electronics to facilitate communications between unit and main processor and between branch unit and indoor/evaporator units.
   1. Control direction of refrigerant flow using electronic expansion valves; use of solenoid valves for changeover and pressure equalization is not permitted due to refrigerant noise; use of multi-port branch selector boxes is not permitted unless spare ports are provided for redundancy.
   2. Provide one electronic expansion valve for each downstream unit served, except multiple indoor/evaporator units may be connected, provided balancing joints are used in downstream piping and total capacity is within capacity range of the branch selector.
   3. When branch unit is simultaneously heating and cooling, energize subcooling heat exchanger.
   4. Casing: Galvanized steel sheet; with flame and heat resistant foamed polyethylene sound and thermal insulation.
   5. Refrigerant Connections: Braze type.

6. Condensate Drainage: Provide unit that does not require condensate drainage.

2.6 INDOOR/EVAPORATOR UNITS

A. All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.
   2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.
   3. Dehumidification Function: In conjunction with wall-mounted wired remote controller.
   4. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
      a. 2-, 3-, or 4-row cross fin design with 14 to 17 fins per inch.
      b. Flare connections to refrigerant piping.
      c. Provide thermistor on liquid and gas lines.
   5. Fans: Direct-drive, with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.
   6. 6eturn Air Filter: Washable long-life net filter with mildew proof resin, unless otherwise indicated.
      a. Where high efficiency filters are indicated, provide air filter rack.
   7. Condensate Drainage: Built-in condensate drain pan with PVC drain connection.
      a. Units With Built-In Condensate Pumps: Provide condensate safety shutoff and alarm.
      b. Units Without Built-In Condensate Pump: Provide built-in condensate float switch and wiring connections.
   8. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

B. Recessed Ceiling Units - 3 FT by 3 FT: Four-way airflow cassette with central return air grille, for installation in a fixed ceiling.
   1. Face Size: 33 inches square, nominal.
   2. Cabinet Height: Maximum of 10 inches above face of ceiling.
   3. Exposed Housing: White, impact resistant, with washable decoration panel.
   4. Supply Airflow Adjustment:
      a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
      b. Field-modifiable to 3-way and 2-way airflow.
      c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.
   5. Return Air Filter: Manufacturer's standard.
   6. Minimum Capacity: As indicated on the drawings.
   7. Sound Pressure Range: Between 28 dB(A) to 33 dB(A) at low speed measured at 5 feet (1.5 m) below the unit.
   8. Fan: Direct-drive turbo type, with motor output range of 0.06 to 0.12 HP.

9. Condensate Pump: Built-in, with lift of 21 inches, minimum.
10. Provide side-mounted supply air branch duct connection.
11. Provide side-mounted fresh air intake duct connection.

C. Recessed Ceiling Units - 2 FT by 2 FT: Four-way airflow cassette with central return air grille, sized for installation in standard 24 by 24 inch lay-in ceiling grid.
1. Cabinet Height: Maximum of 12 inches above face of ceiling.
2. Exposed Housing: White, impact resistant, with washable decoration panel.
3. Maintenance Access: All electrical components accessible through decoration panel.
4. Supply Airflow Adjustment:
   a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
   b. Field-modifiable to 3-way and 2-way airflow.
   c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.
5. Sound Pressure: Measured at low speed at 5 feet below unit.
6. Fan: Direct-drive turbo type.
7. Condensate Pump: Built-in, with lift of 21 inches, minimum.
8. Provide side-mounted supply air branch duct connection.
9. Provide side-mounted fresh air intake duct connection.

D. Concealed-In-Ceiling Units: Ducted horizontal discharge and return; galvanized steel cabinet.
1. Return Air Filter: Manufacturer's standard.
2. Sound Pressure: Measured at low speed at 5 feet below unit.
3. Provide external static pressure switch adjustable for high efficiency filter operation
4. Condensate Pump: Built-in, with lift of 9 inches, minimum.
5. Switch box accessible from side or bottom.

E. Ceiling Surface-Mounted Units: White, finished casing, with removable front grille; foamed polystyrene and polyethylene sound insulation, and mounting brackets; mildew-proof polystyrene drain pan.
1. Airflow Control: Auto-swing louver that closes automatically when unit stops; five (5) steps of discharge angle, set using remote controller; upon restart, discharge angle defaulting to same angle as previous operation.
2. Sound Pressure Range: Measured at low speed at 3.3 feet below and away from unit.
3. Condensate Pump: Built-in, concealed, wide drain connection concealed in ceiling.
4. Condensate Drain Connection: Side (end), not concealed in wall.
5. Fan: Two-speed, direct-drive cross-flow type.
6. Fan Motor Output Range: 0.083 to 0.174 HP.

F. Wall Surface-Mounted Units: Finished white casing, with removable front grille; foamed polystyrene and polyethylene sound insulation; wall mounting plate; polystyrene condensate drain pan.

1. Airflow Control: Auto-swing louver that closes automatically when unit stops; five (5) steps of discharge angle, set using remote controller; upon restart, discharge angle defaulting to same angle as previous operation.
2. Sound Pressure Range: Measured at low speed at 3.3 feet below and away from unit.
3. Condensate Pump: Built-in, concealed.
4. Condensate Drain Connection: Back, with piping concealed in wall.
5. Fan: Direct-drive cross-flow type.
6. Fan Motor Output Range: From 0.054 to 0.058 HP.

G. Exposed Console Units: Top discharge grille, bottom return air; finished casing, sound-insulated with fiberglass urethane foam; auto-swing louver that closes automatically when unit stops.
1. Floor Mounting: Refrigerant and condensate lines directed downward.
2. Wall Mounting: Side (horizontal) refrigerant and condensate connections; manufacturer-supplied wall mounting template.
3. Maintenance Access Required: Not more than 3/4 inch in rear, 4 inch (102 mm) on each side.
4. Sound Pressure Range: Measured at high speed at 5 feet away and 5 feet above floor.
5. Fan: Sirocco type.
6. Fan Motor Output Range: 0.034 to 0.047 HP.

H. Concealed Console Units: Top discharge grille, bottom return air; unfinished casing, sound-insulated with fiberglass urethane foam; auto-swing louver that closes automatically when unit stops.
1. Floor Mounting: Refrigerant and condensate lines directed downward.
2. Wall Mounting: Side (horizontal) refrigerant and condensate connections; manufacturer-supplied wall mounting template.
3. Maintenance Access Required: Not more than 3/4 inch in rear, 4 inch on each side.
4. Sound Pressure Level: Measured at high speed measured at 5 feet away and 5 feet above floor.
5. Fan: Sirocco type.
6. Fan Motor Output Range: 0.034 to 0.047 HP.

I. Air Handling Units: Factory-painted heavy gage steel casing insulated with sound absorbing foil faced insulation.
1. Vertical Configuration: Top discharge air and bottom return air; floor mounted.
2. Horizontal Right Configuration: Horizontal discharge air and horizontal return air.
3. Secondary condensate drain pan; field installed.
4. Fan: Direct-drive ECM type fan with automatic airflow adjustment.
5. Provide air filter.
6. Electric Heating: Field installed, with circuit breaker for each unit.
7. External insulation; field installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that required electrical services have been installed and are in the proper locations prior to starting installation.

B. Verify that condensate piping has been installed and is in the proper location prior to starting installation.

C. Notify Architect f conditions for installation are unsatisfactory.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install refrigerant piping in accordance with equipment manufacturer's instructions.

C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).

D. Coordinate with installers of systems and equipment connecting to this system.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Provide manufacturer's field representative to inspect installation prior to startup.

3.4 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform system startup.

B. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.

C. Adjust equipment for proper operation within manufacturer's published tolerances.

3.5 CLEANING

A. Clean exposed components of dirt, finger marks, and other disfigurements.

3.6 COMMISSIONING

A. See Division 01 - General Requirements.

B. Perform commissioning.

C. Replace components not functioning properly.

3.7 CLOSEOUT ACTIVITIES

A. See Division 01 - General Requirements

B. Demonstrate proper operation of equipment to Owner's designated representative.

C. Demonstration: Demonstrate operation of system to Owner's personnel.
1. Use operation and maintenance data as reference during demonstration.
2. Conduct walking tour of project.
3. Briefly describe function, operation, and maintenance of each component.

D. Training: Train Owner's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's training personnel.
4. Location: At project site.
5. Location: Owner's offsite classroom facilities may be used.
6. Location: Provide local classroom facilities.
7. Location: At manufacturer's training facility; include travel expenses for one member of Owner's staff.

3.8 PROTECTION

A. Protect installed components from subsequent construction operations.

B. Replace exposed components broken or otherwise damaged beyond repair.

3.9 MAINTENANCE

A. See Division 01 - General Requirements.

END OF SECTION 23 8129

SECTION 23 8200 - CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Unit heaters.
   2. Cabinet unit heaters.
   3. Hydronic radiant heaters.

B. Related Sections:
   1. Section 23 04 00 – General Conditions for Mechanical Trades
   2. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
   3. Section 23 07 00 - HVAC Insulation: Execution requirements for insulation specified by this section.
   4. Section 23 21 13 - Hydronic Piping: Execution requirements for connection of chilled water, hot water, and drain piping to units specified by this section.
   5. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.
   6. Section 23 22 13 - Steam and Condensate Heating Piping: Execution requirements for connection of steam supply and steam condensate return piping to units specified by this section.
   7. Section 23 22 16 - Steam and Condensate Piping Specialties: Product requirements for steam piping specialties for placement by this section.
   8. Section 23 23 00 - Refrigerant Piping: Execution requirements for connection of refrigerant piping to units specified by this section.
   9. Section 23 31 00 - HVAC Ducts and Casings: Execution requirements for ducts specified by this section.
   10. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connection 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.

B. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. 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.

C. Product Data: Submit coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions. Submit mechanical and electrical service locations, capacities and accessories or optional items.

D. Samples: Submit one sample of each radiation cabinet color.

E. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.

C. Operation and Maintenance Data: Submit manufacturer’s descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.5 QUALITY ASSURANCE

A. 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 documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept units on site in factory packing. Inspect for damage. Store under roof.

C. 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.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer's warranty for cabinet unit heater and unit heater motors.

1.11 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two sets of filters.

PART 2 PRODUCTS

2.1 UNIT HEATERS

A. Manufacturers:
   1. Vulcan
   2. McQuay
   3. Modine
   4. Substitutions: Division 01 - Product Requirements.

B. Coils: Seamless copper tubing, 0.025 inch minimum wall thickness, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

C. Casing: 0.0478-inch thick steel with threaded pipe connections for hanger rods.

D. Finish: Factory applied baked enamel of color as selected by Architect.

E. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

F. Air Outlet: Adjustable pattern diffuser on projection models and [two] [four]-way louvers on horizontal throw models.

G. Motor: Permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models. Refer to Section 23 05 13.

H. Control: Local multi-speed disconnect switch.

I. Capacity: As scheduled on drawings.

J. Electrical Characteristics:
   1. As per schedules on drawings.

2.2 CABINET UNIT HEATERS

A. Manufacturers:
   1. Trane
   2. Vulcan
   3. McQuay
   4. Modine
   5. Substitutions: Division 01 - Product Requirements.

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.

D. Finish: Factory applied baked enamel of color as selected by Architect 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 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 or permanent washable type, located to filter air before coil.

I. Mixing Dampers: Where indicated, mixing sections with dampers.

J. Capacity: As Scheduled on drawings.

K. Electrical Characteristics:
   1. As per schedules on drawings.

2.3 HYDRONIC RADIANT HEATERS

A. Manufacturers:
   1. Airtite
   2. Rittling
   3. Sterling
   4. Substitutions: Division 01 - Product Requirements.

B. Ceiling Panels: Constructed of modular 24 inch wide aluminum extrusions with interlocking edges to lengths indicated on plans. Manufactured and assembled to sizes and configurations indicated.

C. Pipe Coil: 6 inch spacing module to incorporate extruded void into continuous 1/2 inch copper pipe is rolled and thermally bonded. Furnish return bends for two water connections to each panel.

D. Field cut radiant panels to accommodate column enclosures. Provide “around column” interconnects at each column. Refer to manufacturers instructions.

E. Where Radiant panel length exceeds 12’-0”, provide multiple radiant panel sections connected to form a single panel with each 12’-0” section provide with a supply and return piping connection.

F. Cross brace entire assembly with structural members and insulate with 1 inch thick fiberglass insulation. Configure panels within T-bar ceiling module and run wall to wall.

G. Heating Capacity: As scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. For recessed units, verify recess dimensions are correct size.

C. Verify wall construction is ready for installation.

D. Verify concealed blocking and supports are in place and connections are correctly located.

3.2 INSTALLATION

A. Protect coils to prevent damage to fins and flanges. Comb out bent fins.

B. Install coils level.

C. Make connections to coils with unions and flanges.

D. 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 float operated automatic air vents at high points complete with stop valve. Install water coils to be drainable and install drain connection at low points. Refer to Section 23 21 13.

E. On water and glycol heating coils, connect water supply piping to leaving airside of coil (counter flow arrangement). Refer to Section 23 21 13.

F. On refrigerant coils, install sight glass in liquid piping within 12 inches of coil. Refer to Section 23 23 00.

G. Insulate headers located outside airflow, insulate as specified for piping. Refer to Section 23 07 00.

H. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.

I. Protection: Install finished cabinet units with protective covers during remainder of construction.

J. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

K. Cabinet Unit Heaters: Install at locations as indicated on Drawings. Coordinate to assure correct recess size for recessed units.

L. Hydronic Units: Install with shut-off valve on supply piping and lockshield balancing valve on return piping. Where not accessible, extend vent to exterior surface of cabinet for servicing. For cabinet unit heaters, fan coil units, and unit heaters, install float operated automatic air vents with stop valve. Refer to Section 23 21 13.

3.3 CLEANING

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

D. Install new filters.

3.4 SCHEDULES

A. As per Drawings.

END OF SECTION 23 8200

SECTION 26 0400 - GENERAL CONDITIONS FOR ELECTRICAL TRADES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

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

B. This section applies to certain sections of Division 08 “Openings”, Division 11 “Equipment”, Division 12 “Furnishings”, Division 21“Fire Protection, Division 22 “Plumbing”, Division 23 "Mechanical," Division 27 “Communications”, Division 28 “Electronic safety and Security” and this section applies to all sections of Division 26, "Electrical" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades Architectural, Structural, Mechanical, Fire Protection and Plumbing, Communications, and Electronic Safety and Security shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

D. The drawings of equipment suppliers shall be examined for coordination and familiarity of work with Owner’s equipment suppliers.

1.2 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division, (Division 27 and Division 28). Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

C. It is the intent of this Section of the Specifications to establish a standard of quality and performance characteristics for basic materials and installation methods used in building electrical (communications and electronic safety and security) systems.

1.3 INTENT

A. This contract is for all labor, materials and equipment required for installation. The system shall be complete and finished in all respects, tested and ready for operation.

Work shall include calibration of equipment with factory settings. All materials, equipment and apparatus shall be new and of first class quality.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section has included the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

E. Location of all existing systems and equipment shown on floor plans is based on the best available information. The Contractor shall verify all dimensions and locations of existing systems and equipment in the field and adjust as necessary.

F. Certain items of existing equipment may be indicated for removal or relocation. Items noted for removal shall be disconnected and turned over to the Owner or disposed of by the Contractor if the Owner so requests. If instructed to dispose of items, the Contractor shall remove the items from the premises and dispose of them in a safe, legal and responsible manner and location. Items noted for relocation are intended for reuse in another location as designated on the Drawings. It shall be the responsibility of the Contractor to remove the material from its present location, store the material in a safe place and reinstall the material in its new location. Questions regarding the suitability of the material or equipment shall be brought to the attention of the Owner and Engineer in writing.

G. Wherever a particular piece of equipment, device or material is specifically indicated on the Drawings by model number, type, series or other means, that specification shall take precedence over equipment or materials specified herein. For example: If a particular switch is specified on the Drawings, its specification takes precedence over switch specified herein.

1.4 DEFINITIONS

A. Word “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Plumbing Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

B. Word “install” shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

C. Words “furnish” or “supply” shall mean purchase, deliver to, and off-load at the job site, all ready to be installed including where appropriate all necessary interim storage and protection.

D. Word “provide” shall mean furnish (or supply) and install as necessary.

E. Word “finished” refers to all rooms and areas scheduled to be painted in Room Finish Schedule on the drawings. All rooms and areas not covered in Schedule, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

F. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

G. Words “approved equal” mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

H. Word “wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

I. Word “product” shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

J. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions."

K. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

L. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

M. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Engineer's duties and responsibilities as stated in General and Supplementary Conditions.

N. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

O. Remove: The term “remove” means “to disconnect from its present position, remove from the premises and to dispose of in a legal manner.”

P. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

Q. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.5 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

B. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

C. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

D. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, higher rating, or higher value shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

1.6 SURVEYS AND MEASUREMENTS

A. Before submitting his Bid, the Contractors shall visit the site and become thoroughly familiar with all existing conditions under which his work will be installed. This Contract includes all modifications of existing systems required for the installation of new equipment. This Contract includes all necessary offsets, transitions and modifications required to install all new equipment in existing spaces. All new and existing equipment and systems shall be fully operational under this Contract before the job is considered complete. The Contractors shall be held responsible for any assumptions he makes, any omissions or errors he makes as a result of his failure to become fully familiar with the existing conditions at the site and the Contract Documents.

B. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.7 CODES AND STANDARDS

A. Reference Standard Compliance

1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.
2. Independent Testing Organization Certificate: In lieu of the label or listing, indicated above submit a certificate from an independent testing organization, competent to perform testing, and approved by the engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. The Following Codes and Standards for the state and local jurisdiction where the project is located as listed below apply to all electrical work. Wherever Codes and/or Standards are mentioned in these Specifications, the latest applicable edition or revision shall be followed:
New York State Building Code Including all Supplements
New York State Fire Safety Code Including all Supplements
The International Building Code
The International Mechanical Code
The International Plumbing Code
NFPA 70, the National Electrical Code
NFPA 101, the Life Safety Code
Model Energy Code
NECA - 1 Standard for Good Workmanship in Electrical Construction
ASHRAE 90.1 and International Energy Conservation Code

C. The following Standards shall be used where referenced by the following abbreviations:

AIA	American Institute of Architects
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
EPA	Environmental Protection Agency
FM	Factory Mutual
FSSC	Federal Specification
IEEE	Institute of Electrical and Electronics Engineers
NBS	National Bureau of Standards
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSC	National Safety Council
OSHA	Occupational Safety and Health Administration
UL	Underwriters' Laboratories

D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.8 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.9 EQUIPMENT EQUIVALENTS AND SUBSTITUTIONS

A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of workmanship, finish and design that is required. If the Contractors uses an “approved equal” alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.

B. Where one name only is used and is followed by the words “or approved equal”, the Contractor must use the item named or he is required to apply for a substitution. Where one name only is used, the Contractor must use that item named.

C. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

D. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.

E. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer’s equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

F. If an alternative or substitute item results in a difference in quantity and arrangement of piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that

specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.

G. Equipment, material or devices submitted for review as an "equivalent" shall meet the following requirements:
   1. The equivalent shall have the same construction features such as, but not limited to:
      a. Material thickness, gauge, weight, density, etc.
      b. Welded, riveted, bolted, etc., construction
      c. Finish, undercoating, corrosion protection
   2. The equivalent shall perform with the same or better operating efficiency.
   3. The equivalent shall be locally represented by the manufacturer for service, parts and technical information.
   4. The equivalent shall bear the same labels of performance certification as is applicable to the specified item, such as UL or NEMA labels.

H. Equipment, material or devices submitted for review as a "substitution" shall meet the following requirements:
   1. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.
   2. Submit three (3) copies of each request for substitution for consideration.
   3. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
      a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
      b. Samples, where applicable or requested.
      c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
      d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
      e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
      f. Cost information, including a proposal of the net change, if any in the Contract Sum.

g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.

i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.

2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.10 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 1 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

1. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
2. If an intermediate submittal is necessary, process the same as the initial submittal.
3. Allow two weeks for reprocessing each submittal.
4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Include the following information on the label for processing and recording action taken.
   a. Project name.
   b. Date.
   c. Name and address of Engineer.
   d. Name and address of Contractor.
   e. Name and address of subcontractor.
   f. Name and address of supplier.
   g. Name of manufacturer.
   h. Number and title of appropriate Specification Section.
   i. Drawing number and detail references, as appropriate.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

F. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.

1.11 SHOP DRAWINGS

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated ductwork layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review copies of all shop drawings to be incorporated in the Electrical Contract. Refer to the General Conditions and Supplementary General Conditions for the quantity of copies required for submission. Where quantities are not specified, provide seven (7) copies for review.

C. Provide shop drawings for all devices specified under equipment specifications for all systems including fire alarm, switchgear, lighting, etc., or where called for elsewhere in the Specifications, or where scheduled on the drawings, or where called out on the drawings. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures) of all shop drawings, performance cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. Submittals shall be marked with the trade involved, i.e., Electrical, HVAC, Plumbing, Fire Protection, etc. when the submittal could involve more than one trade.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

F. Failure to submit shop drawings in ample time for review shall not entitle the Contractor to an extension of Contract time. No claim for extension by reason of such default will be allowed, nor shall the Contractor be entitled to purchase, furnish and/or install equipment which has not been reviewed by the Engineer.

G. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

H. Acceptance rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings.

I. Acceptance of shop drawings shall not apply to quantity nor relieve Contractor of his responsibility to comply with intent of Drawings and Specifications.

J. Acceptance of shop drawings is final and no further changes will be allowed without the written consent of the Engineer.

K. Acceptance of shop drawings does not relieve the Contractor from submitting, coordinating and implementing schedules, forms, worksheets and similar as required for owner/operator input and approval as specified herein and required for proper system operation.

L. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

M. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to Bidding to allow for issuance of an Addendum.

N. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.12 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 01 Section "PROJECT COORDINATION," to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of light fixtures, panelboards, conduits, cabinets, etc. Include the following:
   2. Clearances for installing and maintaining insulation.
   3. Clearances for servicing and maintaining equipment, including NEC requirements and space for equipment disassembly required for periodic maintenance.
   4. Equipment connections and support details.
   5. Exterior wall and foundation penetrations.
   6. Fire-rated wall and floor penetrations.
   7. Sizes and locations of required concrete pads and bases.

B. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

D. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

E. Electronic copies of the MEP floor plans are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. If the Contractor elects to obtain the Engineers electronic files an Electronic File Release Form must be submitted. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic File Release Form, the Engineer will provide copies of the electronic files for the Contractor's use. A copy of the Electronic File Release Form is appended to the end of this specification section

1.13 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, heating, condenser, chilled water piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

E. Where work is installed prior to preparation and approval of the Coordination Drawings or in conflict with the approved Coordination drawings and if so directed in other Sections, the Contractor indicated shall prepare composite working drawings and sections clearly showing how the work is to be installed in relation to the work of other trades, at no extra charge to the Owner.

1.14 WORKMANSHIP

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled workmen, journeymen, electricians, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of electrical systems shall be performed by experienced, skilled tradesmen under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, workmanlike manner. The Engineer reserves the right to reject any work which, in his opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.15 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.

B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.16 TEMPORARY UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Provide temporary lighting in all areas, throughout construction activities.

1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.
2. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
    a. Except where overhead service must be used, install electric power service underground.
    b. Power Distribution System: Install wiring overhead, and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
3. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period.

F. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

G. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.17 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, conduit, wiring, fire alarm equipment and testing, lighting and emergency lighting, fire stopping, connection of necessary mechanical equipment, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building or are required to be maintained in a phased fashion during construction shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required to maintain existing systems operational or to accommodate the construction phasing of the project.

1.18 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or workmen and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by workmen or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.19 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer or specified in the contract documents, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct the personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer's recommendations and is operating as intended by the manufacturer. Factory start-up reports shall be included in the operation and maintenance manuals under the appropriate equipment section.

1.20 CLEANING

A. The Contractor shall thoroughly clean all equipment of all foreign substances, oils, dust, dirt, etc., inside and out before final acceptance by the Engineer.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all conduits shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
   1. Remove labels that are not permanent labels.
   2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
   3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces and panelboard interiors.
   4. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.

F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.21 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or the Owner’s representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) day notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer’s representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. At a minimum, the following equipment will require this inspection: emergency generator, fire alarm system, nurse call system, paging systems, etc. These letters will be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.

F. Demonstration shall be recorded on digital media with (2) copies turned over to the Owner.

1.22 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 1 and as follows. The Contractor shall prepare six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Emergency instructions.
6. Spare parts list.
7. Copies of warranties.
8. Wiring diagrams.
9. Recommended "turn around" cycles.
10. Inspection procedures.
11. Shop Drawings and Product Data.
12. Equipment start-up reports.

C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, filter quantities and sizes, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.

1.23 ACCEPTANCES

A. The equipment, materials, workmanship, design and arrangement of all work installed under the Electrical Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Electrical Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Electrical Sections. The intent to use the exact makes specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of the awarding of the Contract. In such instances, deviations may be made pending acceptance by the Engineer or the Owner's representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Electrical Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.24 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
3. Note related Change Order numbers where applicable.
4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
5. Final record documents shall be prepared in the latest Revit version and digital media for all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.25 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties are to be included:
   1. General close-out requirements included in Section "Project Close-out."
   2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions 02 through [50].
   3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.26 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.
   1. Refer to individual Sections of Divisions 2 through [16][50] for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
   1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the installer.
   2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.
   3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.27 GUARANTEES

A. The Contractor shall guarantee all material and workmanship under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner. During this guarantee period, all defects developing through faulty equipment, materials or workmanship shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineers satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided

1.28 PROJECT CLOSE-OUT

A. Contractor shall submit annual maintenance proposal to the Architect/Engineer for review and approval as part of the close out documents.

B. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

C. Deliver tools, spare parts, extra stock, and similar items.

D. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

E. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

F. Inspection Procedures: On receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
   1. The Engineer will repeat inspection when requested and assured that the Work has been substantially completed.
   2. Results of the completed inspection will form the basis of requirements for final acceptance.

END OF SECTION 26 0400

Electronic File Release Form

DELIVERY OF ELECTRONIC FILES FOR: _____
Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys' fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____ _____
Client's Signature Date

_____
Company - Title

_____ _____
Architects' Signature Date

_____
Firm - Title

_____ _____
Owner's Signature Date

_____
Company - Title

SECTION 26 0503 - EQUIPMENT WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

1.2 RELATED SECTIONS

A. Division 01 – General Requirements

B. Section 260400 – General Conditions for Electrical Trades.

C. All of Division 26, Division 27, Division 28 Sections.

1.3 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.4 SUBMITTALS

A. See Division 01 - General Requirements

B. Product Data: Submit device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Provide manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with latest adopted version of applicable building code, including any addendum or supplements.

1.6 CLOSEOUT SUBMITTALS

A. See Division 01- General Requirements

B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.7 COORDINATION

A. See Division 01 - General Requirements

B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 ATTACHMENT PLUGS

A. Manufacturers:
1. Hubbell.
2. Leviton.
3. Legrand / Pass & Seymour
4. Substitutions: Division 01 - General Requirements.

B. Attachment Plug Construction: Conform to NEMA WD 1.

C. Configuration: NEMA WD 6; match receptacle configuration to outlet furnished for equipment.

D. Rating: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

2.2 FLEXIBLE CORD

A. Manufacturers:
1. General Cable.
2. Southwire Company.
3. Hubbell Incorporated.
4. Substitutions: Division 01 - General Requirements.

B. Cord Construction:
1. Type SJO multi-conductor flexible cord with identified neutral and equipment grounding conductor, suitable for use in damp locations.
2. Rating: 600V, amperage to match full load or MCA rating of equipment being served, sized per NFPA 70, Article 400.5.
3. Conductor Identification:

C. Neutral:
1. White or gray colored braid.
2. Colored tracer in the braid.
3. White, gray, or light blue insulation.
4. Ridges, grooves, or white stripes on the exterior of the cord.

D. Equipment Grounding Conductor:
1. Continuous green color.

2. Continuous identifying marker distinguishing it from the other conductors.

E. Connectors:
1. Type: All steel fitting with gland nut, seal, and bushing for securing cable.
2. Suitable for use for passing cord thru enclosure or bulkhead.
3. Provide with suitable NEMA rating for application.

F. Strain Relief:
1. Type: Aluminum fitting with galvanized steel mesh, duct-tight
2. Suitable for size and type of flexible cord being used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 EXISTING WORK

A. Remove exposed abandoned equipment wiring connections, including abandoned connections above accessible ceiling finishes.

B. Disconnect abandoned utilization equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not removed.

C. Extend existing equipment connections using materials and methods compatible with existing electrical installations, or as specified.

3.3 INSTALLATION

A. Make conduit connections to equipment using flexible metal conduit. Use liquidtight flexible metal conduit with watertight connectors in damp or wet locations.

B. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

C. Provide receptacle outlet and plate to accommodate connection to attachment plug.

D. Provide flexible cord and cord-cap for field-supplied attachment plug. Coordinate exact requirements with equipment supplier.

E. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

G. Install terminal block jumpers to complete equipment wiring requirements.

H. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

I. Coolers and Freezers: Coordinate the location of openings in freezer and cooler walls, floor, and ceilings with equipment supplier. Seal openings.

J. Install conduit and wiring for interconnection of motorized door operator and motorized fire door control stations, safety devices and accessories to complete equipment wiring requirements.

K. Install conduit and wiring for interconnection of specialty equipment (motorized divider partitions, scoreboards, motorized backboards, shot clocks, motorized shades…etc.) control stations, safety devices and accessories to complete equipment wiring requirements.

L. Install conduit and wiring for interconnection of receptacles, lighting and switches furnished with equipment (fume hoods, food service equipment, furnishings…etc.).

M. Install conduit and wiring for interconnection of alarm initiating devices, control panels and annunciators furnished with equipment.

N. Install conduit and wiring for interconnection of power supplies furnished by other divisions.

O. Install conduit and wiring for interconnection of fire alarm initiating devices, control panels, motors, disconnect switches, and card access equipment and furnished with elevator equipment.

3.4 ADJUSTING

A. See Division 01 – General Requirements.

B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

3.5 EQUIPMENT CONNECTION SCHEDULE

A. Refer to drawings.

END OF SECTION 26 0503

SECTION 26 0519 - ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wiring connectors.

D. Heat shrink tubing.

E. Oxide inhibiting compound.

F. Wire pulling lubricant.

G. Cable ties.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements.

B. Division 07 – Thermal and Moisture Protection.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 28 3100 - Fire Detection and Alarm: Fire alarm system conductors and cables.

F. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

G. Section 31 2323 - Fill: Bedding and backfilling.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).

D. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

E. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.

F. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); Federal Specification; Revision A, 2008.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

H. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.

I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 183 - Manufactured Wiring Systems; Current Edition, Including All Revisions.

O. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

Q. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

R. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

S. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

T. UL 719 – Nonmetallic-Sheathed Cables; Current Edition, Including All Revisions.

U. UL 854 – Service-Entrance Cables; Current edition, Including All Revisions.

V. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

W. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 – General Requirements.
   2. Extra Manufactured Wiring System Cable Assemblies: One of each configuration, 6 foot lengths.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted, unless noted otherwise.

D. Service entrance cable is not permitted, unless noted otherwise.

E. Armored cable is not permitted.

F. Metal-clad cable is permitted as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet.
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
   2. In addition to other applicable restrictions, may not be used:
      a. Life Safety or Critical Power.
      b. Homeruns from first device, such as lighting fixture, MEP equipment, wiring device to panelboards.
      c. Where not approved for use by the authority having jurisdiction.
      d. Where exposed to view.
      e. Where exposed to damage.
      f. For damp, wet, or corrosive locations.
      g. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.
      h. For patient care areas requiring redundant grounding, unless using HCFC Type cable.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide conductors and cables with lead content less than 300 parts per million.

D. Provide new conductors and cables manufactured not more than one year prior to installation.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

F. Comply with NEMA WC 70.

G. Comply with FS A-A-59544 where applicable.

H. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

I. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

J. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

K. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.

L. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

M. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

N. Conductor Material:
   1. Provide copper conductors only.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, or ASTM B8unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

O. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet 10 AWG minimum, and sized for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet 8 AWG minimum, and sized for voltage drop.
   2. Control Circuits: 14 AWG.

P. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

Q. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
   a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
   a. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral/Grounded: White.
   b. Equipment Ground, All Systems: Green.
   c. Isolated Ground, All Systems: Green with yellow stripe.
   d. Travelers for 3-Way and 4-Way Switching: Pink.
   e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
   f. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
   a. Cerro Wire LLC.
   b. Southwire Company
   c. General Cable Technologies
   d. Substitutions: See Section 01 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
   a. Size 10 AWG and Smaller: Solid.
   b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
   a. Installed Underground: Type XHHW-2.

2.4 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Manufacturers:
   1. Cerro Wire LLC.
   2. Encore Wire Corporation.
   3. Southwire Company.
   4. General Cable Technologies.
   5. Substitutions: See Section 01 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Provide equipment grounding conductor unless otherwise indicated.

D. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

E. Insulation Voltage Rating: 600 V.

F. Insulation: Type XHHW-2.

2.5 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc.
   2. Encore Wire Corporation
   3. Southwire Company
   4. General Cable Technologies
   5. Substitutions: See Section 01 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide oversized neutral conductors where indicated or required.

G. Provide dedicated neutral conductor for each phase conductor where indicated or required.

H. Grounding: Full-size integral equipment grounding conductor.
   1. Provide additional isolated/insulated grounding conductor where indicated or required.

I. Armor: Steel, interlocked tape.

J. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.6 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:
1. Copper conductors 10 AWG and smaller: Install insulated spring wire connectors with plastic caps
2. Copper Conductors Size 8 AWG: Install solderless pressure connectors with insulating covers
3. Copper Conductors Size 6 AWG and larger: Install pressure connectors or split bolt connectors.

D. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:
   a. 3M
   b. Ideal Industries, Inc.

c. NSI Industries LLC.
d. Ilsco
e. Erico
f. Substitutions: See Division 01 – General Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
a. Burndy LLC.
b. Ilsco
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
1. Manufacturers:
a. Burndy LLC.
b. Ilsco
c. Thomas & Betts Corporation
d. Erico
e. Substitutions: See Division 01 – General Requirements.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:
a. Burndy LLC.
b. Ilsco
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements.

2.7 WIRING ACCESSORIES

A. Electrical Tape:
1. Manufacturers:
a. 3M
b. Plymouth Rubber Europa
c. Substitutions: See Division 01 – General Requirements.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F .
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

1. Manufacturers:
   a. 3M
   b. Burndy LLC.
   c. Thomas & Betts Corporation
   d. Substitutions: See Division 01 – General Requirements.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
   1. Manufacturers:
      a. Burndy LLC.
      b. Ideal Industries, Inc.
      c. Ilsco
      d. Substitutions: See Division 01 – General Requirements.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
   1. Manufacturers:
      a. 3M
      b. American Polywater Corporation
      c. Ideal Industries, Inc.
      d. Substitutions: See Division 01 – General Requirements.

E. Cable Ties: Material and tensile strength rating suitable for application.
   1. Manufacturers:
      a. Burndy LLC.
      b. Substitutions: See Section 01 - Product Requirements.
   2. Provide plenum rated cable ties.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.

E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

3.2 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as shown on the drawings.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.3 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.4 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated and routing is not shown, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is not permitted where indicated:
      a. Dedicated neutral conductors are considered current-carrying conductors.
      b. Increase size of conductors as required accounting for ampacity derating.
      c. Size raceways, boxes, etc. to accommodate conductors.
   7. Common Neutrals: Not allowed.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
   2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

H. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
      c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.
      d. Secure at maximum interval of 5 ft.
      e. Install parallel and perpendicular to building lines.
      f. Bundle cables in common routes back to panelboards.
      g. Secure from structure using suitable J-hooks or plenum rated cable ties.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Do not remove conductor strands to facilitate insertion into connector.
   3. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
      b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
   3. Wet Locations: Use heat shrink tubing.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Identify conductors and cables in accordance with Section 26 0553.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07.

S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.5 FIELD QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
   1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Chemically-enhanced ground electrodes.

G. Ground plate electrodes.

H. Ground enhancement material.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Division 03– Concrete.

C. Division 09 - Finishes.

D. Section 26 0400 – General Conditions for Electrical Trades

E. Section 26 4113 – Facility Lightning Protection

F. Section 26 0519 - Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
   1. Includes oxide inhibiting compound.

G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 33 7900 - Site Grounding.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

F. NFPA 780 - Standard for the Installation of Lightning Protection Systems.

G. UL 467 - Grounding and Bonding Equipment.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:
1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction. Provide new grounding and bonding system components as indicated under this specification section if determined that one or all the existing grounding components are unsuitable for reuse or are indicated as new in the drawings. Grounding and bonding components listed under this specification identify all acceptable components and requirements for their installation.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
   a. Provide continuous grounding electrode conductors without splice or joint.
   b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
2. Metal Underground Water Pipe(s):
   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
   c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Other Metal Piping:
   a. Provide connection to all metallic gas piping and miscellaneous metal piping of continuous lengths.
   b. Bond in accordance with NFPA 70.
   c. Size bonding conductor in accordance with NFPA 70.
4. Metal In-Ground Support Structure:
   a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
5. Concrete-Encased Electrode:
   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
6. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 22 feet from each other and any other ground electrode.
   c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
   d. Provide ground enhancement material around electrode where indicated.
   e. Provide ground access well for each electrode.
7. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
8. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
   b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.

c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

I. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
   c. Metal process piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.

10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
11. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
12. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.

J. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
   a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
   b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
   c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
   d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

K. Facility Lightning Protection Systems, in Addition to Requirements of Section 26 4100:
1. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.
2. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0519:
1. Use insulated copper conductors unless otherwise indicated.
   a. Exceptions:
      1) Use bare copper conductors where installed underground in direct contact with earth.
      2) Use bare copper conductors where directly encased in concrete (not in raceway).
2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gage of specified conductors.

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   a. Exceptions:
      1) Use mechanical connectors for connections to electrodes at ground access wells.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
   a. Exceptions:
      1) Use exothermic welded connections for connections to metal building frame.
4. Manufacturers - Mechanical and Compression Connectors:
   a. Advanced Lightning Technology (ALT)
   b. Burndy LLC.
   c. Harger Lightning & Grounding
   d. Thomas & Betts Corporation
   e. Substitutions: See Division 01 - General Requirements.
5. Manufacturers - Exothermic Welded Connections:
   a. Burndy LLC.
   b. Cadweld, a brand of Erico International Corporation
   c. ThermOweld, a brand of Continental Industries, Inc.Substitutions: See Division 01 - General Requirements.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
   a. Advanced Lightning Technology (ALT)
   b. Erico International Corporation
   c. Harger Lightning & Grounding
   d. ThermOweld, a brand of Continental Industries, Inc.
   e. Substitutions: See Division 01 - General Requirements.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
5. Manufacturers:
   a. Advanced Lightning Technology (ALT)
   b. Erico International Corporation
   c. Galvan Industries, Inc.
   d. Harger Lightning & Grounding
   e. Substitutions: See Division 01 - General Requirements.

F. Chemically-Enhanced Ground Electrodes:
1. Description: Copper tube factory-filled with electrolytic salts designed to provide a low-impedance ground in locations with high soil resistivity; straight

(for vertical installations) or L-shaped (for horizontal installations) as indicated or as required.
2. Length: 10 feet.
3. Integral Pigtail: Factory-attached, sized not less than grounding electrode conductor to be attached.
4. Backfill Material: Grounding enhancement material recommended by electrode manufacturer.
5. Manufacturers:
   a. Advanced Lightning Technology (ALT)
   b. Erico International Corporation
   c. Harger Lightning & Grounding
   d. ThermOweld, subsidiary of Continental Industries
   e. Substitutions: See Division 01 - General Requirements.

G. Ground Plate Electrodes:
1. Material: Copper.
2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.
3. Manufacturers:
   a. Advanced Lightning Technology (ALT)
   b. Erico International Corporation
   c. Harger Lightning & Grounding
   d. ThermOweld, subsidiary of Continental Industries
   e. Substitutions: See Division 01 - General Requirements.

H. Ground Enhancement Material:
1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
2. Resistivity: Not more than 20 ohm-cm in final installed form.
3. Manufacturers:
   a. Erico International Corporation
   b. Harger Lightning & Grounding
   c. ThermOweld, subsidiary of Continental Industries
   d. Substitutions: See Division 01 - General Requirements.

I. Oxide Inhibiting Compound: Comply with Section 26 0519.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches deep in accordance with NFPA 70 or provide ground plates.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
   2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.

E. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

F. Install in accordance with IEEE 142.

G. Install rod electrodes at locations as indicated on Drawings. Install additional rod electrodes to achieve specified resistance to ground.

H. Install grounding and bonding conductors concealed from view.

I. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

J. Install continuous grounding using underground cold water system, driven rods and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

K. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

L. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

M. Permanently attach equipment and grounding conductors prior to energizing equipment.

N. Common Ground Bonding with Lightning Protection System: Bond electric power system, grounding electrode system directly to lightning protection system earth connection at closest point to electric service grounding electrode. Use bonding conductor sized the same as system grounding conductor and install in conduit.

O. Identify grounding and bonding system components in accordance with Section 26 0553.

3.4 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26 0526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for electrical equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Division 03 - Cast-in-Place Concrete: Concrete equipment pads.

C. Section 260400 – General Conditions for Electrical Trades

D. Section 260533 – Raceway and Boxes for Electrical Systems: Additional support and attachment requirements for conduits.

E. Section 265100 - Lighting: Additional support and attachment requirements for interior luminaires.

1.3 REFERENCE STANDARDS

A. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. See Division 01: General Requirements.

B. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components being installed.
2. Coordinate the work with other trades and provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

C. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Division 03.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with latest adopted version of applicable building code, including any addendum or supplements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D. Installer Qualifications for Field-Welding: As specified in Section 260400 General Requirements for Electrical Trades.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, fiberglass or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; zinc plated steel.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation
      b. Erico International Corporation
      c. O-Z/Gedney, a brand of Emerson Industrial Automation
      d. Thomas & Betts Corporation
      e. Substitutions: See Division 01 - General Requirements.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
   1. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation
      b. Erico International Corporation
      c. O-Z/Gedney, a brand of Emerson IndustrialAutomation

d. Thomas & Betts Corporation
e. Substitutions: See Division 01 - General Requirements.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
2. Channel Material:
   a. Indoor Dry Locations: Use galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
3. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
5. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation
   b. Thomas & Betts Corporation
   c. Unistrut, a brand of Atkore International Inc.
   d. Substitutions: See Division 01- General Requirements.
   e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Busway Supports: 1/2 inch diameter.
   c. Single Conduit up to 1 inch trade size: 1/4 inch diameter.
   d. Single Conduit larger than 1 inch trade size: 3/8 inch diameter.
   e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
   f. Outlet Boxes: 1/4 inch diameter.
   g. Luminaires: 1/4 inch diameter.

F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
4. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation
   b. Erico International Corporation
   c. PHP Systems/Design
   d. Unistrut, a brand of Atkore International Inc.
   e. Substitutions: See Division 01 - General Requirements.

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners may be used with:
    a. Permission by Architect.
    b. Permission by Structural Engineer.
    c. Use only threaded studs; do not use pins.
11. Hammer-driven anchors and fasteners are permitted as follows:
    a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction (when specified).
    b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction (when specified).
12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch minimum base metal thickness.
    d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
13. Manufacturers - Mechanical Anchors:
    a. Hilti, Inc.
    b. ITW Red Head, a division of Illinois Tool Works, Inc.
    c. Powers Fasteners, Inc.
    d. Simpson Strong-Tie Company Inc.
    e. Substitutions: See Division 01 - General Requirements.
14. Manufacturers - Powder-Actuated Fastening Systems:
    a. Hilti, Inc.
    b. ITW Ramset, a division of Illinois Tool Works, Inc. Powers Fasteners, Inc.
    c. Simpson Strong-Tie Company Inc.
    d. Substitutions: See Division 01 - General Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated, do not provide support from roof deck.

F. Do not penetrate, notch, or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Division 03.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 26 05 33.

I. Cable Tray Support and Attachment: Also comply with Section 26 05 36.

J. Box Support and Attachment: Also comply with Section 26 05 33.

K. Luminaire Support and Attachment: Also comply with Section 26 51 00.

L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners according to manufacturer's recommended torque settings.

N. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 26 0529

SECTION 26 0533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Conduit Applications
2. General Requirements
3. Galvanized steel rigid metal conduit (RMC).
4. Intermediate metal conduit (IMC)
5. Flexible metal conduit (FMC).
6. Liquidtight flexible metal conduit (LFMC).
7. Electrical metallic tubing (EMT).
8. Rigid polyvinyl chloride (PVC) conduit.
9. Liquidtight flexible nonmetallic conduit (LFNC).
10. Non-metallic tubing
11. Surface metal raceway
12. Wireway
13. Boxes
14. Accessories.

B. Related Sections:
1. Section 260503 - Equipment Wiring Connections.
2. Section 260519 – Electrical Power Conductors and Cables.
3. Section 260526 - Grounding and Bonding for Electrical Systems.
4. Section 260529 - Hangers and Supports for Electrical Systems.
5. Section 260534 - Floor Boxes for Electrical Systems.
6. Section 260553 - Identification for Electrical Systems.
7. Section 262726 - Wiring Devices.
8. Section 270533 - Raceway and Boxes for Communications Systems.
9. Section 280533 - Raceway and Boxes for Electronic Safety and Security.

1.2 REFERENCES

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC);

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S);

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A);

D. NECA 1 - Standard for Good Workmanship in Electrical Construction;

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT);

F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit;

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC);

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable;

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit;

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit;

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing;

L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT);

M. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

N. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

O. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

R. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

S. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

T. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

U. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

V. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

W. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

X. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

Y. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

Z. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

AA. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.3 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for all conduits and fittings outlined in Part 2.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Shop Drawings:
1. Indicate proposed arrangement for conduits to be installed within or under structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

E. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs (where permitted), and conduits 2 inch trade size and larger.

F. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

G. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 – General Requirements.
   2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

D. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

1.8 COORDINATION

A. See Division 01 – General Requirements

B. Coordinate installation of outlet boxes for equipment connected under Section 260503.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

D. Electrical contractor is responsible to fully coordinate with the site and concrete contractors and all other trades when routing conduit underslab. Routing of conduit underslab may be acceptable, provided spacing of conduits is adequate for proper backfilling of area surrounding conduits. Adequate spacing shall mean using factory made conduit spacers that allow for a minimum of 3-inches for backfilling with sand or 3 times the pipe diameter for backfilling with a structural fill. Proposed conduit routing, installation and methods and backfilling procedures shall be submitted to the Engineer for review prior to installation.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

C. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications listed below. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
   1. Underground:
      a. Under Slab on Grade: Use schedule 40 rigid PVC conduit with galvanized steel rigid metal conduit sweeps. Provide cast metal boxes or nonmetallic handhole. Applications limited to:
         1) Panelboard feeders
         2) Floor boxes
         3) Free-standing equipment
      b. Exterior, Within Trench: Use schedule 40 or schedule 80 rigid PVC conduit with galvanized steel rigid metal conduit sweeps. Provide cast metal boxes or nonmetallic handhole.
      c. Exterior, Concrete Encased: Use Type EB rigid PVC conduit. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   2. Embedded Within Concrete:
      a. Within Slab on Grade: Floor box applications only.
      b. Within Slab Above Ground: Not permitted.
      c. Within Concrete Walls Above Ground: Use Type EB rigid PVC conduit. Provide flush mounted box rated for masonry applications.
   3. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT). Provide flush mounted boxes rated for masonry applications.
   4. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT) or MC cable (where allowed).Provide flush mounted sheet-metal boxes.
   5. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT) or MC cable (where allowed).
   6. Interior, Damp or Wet Locations Provide:
      a. Rigid steel conduit
      b. Intermediate metal conduit
      c. Electrical metallic tubing (EMT) with compression fittings
      d. Schedule 40 PVC conduit
      e. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
   7. Exposed, Interior dry locations: Use electrical metallic tubing (EMT)
   8. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.

a. Locations subject to physical damage include, but are not limited to:
   1) Where exposed below 8 feet, except within electrical and communication rooms or closets.

9. Exposed, Exterior: Use galvanized steel rigid metal conduit
10. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
    a. Maximum Length: 6 feet.
11. Connections to Vibrating Equipment:
    a. Dry Locations: Use flexible metal conduit or MC Cable.
    b. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
    c. Maximum Length: 6 feet unless otherwise indicated.
    d. Vibrating equipment includes, but is not limited to:
       1) Transformers.
       2) Motors.
       3) Pumps.
       4) Fans.
12. Exposed Dry Finished Locations: Provide surface metal raceway and fittings. Unless specified on drawings, requires design team approval for use of surface metal raceway in finished locations. Coordinate all vertical runs of surface raceway with the architect prior to installation.

2.2 GENERAL REQUIREMENTS

A. Fittings for Grounding and Bonding: Also comply with Section 260526.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch trade size.
   2. Branch Circuit Homeruns: 3/4 inch trade size.
   3. Control Circuits: 1/2 inch trade size.
   4. Flexible Connections to Luminaires: 3/4 inch trade size.
   5. Underground, Interior: 1 inch trade size.
   6. Underground, Exterior: 1 inch trade size.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube and Conduit.
   2. Western Tube and Conduit.
   3. Wheatland Tube Company.
   4. Substitutions: See Division 01 – General Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc.
b. O-Z/Gedney.
c. Thomas & Betts Corporation.
d. Substitutions: See Division 01 – General Requirements
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
5. Do not use die cast zinc fittings.
6. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube and Conduit.
2. Western Tube and Conduit.
3. Wheatland Tube Company.
4. Substitutions: See Division 01 – General Requirements.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc
b. O-Z/Gedney, a brand of Emerson Industrial Automation
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type or compression fittings only.

2.5 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. Carlon Electrical Products.
2. Allied Tube and Conduit.
3. AFC Cable Systems, Inc
4. Substitutions: See Division 01 – General Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc
b. O-Z/Gedney, a brand of Emerson Industrial Automation
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
a. Do not use die cast zinc fittings.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. Carlon Electrical Products.
2. Allied Tube and Conduit.
3. AFC Cable Systems, Inc
4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc
b. O-Z/Gedney, a brand of Emerson Industrial Automation
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel
a. Do not use die cast zinc fittings.

2.7 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube and Conduit.
2. Western Tube and Conduit.
3. Wheatland Tube Company.
4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc
b. O-Z/Gedney, a brand of Emerson Industrial Automation
c. Thomas & Betts Corporation
d. Substitutions: See Division 01 – General Requirements

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
4. Connectors and Couplings: Use compression (damp or wet location)or set-screw type elsewhere

2.8 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. Cantex Inc
2. Carlon, a brand of Thomas & Betts Corporation
3. JM Eagle
4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.9 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
1. AFC Cable Systems, Inc
2. Electri-Flex Company
3. International Metal Hose
4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.10 WIREWAY

A. Manufacturers:
1. Carlon Electrical Products.
2. Thomas & Betts Corp.
3. Hoffman.
4. Substitutions: See Division 01 – General Requirements

B. Product Description: General purpose.

C. Knockouts: Manufacturer's standard.

D. Cover: Screw cover.

E. Connector: Flanged.

F. Fittings: Lay-in type with removable top, bottom, and side; captive screws.

G. Finish: Rust inhibiting primer coating with gray enamel finish.

2.11 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Manufacturers:
   a. Cooper Crouse-Hinds, a division of Eaton Corporation
   b. Hubbell Incorporated; Bell Products
   c. Hubbell Incorporated; RACO Products
   d. Leviton
   e. O-Z/Gedney, a brand of Emerson Industrial Automation
   f. Thomas & Betts Corporation
   g. Substitutions: See Division 01 – General Requirements
2. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
3. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
4. Use cast iron boxes or cast aluminum boxes with threaded hubs where exposed galvanized steel rigid metal conduit is used.
5. Use cast aluminum boxes with threaded hubs where aluminum rigid metal conduit is used.
6. Use nonmetallic boxes where exposed rigid PVC conduit is used.
7. Use suitable concrete type boxes where flush-mounted in concrete.
8. Use suitable masonry type boxes where flush-mounted in masonry walls.
9. Use raised covers suitable for the type of wall construction and device configuration where required.
10. Use shallow boxes where required by the type of wall construction.
11. Do not use "through-wall" boxes designed for access from both sides of wall.
12. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

13. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
14. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
15. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
16. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
17. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep trade size.
    b. Communications Systems Outlets:
        1) Minimum 4 inch square by 2-1/8 inch trade size.
        2) Provide with single-gang drywall ring.
        3) Comply with Section 27 0533.
    c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep trade size.
18. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches :
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches :
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable.
    c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
    d. Provide with grounding stud.
    e. Provide with document pocket in cover.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation
    b. Hoffman, a brand of Pentair Technical Products
    c. Hubbell Incorporated; Wiegmann Products
    d. Substitutions: See Division 01 – General Requirements

D. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
1. Manufacturers:

a. Appleton, a brand of Emerson Industrial Automation
b. Cooper Crouse-Hinds, a division of Eaton Corporation
c. Hubbell Incorporated; Killark Products
d. Substitutions: See Division 01 – General Requirements

2. Provide outlet boxes and sealing fittings that comply with Article 501 of the NEC based on the classification of the area.

2.12 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).

D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

E. Mechanical Sleeve Seals

F. Manufacturers:

1. Thunderline Link-Seal, Inc.
2. NMP Corporation.
3. PSI Link-Seal.
4. Substitutions: See Division 01 – General Requirements

G. 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.

H. Use: Provide for all penetrations through foundation walls.

PART 3 EXECUTION

3.1 EXAMINATION

A. See Division 01 – General Requirements.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

C. Verify that field measurements are as shown on drawings.

D. Verify that mounting surfaces are ready to receive conduits.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 EXISTING WORK

A. Remove exposed abandoned raceway including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations or as specified.

F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 260526.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 260529.

C. Identify raceway and boxes in accordance with Section 260553.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

E. Install products in accordance with manufacturer's instructions.

F. Perform work in accordance with NECA 1 (general workmanship).

G. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated and routing is not shown, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
      e. Interior finished spaces.
   5. Conduits installed underslab or embedded in concrete (see section 2.1 where applicable) may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

6. Arrange conduit to maintain adequate headroom, clearances, and access.
7. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
8. Arrange conduit to provide no more than 150 feet between pull points.
9. Route conduits above water and drain piping where possible.
10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
11. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
12. Maintain minimum clearance of 12 inches between conduits and surfaces exceeding 104 degrees F. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
13. Group parallel conduits in the same area together on a common rack.

H. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
5. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
10. Use of spring steel conduit clips for support of conduits is not permitted.
11. Use of wire for support of conduits is not permitted.

I. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.

6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs 6" above finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.

J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable mechanical sleeve seals where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07 Section 07 8400.

K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

L. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

M. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

N. Provide grounding and bonding in accordance with Section 260526.

O. Identify conduits in accordance with Section 260553.

P. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.

Q. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

3.4 INSTALLATION – BOXES

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Install gang box with plaster ring for single device outlets.

I. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Division 08 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
      b. Communications Systems Outlets: Comply with Section 270533.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.

8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual non-communicating stud cavities or protect both boxes with listed putty pads.
    b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260534.

J. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 260529.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Install stamped steel bridges to fasten flush mounting outlet box between studs.
5. Install adjustable steel channel fasteners for hung ceiling outlet box.

K. Install boxes plumb and level.

L. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

M. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Division 03.

N. Install boxes as required to preserve insulation integrity.

O. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

P. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

Q. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.

S. Close unused box openings.

T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

U. Provide grounding and bonding in accordance with Section 260526.

V. Identify boxes in accordance with Section 260553.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Locate outlet boxes to allow luminaires positioned as indicated on reflected ceiling plan.

B. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. See Division 01 – General Requirements Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. See Division 01 – General Requirements

B. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

C. Clean exposed surfaces and restore finish.

3.8 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 0533

SECTION 26 0534 - FLOOR BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes floor boxes; floor box service fittings; poke-through fittings; and access floor boxes.

B. Related Sections:
1. Section 07 84 00 - Firestopping: Firestopping for electrical work.
2. Section 26 05 29 - Hangers and Supports for Electrical Systems: Firestopping for electrical work.
3. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
4. Section 26 27 26 - Wiring Devices: Receptacles for installation in floor boxes.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog data for floor boxes service fittings.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of each floor box and poke-through fitting.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.

1.6 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two protective rings.

C. Furnish two carpet rings.

PART 2 PRODUCTS

2.1 FLOOR BOXES

A. Manufacturers:
   1. Per Floorbox Schedule in the drawings.
   2. Substitutions: Section 01 60 00 - Product Requirements

B. Material: Cast metal.

C. Configuration: As indicated on drawings to satisfy Power, AV, and Technology design needs. Provide assembly with adequate gang sizing.

D. Cover finish: Shall be coordinated during the submittal process. Cover shall be in-use type.

E. Shape: Per model# as scheduled.

2.2 POKE-THRU FITTINGS

A. Manufacturers:
   1. Per Floorbox Schedule in the drawings.
   2. Substitutions: Section 01 60 00 - Product Requirements

B. Material: Cast metal.

C. Product Description: Assembly comprising of service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination.

D. Fire rating to match that of floor. Coordinate and verify with Architectural/Structural drawings. Provide fire proofing for all penetrations with approved fire proofing material.

E. Service fitting type: Flushed.

F. Shape: Round.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify locations of floor boxes and outlets per the drawings and coordinate with the Architect prior to rough-in.

C. Verify openings in access floor are in proper locations.

3.2 INSTALLATION

A. Boxes and fittings are indicated on Drawings in approximate locations unless

dimensioned. Adjust box location up to 10 feet to accommodate intended purpose.

B. Install protective rings on active flush cover service fittings.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust floor box flush with finish flooring material.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

END OF SECTION 26 0534

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. See Division 01 – General Requirements

B. Division 09 - Finishes.

C. Section 260400 – General Conditions for Electrical Trades.

D. All of Divisions 26, 27 & 28.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 70 - National Electrical Code.

D. NFPA 70E - Standard for Electrical Safety in the Workplace

E. UL 969 - Marking and Labeling Systems.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.8 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature and humidity is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Switchgear:
   1) Identify switchgear name.
   2) Identify ampere rating.
   3) Identify voltage and phase.
   4) Identify power source and circuit number. Include location when not within sight of equipment.
   5) Use identification nameplate to identify main and tie devices.
   6) Use identification nameplate to identify load(s) served for each branch device, including spares and prepared spaces.

b. Switchboards:
   1) Identify switchboard name.
   2) Identify ampere rating.
   3) Identify voltage and phase.
   4) Identify power source and circuit number. Include location when not within sight of equipment.
   5) Use identification nameplate to identify main overcurrent protective device.
   6) Use identification nameplate to identify load(s) served for each branch device, including spares and prepared spaces.

c. Panelboards:
   1) Identify panel name.
   2) Identify ampere rating.
   3) Identify voltage and phase.
   4) Identify power source and circuit number. Include location when not within sight of equipment.
   5) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
   6) Use typewritten circuit directory to identify load(s) served for panelboards with a door, including spares and spaces

d. Enclosed switches, circuit breakers, and motor controllers:
   1) Identify voltage and phase.
   2) Identify power source and circuit number. Include location when not within sight of equipment.
   3) Identify load(s) served. Include location when not within sight of equipment.

e. Enclosed Contactors:
   1) Identify ampere rating.
   2) Identify voltage and phase.
   3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
   4) Identify coil voltage.
   5) Identify load(s) and associated circuits controlled. Include location.

f. Transfer Switches:
   1) Identify voltage and phase.
   2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.

3) Identify load(s) served. Include location when not within sight of equipment.
4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

g. Electricity Meters:
1) Identify load(s) metered.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.
b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

3. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.

4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.

5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.

6. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.

7. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.

8. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.

9. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.

10. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

11. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Division 09.

12. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
a. Service equipment.
b. Industrial control panels.
c. Elevator control panels.

13. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
    a. Minimum Size: 3.5 by 5 inches.
    b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
    c. Service Equipment: Include the following information in accordance with NFPA 70.
        1) Nominal system voltage.
        2) Available fault current.
        3) Clearing time of service overcurrent protective device(s).
        4) Date label applied.
14. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
15. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
16. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
17. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Identification for Communications Conductors and Cables: Comply with Section 270553.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    a. At each source and load connection.
    b. Within boxes when more than one circuit is present.

c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
d. In cable tray, at maximum intervals of 20 feet.

5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
6. Use underground warning tape to identify direct buried cables.

D. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
1) Color Code:
a) Emergency Power System: Red.
(1) Life Safety Branch: YELLOW.
(2) Critical Branch: RED.
(3) Equipment Branch: GREEN.
b) Fire Alarm System: Red.
2) Field-Painting: Comply with Division 09.
3) Vinyl Color Coding Electrical Tape: Comply with Section 260519.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.
6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

E. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
a. Color-Coded Boxes: Field-painted in accordance with Division 09 per the same color code used for raceways.
1) Emergency Power System: Red.
(1) Life Safety Branch: YELLOW.
(2) Critical Branch: RED.
(3) Equipment Branch: GREEN.
2) Fire Alarm System: Red.
b. For exposed boxes in public areas, do not color code.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
a. For exposed boxes in public areas, use only identification labels.

4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

F. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 270553.
2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
3. Factory Pre-Marked Wallplates: Comply with Section 262726.
4. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
5. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
   a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
6. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
7. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

G. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
   a. Brimar Industries, Inc.
   b. Kolbi Pipe Marker Co.
   c. Seton Identification Products
   d. Substitutions: Division 01 - General Requirements.
2. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Manufacturers:
   a. Brady Corporation
   b. Brother International Corporation
   c. Panduit Corp.
   d. Substitutions: Division 01 - General Requirements.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. System designation where applicable:
      1) Emergency Power System: Identify with text "EMERGENCY".
      2) Life Safety Branch: Identify with text "LIFE SAFETY"
      3) Critical Branch: Identify with text "CRITICAL"
      4) Equipment Branch: Identify with text "EQUIPMENT"
      5) Fire Alarm System: Identify with text "FIRE ALARM".
   b. Equipment designation or other approved description.
   c. Other information as indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
   c. Other Information: 1/4 inch.
   d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power System: White text on red background.
      1) Life Safety Branch: White text on YELLOW background.
      2) Critical Branch: White text on RED background.
      3) Equipment Branch: White text on GREEN background.
   c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.
   a. Exceptions:
      1) Provide white text on red background for general information or operational instructions for emergency systems.
      2) Provide white text on red background for general information or operational instructions for fire alarm systems.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.
6.

2.3 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation
2. HellermannTyton
3. Panduit Corp.
4. Substitutions: Division 01 - General Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
1. Do not use self-adhesive type markers.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
   1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Manufacturers:
   1. Brady Corporation
   2. Brimar Industries, Inc.
   3. Seton Identification Products
   4. Substitutions: Division 01 - General Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
   1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
   2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
   3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
   4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:
   1. Markers for Voltage Identification: Highest voltage present.
   2. Markers for System Identification:
      a. Emergency Power System: Text "EMERGENCY".
      b. Other Systems: Type of service.

F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. Brady Corporation
   2. Brimar Industries, Inc.
   3. Seton Identification Products
   4. Substitutions: Division 01 - General Requirements.

B. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:

1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 WARNING SIGNS AND LABELS

A. Manufacturers:
1. Brimar Industries, Inc.
2. Clarion Safety Systems, LLC.
3. Seton Identification Products
4. Substitutions: Division 01 - General Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
1. Materials:
a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
a. Do not use labels designed to be completed using handwritten text.
b. Provide polyester overlaminate to protect handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.

6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 12 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 0553

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. General Requirements
2. Line Voltage Switches
3. Line Voltage Dimmer Switches
4. Switch Plates.
5. Line Voltage Occupancy/Vacancy Sensor Switches
6. Low Voltage Occupancy/Vacancy Sensors
7. Photocells
8. Room Controllers / Power Packs
9. Low Voltage Keypads / Switches.
10. UL 924 Bypass Relays
11. Lighting Control Relay Panels
12. Class 2 Conductors and Cables

B. Related Sections:
1. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.
2. Section 26 05 19– Electrical Power Conductors and Cables.
3. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Product requirements for raceway and boxes for placement by this section.
4. Section 26 05 53 - Identification for Electrical Systems: Product requirements for electrical identification items for placement by this section.
5. Section 26 24 16 - Panelboards.
6. Section 26 27 26 - Wiring Devices: Product requirements for wiring devices for placement by this section.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA FU 1 - Low Voltage Cartridge Fuses.
3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contractors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
4. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.
5. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
6. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
7. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
8. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
9. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2015.

B. 47 CFR 15 - Radio Frequency Devices; current edition.

C. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.

D. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2004 (R2010).

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

I. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

J. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

K. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

M. IECC – International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SYSTEM DESCRIPTION

A. IECC compliant lighting controls to control all interior and exterior lighting:
   1. Standalone lighting controls in individual spaces consisting of some combination of occupancy sensors, vacancy sensors, photocells, power packs, low voltage switches and low voltage switches with dimming capability.
   2. Standalone microprocessor based controllers with distributed switching control using self-contained individually mounted lighting relays. Provides multiple modes of operation incorporating vacancy sensors, photocells and low voltage control stations.
   3. Lighting control relay panels to control lighting in corridors, large open areas, stairwells, and exterior lighting. Incorporates microprocessor local and centralized control, communications modules, bus connected sensors and control stations and power supplies.

B. Refer to lighting control details and riser diagrams on the drawings for additional information.

C. Provide automatic shutoff for lighting inside building, where required. Control shutoff by method conforming to IECC.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switches with actual installed door swings and sidelights.
3. Coordinate the placement of wall switch occupancy/vacancy sensors with actual installed door swings and sidelights.
4. Coordinate the placement of occupancy/vacancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
5. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Protect lighting control devices during construction.
2. Clean lighting control devices once final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01 - General Requirements.

B. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.
1. One Line Diagram: Indicating system configuration, panels, number and type of switches or devices.
2. Include typical wiring diagrams for each component.
3. Floor Plan Layout Drawings: Manufacturers symbols are acceptable, provided that symbology between engineer’s device legend and manufacturers symbols are cross-referenced.

C. Product Data: Submit manufacturer’s standard product data for each system component. This shall include, but not be limited to: ratings, configurations, dimensions, sensor coverage ranges, colors, service condition requirements, and installation features.

D. Manufacturer's Installation Instructions: Submit for each system component.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections and evidence that the control schemes identified herein and shown on the typical lighting control details are configured and operational as specified.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
2. Provide documentation addressing each room/area control scheme specified with a description of how the submitted system complies.

1.6 CLOSEOUT SUBMITTALS

A. See Division 01 - General Requirements

B. Project Record Documents: Record the following information:
1. Actual installed locations of components and settings for lighting control devices. Record circuiting and switching arrangements.
2. Wiring diagrams reflecting field-installed conditions with identified and numbered system components and devices.

C. Operation and Maintenance Data:
1. Submit replacement parts numbers.
2. Submit manufacturer's published installation instructions and operating instructions.
3. Recommended renewal parts list.
4. Detailed information on device programming and setup.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience. Company shall provide 24/7 telephone support by qualified technicians.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

C. Installer Qualifications: Installer shall be one who is experienced in performing the work of this section, and who has specialized in installation of work similar to that required for this project.

D. Contractor shall ensure that lighting system control devices and assemblies are fully compatible and can be integrated into a system that operates as described in the lighting control notes on drawings and as described within this specification. Any incompatibilities between devices, assemblies, and system controllers shall be resolved between the contractor and the system provider, as required to ensure proper system operation and maintainability.

E. Performance Requirements: Shall provide all system components that have been manufactured, assembled, and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

F. Performance Testing Requirements
1. Manufacturer shall 100% test all equipment prior to shipment. Sample testing is not acceptable.

G. Code Requirements
1. System Control Unit and System Field Devices shall be UL listed and certified.
2. All system components shall be FCC / IC compliant.
3. All system components shall be installed in compliance with National Electrical Codes.
4. Building Codes: All units shall be installed in compliance with applicable, local building codes.

1.8 PRE-INSTALLATION MEETINGS

A. See Division 01 - General Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 - General Requirements.

B. Accept components on site in manufacturer's packaging. Inspect for damage.

C. Protect components by storing in manufacturer's containers indoor protected from weather.

1.10 WARRANTY

A. See Division 01 - General Requirements.

B. Furnish five year manufacturer warranty for all components.

1.11 EXTRA MATERIALS

A. See Division 01 - General Requirements Furnish two of each switch type.

B. Furnish two of each occupancy/vacancy sensor type.

C. Furnish two of each photocell type.

D. Furnish two of each power pack type.

E. Furnish one room controller

PART 2 PRODUCTS

2.1 LIGHTING CONTROL DEVICES – GENERAL REQUIREMENTS

A. Manufacturers:
1. nLight (Basis of Design)
2. Hubbell
3. Douglas
4. Crestron

5. Substitutions: See Division 01 – General Requirements.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

D. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

E. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

F. Refer to lighting control details on drawings for additional requirements and product specifications.

2.2 LINE VOLTAGE SWITCHES

A. Manufacturers:
1. Hubbell Incorporated
2. Leviton Manufacturing Co., Inc.
3. Pass and Seymour/Legrand
4. Substitutions: Division 01 - General Requirements

B. Line Voltage Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
2. Body and Handle finish: Color selection by Architect.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.3 LINE VOLTAGE DIMMER SWITCHES

A. Manufacturers:
1. Leviton Manufacturing Company, Inc.
2. Lutron Electronics Company, Inc; Maestro Series
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Substitutions: See Division 01 - General Requirements.

B. Line Voltage Dimmer Switches - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency

interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
1. Body and Control finish: Color selection by Architect.

C. Control: Slide control type with separate on/off switch.

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
1. Incandescent: 600 VA.
2. Magnetic Low-Voltage: 600 VA.
3. Electronic Low-Voltage: 400 VA.
4. Fluorescent: 600 VA.

E. Provide locator light, illuminated with load off.

F. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

G. Refer to plans and lighting fixture schedule for dimming driver/ballast requirements.

2.4 SWITCH PLATES

A. Manufacturers:
1. Hubbell Incorporated
2. Leviton Manufacturing Co., Inc.
3. Pass and Seymour/Legrand
4. Substitutions: Division 01 - General Requirements.
a. Where low voltage keypads / switches or line voltage sensor switches are shown, provide switch plate by same manufacturer.

B. Product Description: Specification Grade.
1. Material: Plastic.
2. Color: By Architect.

2.5 LINE VOLTAGE OCCUPANCY/VACANCY SENSOR SWITCHES

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Provide wall switch style occupancy/vacancy sensor capable of turning lights OFF when the space becomes unoccupied and ON when the space becomes re-occupied. Provide with 0-10V dimming capabilities and/or integral daylight control, where indicated on the drawings. Refer to drawings for occupancy or vacancy mode setting.
1. Material: Plastic.
2. Color: By Architect.

C. Sensor Switch Requirements:
1. Sensor switch shall be line voltage @ 120/277 VAC, rated for 20A.
2. Sensor technology shall be dual technology: PIR and ultrasonic.

3. Sensor shall have field of view of 180 degrees.
4. Sensor switch shall be capable of operating with LED.
5. Sensor switch shall be set to:
   a. Auto-ON, Auto-OFF mode (Occupancy Sensor)
   b. Manual-ON, Auto-OFF mode (Vacancy Sensor)
   c. Dipswitch selectable to toggle between occupancy and vacancy mode.
6. Sensor shall be capable of turning lights OFF after 20 minutes of inactivity. Switch shall also have 10 and 20 minute overrides.
7. Provide device capable of accepting a 2-wire (hot and neutral) input plus ground.
8. Sensor switch shall be capable of operating in conjunction with a 3-way switch per manufacturers requirements, where indicated on drawings.
9. Provide with 0-10V dimming control.
10. Provide with integral daylight harvesting control: 10-500 foot-candle override range.

2.6 LOW VOLTAGE OCCUPANCY/VACANCY SENSORS

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Factory-assembled commercial grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated. Mounting as indicated on floor plans.

C. Sensor Requirements:
1. Sensor Technology:
   a. Sensor shall be Dual Technology, unless otherwise noted on drawings. Available sensor technologies:
      1) Passive Infrared/Ultrasonic Dual Technology Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
      2) Passive Infrared/Acoustic Dual Technology Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
2. Sensor shall be set to:
   a. Auto-ON, Auto-OFF mode (Occupancy Sensor)
   b. Manual-ON, Auto-OFF mode (Vacancy Sensor)
   c. Dipswitch selectable to toggle between occupancy and vacancy mode.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
5. Passive Infrared Lens Field of View: Field customizable to block motion detection in selected areas.
6. Sensor shall be capable of turning lights OFF after 20 minutes of inactivity. Switch shall also adjustable overrides.
7. Sensitivity: Field adjustable.
8. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.

9. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
10. Coverage:
    a. Small Space (< 500 Sq Ft): 500 square feet minimum
    b. Medium Space (500-1000 Sq Ft): 1,000 square feet minimum
    c. Large Space (>1000 Sq Ft): 2,000 square feet minimum. Multiple sensors where shown on the plans.
11. Furnish with power pack or room controller by same manufacturer.
    a. Provide for zone control and maximum number of sensors connected to power pack per manufacturer's requirements.
    b. Provide room controller with functions and quantity of zones as indicated on drawings and as required per manufacturer. Refer to Paragraph 2.9 for additional information.
12. Operation: Silent.

D. Room Sensor Type: As indicated on Drawings.

E. Corridor and Hallway Sensors:
1. Capable of detecting major motion with a long, narrow pattern designed for corridor and aisle sensing. Refer to lighting control details for product specification.

F. High Bay areas: For areas with ceilings more than 15 feet above finished floor, provide high-bay ceiling mounted occupancy sensor. Refer to lighting control details for product specification.

2.7 PHOTOCELLS

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls. Sensor mounted as indicated on Drawings with separate control-calibration module. Control unit powered by 24 VAC.

C. Control-Calibration Module: Furnish with the following:
1. Capable of being switched between multiple measurement ranges.
2. Separate trip points for high and low response settings.
3. Three-minute time delay between switching outputs to avoid nuisance tripping.

D. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
1. Sensor Type: Photodiode with diffusing lens
2. Sensor Range:
    a. Indoor Photo Sensors: 5 to 100 footcandles (53.8 to 1,080 lx).
    b. Outdoor Photo Sensors: 5 to 250 footcandles (53.8 to 2690 lx).
    c. Atrium Photo Sensors: 200 to 2,500 footcandles (2150 to 2,6910 lx).

d. Skylight Photo Sensors: 1,000 to 6,000 footcandles (10,760 to 64,580 lx).
e. Open Loop Photo Sensors: 3 to 6,000 footcandles (32.3 to 64,580 lx).

3. Finish: White unless otherwise indicated.

E. Standalone Dimming Photo Sensors: Photo sensor units with integral 0-10V controller compatible with specified dimming drivers/ballasts, for direct continuous dimming of up to 50 drivers/ballasts.

F. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.

2.8 ROOM CONTROLLERS / POWER PACKS

A. Manufacturers: See Paragraph 2.1(A)

B. Refer to lighting control details on drawings for types, configurations, performance requirements, and additional information.

C. Description: Integrated lighting, dimming, and equipment switching control system for mounting in a concealed space, enclosure shall be plenum rated. Provide pre-configured lighting controller(s), with capabilities for manual setup, and software setup through programming port, configured as a standalone controller.
1. Room Controllers.
2. Power Packs.

D. Dimmable Load Types: 16A per channel at 100 to 277VAC, 50/60 Hz:
1. 0 – 10V LED drivers.

E. Magnetic low voltage.
1. Electronic low voltage.
2. LED

F. General Requirements:
1. Power Packs:
a. Main Power: 100 – 277 VAC, 50/60 Hz.
b. Input/Output (Refer to Drawings and Details for Input/Output Applicable to Project):
1) Line Power Inputs: 1.
2) Switch Channel Outputs: 1 or 2.
3) 0 – 10V Dimmer Outputs: 1 - Class 1 or Class 2.
4) Auxiliary Relay for Interface with Other Systems.
5) Auxiliary Inputs: Hold On/Hold Off as specified.
c. Enclosure: Plenum rated, surface-mounted industrial control enclosure mounts directly to electrical junction box.
2. Room Controllers:
a. Main Power: 100 – 277 VAC, 50/60 Hz.

b. Input/Output (Refer to Drawings and Details for Input/Output Applicable to Project):
   1) Line Power Inputs: 1.
   2) Switch Channel Outputs: As Indicated on Drawings.
   3) 0 – 10V Dimmer Outputs: As Indicated on Drawings. Class 1 or Class 2.
   4) Device Bussing, Provide control bussing for the following:
      a) Low Voltage Keypads / Switches
      b) Photocells / Daylight Sensors
      c) Occupancy / Vacancy Sensors
      d) Wiring: CAT X, Digital, or per manufacturers requirements.
   5) Auxiliary Relay for Interface with Other Systems.
   6) Auxiliary Inputs: Hold On/Hold Off as specified.

c. Enclosure: Plenum rated surface-mounted industrial control enclosure.

d. Control Processor:
   1) Integrates sensors and other low voltage controls, devices, and subsystems through multiple control interfaces with control network. Refer to drawings for functions and operation required by project.

2.9 LOW VOLTAGE KEYPADS / SWITCHES

A. Provide low voltage keypads / switches with configuration, functionality and operation as indicated on drawings.

B. General Requirements:
   1. Custom engravable buttons/switches, refer to drawings for labeling. Refer to Paragraph C below for additional requirements.
   2. Quantity and function as indicated on drawings.
   3. LED indicators, as shown on drawings.
   4. Configured to fit in standard gang boxes.
   5. Color: By Architect

C. Labeling:
   1. Provide factory engraved labels for all low voltage keypads / switches buttons.
   2. Refer to lighting control details on drawings for suggested labeling of lighting control equipment. Coordinate naming of scenes/control zones with the Owner. Provide a worksheet listing remote keypad controls, labeling requests and locations to the Owner for their labeling requests.
   3. Do not order labels until Owner coordination is complete.

D. Lighting keypad shall be provided by the same manufacturer as the lighting control system.

2.10 UL 924 BYPASS RELAYS

A. General Requirements:
   1. Refer to drawings and details for required functions.

2. The UL 924 Bypass Relay shall automatically illuminate connected emergency loads upon utility power interruption, regardless of room switch position. (NEC Article 700)
3. The UL 924 Bypass Relay shall include an automatic diagnostic, which is initiated when the room switch is turned off. This test procedure will turn the emergency luminaires on for at least 2 seconds, indicating that an emergency power source is available & that the device, ballast, & lamp are all functioning correctly.
4. Automatic diagnostic shall be approved to meet periodic testing requirements (NEC Article 700 NFPA 101 Chapter 7)
5. Local room switch, dimmer or lighting keypad shall turn both regular & emergency luminaires on at the same time (no dedicated emergency room switch required).
6. The UL 924 Bypass Relay shall include a dry contact for 0-10V override during utility power interruption, where indicated on drawings and details.
7. The UL 924 Bypass Relay shall have a minimum load rating of 20 Amps at 120V or 277V, general use 20 Amps.
8. The UL 924 Bypass Relay shall accept 120V & 277V 60 Hz Input & Output (voltage tolerance +/- 15%).
9. The UL 924 Bypass Relay shall include emergency power and regular power indicator LED's and a manual test switch which are visible to room occupants when installed flush. (UL924 Section 29)
10. Load contacts shall be able to withstand 10 direct shorts while connected to 20 Amp breaker without permanent damage.
11. The UL 924 Bypass Relay shall not generate any objectionable electrical or mechanical noise.
12. The UL 924 Bypass Relay shall mount inside a 4-11/16" junction box with an extension & single gang plaster ring.
13. The UL 924 Bypass Relay shall be installed flush to the ceiling or above ceiling adjacent to load controlled, such that test switch & LED's are in plain view of room occupants as required by some local electrical codes.
14. The UL 924 Bypass Relay shall have UL94-V0 or UL94-5VA flame rating & be approved for installation above the suspended ceiling

2.11 LIGHTING RELAY PANELS

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Standalone relay panel with quantity of relays as indicated on drawings. Standalone panel shall utilize a digital controller with LCD screen and numerical keypad.

C. All components are to be supplied by the same manufacturer. The manufacturer shall be a supplier of this type of equipment for over 5 years.

D. Relay Panel shall come pre-assembled complete with Relays, Transformer & Timeclock.

E. Relays mounted in the lighting control panels shall be full load relays suitable for all types of lamp loads up to 20 Amperes. Relays shall be mechanically latching and must have a physical ON/OFF override built into the relay.

F. Time Controls shall be a 365 Day Astronomical Timer for switching, 2-Wire Relays. Programming shall be accomplished by entering data on a membrane key pad with an LCD graphic display. Any output shall be time, astro, photo-controlled or combination photo/time or astro/time controlled. There shall be available up to 500 events per week and 32 holiday programs. The controllers memory and time are not lost when power fails. Programs are held indefinitely and time is held for 72 hours.

G. Provide with inputs for each relay for manual override and programmable control of associated relays or groups of relays.

H. Provide with "BLINK" warning to blink the lights prior to expiration (off control) of a relay or groups of relays via time schedule.
   1. When manual override control is activated relay or relay group shall remain on for up to two hours (programmable).
   2. Relay or groups of relays shall sweep off every two hours until next time scheduled event.

I. Provide manual override low-voltage switches by same manufacturer in locations indicated on drawings.

J. Panel shall be capable of connecting to the building management system via BACNET interface.

K. Panel shall be capable of connecting to the fire alarm system to force all lighting fed through relay panel to 100% brightness.

2.12 CLASS 2 CONDUCTORS AND CABLES

A. General Requirements:
   1. Line Voltage Wiring: Comply with requirements of Division 26 Section "Electrical Power Conductors and Cables".
   2. Class 2 Low-Voltage Cable:
      a. Provide plenum-rated cable.
      b. UTP Cable: CAT 5, CAT 6, or as required by manufacturer:
         1) Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
         2) All cabling shall meet or exceed Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA 568-C.2
         3) Cabling shall use 23AWG minimum conductors.
         4) Pulling tension: The cable pulling tension shall not exceed 25 ft/lbs as indicated in TIA/EIA-568-A.
      c. Control Cable:
         1) Stranded copper cable, Type CMP.
            a) Multiple-Conductor.
            b) Twisted Pair.
            c) Shielded Twisted Pair
            d) Minimum AWG: Per manufacturer requirements, as shown on drawings and details.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification:
   1. Verify that wiring conditions, which have been previously installed under other sections or at a previous time, are acceptable for product installation in accordance with manufacturer's instruction.
   2. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
   3. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
   4. Verify that final surface finishes are complete, including painting.
   5. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
   6. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
   7. Verify that conditions are satisfactory for installation prior to starting work.

B. Inspection: Inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. The Electrical Contractor, as part of the work of this section, shall coordinate, receive, mount, connect, and place into operation all equipment. The Electrical Contractor shall furnish all conduit, wire, connectors, hardware, and other incidental items necessary for properly functioning lighting control as described herein and shown on the plans (including but not limited to System Field Devices, 0-10V dimming ballasts, fixed output ballasts, 0-10V LED drivers and communication wire). The Electrical Contractor shall maintain performance criteria stated by manufacturer without defects, damage, or failure.

B. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards, unless otherwise indicated. Install per manufacturer's instructions.

C. Power: The contractor shall test that all branch load circuits are operational before connecting loads to sensor system load terminals, and then de-energize all circuits before installation.

D. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

E. Install wiring in accordance with Section 260519 and paragraph 2.13.

F. Use only properly color coded, stranded wire. Install wire sizes as indicated on Drawings. Install wire in conduit in accordance with Section 260533 and paragraph 2.13.

G. Mount relay panel as indicated on Drawings. Wire numbered relays in panel to control power to each load.

H. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

I. Identify power wiring with circuit breaker number controlling load. When multiple circuit breaker panels are feeding into relay panel, label wires to indicate originating panel designation.

J. Label each low voltage wire with relay number at each switch or sensor. Refer to Section 26 05 53.

K. Coordinate locations of outlet boxes provided under Section 260533 as required for installation of lighting control devices provided under this section.

L. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

M. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

N. Prior to setting scenes or zones dependent on furniture placement, whiteboard locations, projection screen locations, lectern locations or similar, coordinate with the Owner, Architect and red-lined furniture plans. Make all required adjustments during construction.

O. Systems Integration:
   1. Equipment Integration Meeting:
      a. Facility Representative to coordinate meeting between Facility Representative, Lighting Control System Manufacturer and other related equipment manufacturers to discuss equipment and integration procedures prior to system startup

P. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

Q. Install lighting control devices plumb and level, and held securely in place.

R. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

S. Identify lighting control devices in accordance with Section 260553.

T. Unless otherwise indicated, install power packs/room controllers for lighting control devices within the same space above accessible ceiling or above access panel in inaccessible ceiling.

U. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

3.4 SENSOR INSTALLATION:

A. Adjust sensitivity to cover area installed

B. Set time delay on sensors that are connect to the lighting control system to the minimum. Time delay to off shall be set to no longer than 20 minutes.

C. Provide vacancy sensor configurations as indicated on drawings.

D. Install sensors on vibration free stable surface.

E. Install interior light sensor in ceiling facing the floor.

F. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.

G. Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.

H. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors away from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

I. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on sensor lenses to block undesired motion detection.

J. Outdoor Photo Sensor Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
   3. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
   4. Unless otherwise indicated, set outdoor photo sensor for dusk-to-dawn operation. Lighting shall turn on at dusk / off at dawn.

K. Daylighting Control Photo Sensor Locations:

1. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize control and avoid conflicts or problems affecting proper detection of light levels.
2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
4. Refer to drawings and details for maintained light level settings.

3.5 MANUFACTURER'S FIELD SERVICES

A. Division 01 - General Requirements.

B. Manufacturer’s Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following field tests and inspections with the assistance of a factory-authorized service representative:
1. Operational Test: After installing wall stations and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
4. Test outdoor photo controls to verify proper operation, including time delays where applicable. Record test results in written report to be included with submittals.
5. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
6. Adjust relay panel settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings and as-built relay panel schedules in written report, to be included with submittals.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

3.6 FIELD QUALITY CONTROL

A. Division 01 - General Requirements.

B. Inspect each lighting control device for damage and defects.

C. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.7 ADJUSTING

A. Division 01 - General Requirements.

B. Test contactors and switches after installation to confirm proper operation.

C. Confirm correct loads are recorded on directory card in each panel.

D. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.8 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.9 COMMISSIONING

A. Division 01 - General Requirements.

3.10 DEMONSTRATION

A. Division 01 - General Requirements.

B. Demonstrate proper operation of lighting control devices to Architect and Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.
   3. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.
   4. Instructor: Qualified manufacturer’s representative familiar with the project and with sufficient knowledge of the installed lighting control devices.

END OF SECTION 26 0923

SECTION 26 2413 - SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements

B. Division 03 - Concrete

C. Section 260400 – General Conditions for Electrical Trades

D. Section 260526 - Grounding and Bonding for Electrical Systems

E. Section 260553 - Identification for Electrical Systems

F. Section 262813 - Fuses

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Current Edition, Including All Revisions.

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; Current Edition, Including All Revisions.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; Current Edition, Including All Revisions.

D. NECA 400 - Standard for Installing and Maintaining Switchboards; Current Edition, Including All Revisions.

E. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); Current Edition, Including All Revisions.

F. NEMA PB 2 - Deadfront Distribution Switchboards; Current Edition, Including All Revisions.

G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; Current Edition, Including All Revisions.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; Current Edition, Including All Revisions.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

L. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

M. UL 891 - Switchboards; Current Edition, Including All Revisions.

N. UL 977 - Fused Power-Circuit Devices; Current Edition, Including All Revisions.

O. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:
1. Coordinate with Electric Utility Company and provide switchboards in compliance with Utility Company requirements and with suitable provisions for electrical service and utility metering, where applicable.
2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
3. Obtain Utility Company approval of switchboard prior to fabrication.
4. Pre-installation Meeting: Convene with Utility Company representative a minimum of two weeks prior to commencing work of this section to review requirements.
5. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.5 SUBMITTALS

A. See Division 01 - General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Submit electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and front & side elevation views of switchboards and adjacent equipment with overall dimensions shown and all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings upon request.
   5. Include documentation demonstrating selective coordination upon request.

D. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production tests.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Field Quality Control Test Reports.

H. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements.
   2. Enclosure Keys: Two of each different key.
   3. Electronic Trip Circuit Breakers: Provide one portable test set.
   4. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle in accordance with NEMA PB 2.1. Lift only with lugs provided. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

B. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Switchboards
1. Siemens Industry, Inc. (Basis of Design)
2. Schneider Electric; Square D Products
3. Eaton Corporation
4. General Electric Company
5. Substitutions: See Division 01 - General Requirements.

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

C. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Front-Connected Switchboards:
1. Main Device(s): Individually-mounted.
2. Feeder Devices: Panel/group-mounted.
3. Arrangement: Front accessible only (not rear accessible), rear aligned.
4. Gutter Access: Bolted covers.
5. Energy Reduction Maintenance Setting (ERMS) system.
6. Pull Section: Arrange as indicated on Drawings.
7. Pull Box: Removable top and sides, same construction as switchboard, size as indicated on Drawings. Furnish insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.
8. Align sections at rear only.

E. Service Entrance Switchboards:
1. Listed and labeled as suitable for use as service equipment according to UL 869A.
2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
3. Comply with Utility Company requirements for electrical service.
4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.

F. Service Conditions:
1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
   a. Altitude: Less than 6,600 feet.
   b. Ambient Temperature:
      1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
      2) Switchboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

G. Short Circuit Current Rating:
   1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

H. Main Devices: Configure for bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
   1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
   2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Phase and Neutral Bus Material: Silver Plated Copper.
   5. Ground Bus Material: Silver Plated Copper.

J. Conductor Terminations: Suitable for use with the conductors to be installed.
   1. Line Conductor Terminations:
      a. Main and Neutral Lug Material: Silver Plated Copper, suitable for terminating aluminum or copper conductors.
      b. Main and Neutral Lug Type: Mechanical.
   2. Load Conductor Terminations:
      a. Lug Material: Silver Plated Copper, suitable for terminating aluminum or copper conductors.
      b. Lug Type:
         1) Provide mechanical lugs unless otherwise indicated.
         2) Provide compression lugs where indicated.

K. Enclosures:
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish: Manufacturer's standard unless otherwise indicated.
   3. Enclosure Space Heaters:
      a. Provide in each switchboard section installed outdoors and in unconditioned indoor spaces.
      b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
      c. Heater Control: Thermostat.
      d. Heater Power Source: Provide connection to transformer factory-installed in switchboard or suitable external branch circuit as indicated or as required.
   4. Outdoor Enclosures:
      a. Enclosure Type: Non-walk-in type unless otherwise indicated.
      b. Color: Manufacturer's standard.
      c. Access Doors: Lockable, with all locks keyed alike.

L. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
3. Where designated spaces for future device provisions are not indicated, include provisions for minimum of six device(s) rated at ten percent of rating of switchboard main or incoming feed.
4. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.

M. Surge Protective Device:
1. Product Description: IEEE C62.41, factory-mounted surge protective device, selected to meet requirements for high exposure (200,000A) and to coordinate with system circuit voltage. integral type 1 surge protection at [208v]Y 3 phase with L-N=1200 L-G=1200 N-G=1200 and L-L 2000
2. Minimum surge current rating per phase: 320 kA.
3. Surge Protective device module shall be integral to switchboard and shall be fused.

N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
   a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
   b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
   c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
3. Furnish monitor panel with lamp to indicate relay operation, TEST and RESET control switches.

O. All circuit breakers rated 1200 amps and above shall have energy reduction maintenance setting (ERMS) system. Provide the following:
1. Energy Reduction Maintenance Setting Switch (ERMS).
   a. Provide a maintenance OFF ON selector switch on the compartment door to switch the circuit breaker instantaneous tripping characteristics to an alternate setting temporarily during maintenance activity.
   b. Provide a lock feature for the ERMS switch so that it may be locked in either the OFF or ON maintenance mode position.
   c. Provide a blue LED indicating light to indicate trip unit is in the ERMS mode.

P. Phase Failure Relay:
1. Provide integral phase failure relays within switchboard.

Q. Instrumentation:

1. Provide power metering equal to a Square D Class 3020 PM8244 PowerLogic Power Meter with display. Device shall be panel mounted in the switchboard. Devices by others will be considered providing all the following specifications are met.
2. The Power Meter shall be equipped with a two (2)-line by sixteen (16)-character LCD display for electrical circuit information.
3. The information displayed by the Power Meter shall include the following quantities:
   a. Current, per-phase
   b. Volts, phase-to-phase & phase-neutral
   c. Real Power (kW), three-phase total
   d. Reactive Power (kVAR), three phase total
   e. Apparent Power (kVA), three phase total
   f. Power Factor, true, per-phase & three-phase total
   g. Frequency
   h. Current Demand, per phase and neutral, present and peak
   i. Real Power Demand (kWd), three phase total, present and peak
   j. Reactive Power Demand (kVARd), three phase total, present and peak
   k. Apparent Power Demand (kVAd), three phase total, present and peak
   l. Real Energy (kWh), three phase total
   m. Reactive Energy (kVARh), three phase total
   n. Apparent Energy (kVAh), three phase total
   o. Energy Accumulation Modes, signed, absolute, energy in, energy out
   p. Watt-hour KYZ Pulse Initiator Output
   q. Total Harmonic Distortion, Voltage
   r. Total Harmonic Distortion, Current
   s. Date/Time Stamping.
4. Communications port for Power Monitoring Systems communications and Modbus RTU communications.
5. The Power Meter shall be accurate to .25% for voltage and current sensing, .50% for power, energy, & demand sensing, and 1% for power factor sensing.
6. All information stored in the Power Meter shall be remotely accessible through data communications.
7. The Power Meter shall be UL Listed, rated for an operating temperature range of 0C to 55C and have an overcurrent withstand rating of 500 amps for 1 second.
8. The Power Meter metering inputs shall utilize industry standard current transformers (5A secondary CT's), have VT inputs for direct connection of VT leads to up to 600V, and adhere to UL standard 508 for dielectric voltage-withstand.
9. Each Circuit Monitor shall have built-in data communications to allow multipoint communication to multiple computer workstations, programmable controllers, and other host devices, at a minimum data rate of 9600 baud.
10. The data communications shall be optically isolated to provide reliable operation.
11. Power meter shall include a communications interconnection interface with the Building Management System (BMS). Coordinate interconnection requirements with the BMS provider. Available protocols:
    a. Modbus.
    b. Ion.

c. DNP3.
d. IEC 61850.
e. HTTP.
f. FTP.
g. SNMP.
h. DPWS.
i. RSTP.
j. NTP.
k. SNTP.
l. GPS.

R. Instrument Transformers:
1. Comply with IEEE C57.13.
2. Select suitable ratio, burden, and accuracy as required for connected devices.
3. Current Transformers: Connect secondaries to shorting terminal blocks.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
1. Interrupting Capacity:
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated. Series rating not allowed.
2. Main circuit breakers in all switchboards shall have Long time, Short time, Instantaneous and ground fault protection (LSIG) functions. These functions shall similar to those functions found on a Square D PowerPact circuit breaker. Circuit breaker shall have energy reduction maintenance setting (ERMS) system. Provide the following;
a. Energy Reduction Maintenance Setting Switch (ERMS)
1) For the Main circuit breaker above 1200 amps, provide a maintenance OFF ON selector switch on the compartment door to switch the circuit breaker instantaneous tripping characteristics to an alternate setting temporarily during maintenance activity.
2) Provide a lock feature for the ERMS switch so that it may be locked in either the OFF or ON maintenance mode position.
3) Provide a blue LED indicating light to indicate trip unit is in the ERMS mode.
3. Molded Case Circuit Breakers:
a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
1) Provide thermal magnetic circuit breakers unless otherwise indicated.

2) Provide electronic trip circuit breakers where indicated.

b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   2) Provide interchangeable trip units for circuit breaker frame sizes 125A and above.

c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   1) Provide the following field-adjustable trip response settings:
      a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      b) Long time delay.
      c) Short time pickup and delay.
      d) Instantaneous pickup.
      e) Ground fault pickup and delay where ground fault protection is indicated.
   2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
   3) Provide communication capability where indicated: Compatible with system indicated.

d. Provide the following circuit breaker types where indicated:
   1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
   2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

e. Provide the following features and accessories where indicated or where required to complete installation:
   1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
   3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
   4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
   5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.4 SOURCE QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Factory test switchboards according to NEMA PB 2, including the following production tests on each switchboard assembly or component:
   1. Dielectric tests.
   2. Mechanical operation tests.
   3. Grounding of instrument transformer cases test.
   4. Electrical operation and control wiring tests, including polarity and sequence tests.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 EXISTING WORK

A. Disconnect and remove abandoned switchboards.

B. Maintain access to existing switchboards and other installations remaining active.

C. Clean and repair existing switchboards to remain or to be reinstalled.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 6 inches between switchboard and wall.

E. Provide required support and attachment components in accordance with Section 260529.

F. Install switchboards plumb and level.

G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Division 03 - Concrete.

H. Provide grounding and bonding in accordance with Section 260526.

I. Install all field-installed devices, components, and accessories.

J. Install identification in accordance with Section 260553.
   1. Labeling & Identification:
      a. Indicate the maximum available fault current at the equipment, including the date the fault current calculation was performed. Label shall include warning for “Arc Flash Hazard” and requirement for “PPE Protection”.
      b. Indicate locations of sources and feeders for all services to the building (generator and fire pump).

K. Installation of ERMS maintenance lockable selector switch and blue indicating light onto compartment door of the main circuit breaker. Installation of the IO module and the IFE module in accordance with manufactures recommendations.
   1. Set point for the ERMS instantaneous is based on manufactures recommendations. For Square D Power Pact circuit breaker (Basis of design) the default programmed setting to the instantaneous (li) set point is 2xIn.

L. Install breaker circuit directory.

M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

N. Provide filler plates to cover unused spaces in switchboards.

3.4 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.1.

G. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 225 amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.

2. Test functions of the trip unit by means of secondary injection.

H. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

I. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10.

J. Test shunt trips to verify proper operation, if applicable.

K. Correct deficiencies and replace damaged or defective switchboards or associated components.

L. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.5 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

3.6 CLEANING

A. See Division 01 – General Requirements.

B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

C. Repair scratched or marred surfaces to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Division 01 – General Requirements.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.8 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION 26 2413

SECTION 26 2416 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service..

B. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NEMA FU 1 – Low Voltage Cartridge Fuses.

E. NECA 407 - Standard for Installing and Maintaining Panelboards.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

G. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

H. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).

I. NEMA PB 1 - Panelboards.

J. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

K. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

N. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

O. UL 67 - Panelboards; Current Edition, Including All Revisions.

P. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

Q. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

R. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

S. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

T. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

U. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Include documentation of listed series ratings upon request.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 - Product Requirements, for additional provisions.
2. Panelboard Keys: Two of each different key.
3. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
   2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siemens Industry, Inc.

B. Schneider Electric; Square D Products.

C. ABB/GE.

D. Eaton Corporation.

E. Substitutions: See Division 01 - Product Requirements.

F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
      b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

2. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
2. Outdoor Locations: Type 3R.
   a. Furnish thermostatically controlled electric heaters sized to prevent condensation under expected weather conditions at Project site. Furnish control power transformer and terminals for separate connection of heater power circuit.
   b.
3. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
   b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
   c. Provide removable end walls for NEMA Type 1 enclosures.
   d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
4. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
5. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided, list and label panelboards as a complete assembly including surge protective device.

K. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
   1. Ampere Rating: Not less than ampere rating of panelboard bus.
   2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
   3. Coil Voltage: As required for connection to control system indicated.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
      c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

N. Selective Coordination:
   1. Fusible branch circuit panelboards overcurrent protective devices shall be selectively coordinated with all supply side (fed from both the normal and emergency source) overcurrent protective devices. Provide recommended fuses from a single manufacturer to maintain published minimum ampere coordination ratios.

O. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

P. Load centers are not acceptable.

Q. Provide the following features and accessories where indicated or where required to complete installation:
   1. Feed-through lugs.
   2. Sub-feed lugs.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Tin plated copper.
   2. Ground Bus Material: Copper.

D. Circuit Breakers:
   1. Provide bolt-on type. .
   2. Provide thermal magnetic circuit breakers unless otherwise indicated.
   3. Provide electronic trip circuit breakers where indicated.

E. Circuit breakers rated 1000 amps or more on solidly grounded 480V systems shall include ground fault protection.

F. Circuit breakers rated 1200 amps and above shall have Long time, Short time, Instantaneous and Ground fault protection (LSI) functions. These functions shall similar to those functions found on a Square D PowerPact circuit breaker. Circuit breaker shall have energy reduction maintenance setting (ERMS) system. Provide the following;
   1. Energy Reduction Maintenance Setting Switch (ERMS)
      a. For the circuit breakers above 1200 amps, provide a maintenance OFF ON selector switch on the compartment door to switch the circuit breaker instantaneous tripping characteristics to an alternate setting temporarily during maintenance activity.
      b. Provide a lock feature for the ERMS switch so that it may be locked in either the OFF or ON maintenance mode position.
      c. Provide a blue LED indicating light to indicate trip unit is in the ERMS mode.

G. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.
   2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.
   3. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   4. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   5. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Tin plated copper.
   3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   4. Provide clear plastic circuit directory holder mounted on inside of door.

F. Provide column-width panelboards with accessory column-width cable trough and pullbox where indicated.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
         1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
         2) 14,000 rms symmetrical amperes at 480 VAC.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Provide compression lugs where indicated.
      c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   b. Provide interchangeable trip units where indicated.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
6. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
   d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
7. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
    d. Under-voltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
    e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.6 SOURCE QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required supports in accordance with Section 260529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Division 03.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 260526.
   1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
   2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

L. Install all field-installed branch devices, components, and accessories.

M. Provide fuses complying with Section 262813 for fusible switches as indicated and if applicable.

N. Energy Reduction Maintenance Switch:
   1. Installation of ERMS maintenance lockable selector switch and blue indicating light onto compartment door of the circuit breaker. Installation of the IO module and the IFE module in accordance with manufactures recommendations.
      a. Set point for the ERMS instantaneous is based on manufactures recommendations. For Square D Power Pact circuit breaker (Basis of design) the default programmed setting to the instantaneous (li) set point is 2xIn.

O. Install a permanent label indicating the panelboard or transformer where the power supply to the panel originates.

P. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

Q. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

R. Set field-adjustable circuit breaker tripping function settings as indicated.

S. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

T. Provide filler plates to cover unused spaces in panelboards.

U. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

V. Identify panelboards in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 800 amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.
   2. Test functions of the trip unit by means of secondary injection.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

F. Test GFCI circuit breakers to verify proper operation.

G. Test shunt trips to verify proper operation.

H. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

I. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. See Division 01 – General Requirements.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

C. Adjust alignment of panelboard fronts.

D. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. See Division 01 – General Requirements.

B. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

C. Repair scratched or marred exterior surfaces to match original factory finish.

3.6 PROTECTION

A. Protect installed panelboards from subsequent construction operations.

END OF SECTION 26 2416

SECTION 26 2716 - ELECTRICAL CABINETS AND ENCLOSURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes hinged cover enclosures, cabinets, terminal blocks, and accessories.

B. Related Sections:
1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
3. Section 27 05 33 - Conduits and Backboxes for Communications Systems.
4. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.5 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two of each key.

PART 2 PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Manufacturers:

1. Hoffman
2. Carlon Electrical Products.
3. Hubbell Wiring Devices.
4. Substitutions: Section 01 60 00 - Product Requirements

B. Construction: NEMA 250, Type 1 or 3R steel enclosure, depending on the location.

C. Covers: Continuous hinge, held closed by flush latch operable by key.

D. Furnish interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.

E. Enclosure Finish: Manufacturer's standard enamel.

2.2 CABINETS

A. Manufacturers:

1. Hoffman
2. Carlon Electrical Products.
3. Hubbell Wiring Devices.
4. Substitutions: Section 01 60 00 - Product Requirements

B. Boxes: Galvanized steel with removable end walls.

C. Box Size: 24 inches wide x 24 inches high x 6 inches inches deep.

D. Backboard: Furnish 3/4 inch thick plywood backboard for mounting terminal blocks. Paint matte white.

E. Fronts: Steel, surface type with screw cover front, door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.

F. Knockouts: Factory layout.

G. Furnish metal barriers to form separate compartments wiring of different systems and voltages.

H. Furnish accessory feet for free-standing equipment.

2.3 TERMINAL BLOCKS

A. Manufacturers:
1. Carlon Electrical Products
2. Hubbell Wiring Devices
3. Reliance Electric

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Terminal Blocks: NEMA ICS 4.

C. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

D. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

E. Furnish ground bus terminal block, with each connector bonded to enclosure.

2.4 PLASTIC RACEWAY

A. Manufacturers:

1. Panduit.

2. Hubbell Wiring Devices.

3. Carlon Electrical Products.

4. Substitutions: Section 01 60 00 - Product Requirements

B. Product Description: Plastic channel with hinged or snap-on cover.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Remove abandoned cabinets and enclosures, including abandoned cabinets and enclosures above accessible ceiling finishes.

B. Maintain access to existing cabinets and enclosures and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing cabinets and enclosures to remain or to be reinstalled.

3.2 INSTALLATION

A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner in accordance with Section 26 05 29.

B. Install cabinet fronts plumb.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean electrical parts to remove conductive and harmful materials.

C. Remove dirt and debris from enclosure.

D. Clean finishes and touch up damage.

END OF SECTION 26 2716

SECTION 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Division 09 - Finishes

C. Section 260400 – General Conditions for Electrical Trades

D. Section 260519 - Electrical Power Conductors and Cables.

E. Section 260526 - Grounding and Bonding for Electrical Systems.

F. Section 260503 – Equipment Wiring Connections.

G. Section 260533 – Raceways and Boxes for Electrical Systems.

H. Section 260553 - Identification for Electrical Systems.

I. Section 260923 - Lighting Control Devices.

J. Section 262913 - Enclosed Controllers.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Revision H.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Revision G.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

E. NEMA WD 1 - General Color Requirements for Wiring Devices.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

H. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

I. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

J. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

K. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

L. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

M. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01 - General Requirements.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
1. Wall Dimmers: Include derating information for ganged multiple devices.
2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

C. Samples: One for each type and color of device and wall plate specified.

D. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data:
   1. GFCI Receptacles: Include information on status indicators.
   2. Surge Protection Receptacles: Include information on status indicators.

G. Project Record Documents: Record actual installed locations of wiring devices.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements, for additional provisions.
   2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
   3. Extra Keys for Locking Switches: Two of each type.
   4. Extra Surge Protection Receptacles: Two of each type.
   5. Extra Wall Plates: One of each style, size, and finish.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles where indicated on the drawings.

E. Provide GFCI protection for receptacles installed within 6 feet of water source.

F. Provide GFCI protection in other than dwelling units for all single-phase receptacles rated 150 volts to ground or less and all three-phase receptacles rated 150 volts to ground or less, 100 amperes of less in: Bathrooms, Kitchens and on Rooftops

G. Provide GFCI protection for receptacles serving electric drinking fountains.

H. Unless noted otherwise, do not use combination switch/receptacle devices.

2.2 WALL SWITCHES: See Section 260923 – Lighting Control Devices for specifications.

2.3 WALL DIMMERS: See Section 260923 – Lighting Control Devices for specifications.

2.4 RECEPTACLES

A. Manufacturers:
1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Substitutions: See Division 01 - General Requirements.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.
3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.
4. Body color:
   a. General Purpose Receptacles: color by Architect.
   b. Emergency, [Critical Branch], [Equipment Branch] receptacles: Red.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

E. USB Charging Devices:
1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
   a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
   b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.
2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
3. USB Charging Noncombination Devices: Four-port; rectangular decorator style.

F. Surge Protection Receptacles:
1. Surge Protection Receptacles - General Requirements: Listed and labeled as complying with UL 1449, Type 2 or 3.
   a. Energy Dissipation: Not less than 240 J per mode.
   b. Protected Modes: L-N, L-G, N-G.
   c. UL 1449 Voltage Protection Rating (VPR): Not more than 700 V for L-N, L-G modes and 1200 V for N-G mode.
   d. Diagnostics:
      1) Visual Notification: Provide indicator light to report functional status of surge protection.
      2) Audible Notification: Provide switchable audible alarm to report that surge protection is not functional.

2. Standard Surge Protection Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

G. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.
2. Special Purpose Locking Receptacles: refer to drawings and schedules for NEMA locking configuration.

2.5 WALL PLATES

A. Manufacturers:
1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Substitutions: See Division 01 - General Requirements.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Screws: Metal with slotted heads finished to match wall plate finish.
3. Provide screwless wallplates with concealed mounting hardware where indicated.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
1. Colors by the Architect and/or as noted on the plans.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.

F. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

G. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Wall Dimmers: 48 inches above finished floor.
      c. Receptacles: 18 inches above finished floor or 6 inches above counter.
      d. Install convenience GFCI type receptacles 36 to 48 inches above roof deck, or at designated heights as indicated on drawings.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in special application enclosures per manufacturer’s instructions, provide stainless steel cover plates.

D. Install wiring devices in accordance with manufacturer's instructions.

E. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

F. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

G. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper. When stranded conductors are used in lieu of solid, use insulated crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screw terminals.

I. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

J. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

K. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

L. Install wiring devices plumb and level with mounting yoke held rigidly in place.

M. Install wall switches with OFF position down.

N. Do not share neutral conductor on branch circuits utilizing wall dimmers.

O. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

P. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

R. Identify wiring devices in accordance with Section 260553.

3.4 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI protected receptacle for proper tripping operation according to manufacturer's instructions.

F. Inspect each surface protection receptacle to verify surge protection is active.

G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 2726

SECTION 26 2813 - FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED REQUIREMENTS

A. See Division 01 – General Requirements

B. Section 260400 – General Conditions for Electrical Trades

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 262413 - Switchboards: Fusible switches.

E. Section 262416 - Panelboards: Fusible switches.

F. Section 262819 - Enclosed Switches: Fusible switches.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. See Division 01: General Requirements

B. Coordination:
1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
a. Fusible Switches for Switchboards: See Section 262413.
b. Fusible Enclosed Switches: See Section 262819.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain written direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
1. Spare Fuse Cabinet: Include dimensions.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 - Product Requirements, for additional provisions.
2. Extra Fuses: One set(s) of three for each type and size installed.
3. Fuse Pullers: One set(s) compatible with each type and size installed.
4. Spare Fuse Cabinet Keys: Two.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussmann

B. Littelfuse, Inc.

C. Ferraz Shawmut

D. Substitutions: See Division 01- General Requirements.

2.2 APPLICATIONS

A. General Purpose Branch Circuits: Class RK1, time-delay.

B. Individual Motor Branch Circuits: Class RK1, time-delay.

C. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

D. Primary Protection for Control Transformers: Class CC, time-delay.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class J Fuses: Comply with UL 248-8.

I. Class L Fuses: Comply with UL 248-10.

J. Class T Fuses: Comply with UL 248-15.

K. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

L. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.
   2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.4 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 260553.

END OF SECTION 26 2813

SECTION 26 2819 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fusible and non-fusible switches.

B. Related Sections:
   1. Section 26 28 13 - Fuses.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

   1. NEMA FU 1 - Low Voltage Cartridge Fuses.

   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:

   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:

   1. General Electric.

2. Square D.

3. Siemens.

4. Eaton/Cutler Hammer.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R or J fuses.

D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.

1. Interior Dry Locations: Type 1.

2. Exterior Locations: Type 3R.

3. Industrial Locations: Type 4.

E. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

F. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:

1. General Electric.

2. Square D.

3. Siemens.

4. Eaton/Cutler Hammer.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray.

1. Interior Dry Locations: Type 1.

2. Exterior Locations: Type 3R.

3. Industrial Locations: Type 4.

D. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

E. Furnish switches with entirely copper current carrying parts.

2.3 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere). 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes). 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned enclosed switches.

B. Maintain access to existing enclosed switches and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing enclosed switches to remain or to be reinstalled.

3.2 INSTALLATION

A. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.

B. Height: 5 feet to operating handle.

C. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

D. Install engraved plastic nameplates in accordance with Section 26 05 53.

E. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.3 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION 26 2819

SECTION 26 4113 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Strike (air) terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

C. Description: Conductor system protecting [entire building] and having UL Master Label.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Section 260400 – General Conditions for Electrical Trades

C. Section 260526 - Grounding and Bonding for Electrical Systems: Electrical system grounds.

D. Surge Protection for Wiring Systems: Specified in individual system requirements.

1.3 REFERENCE STANDARDS

A. NFPA 780 - Standard for the Installation of Lightning Protection Systems;

B. UL 96 - Lightning Protection Components; Current Edition, Including All Revisions.

C. UL 96A - Installation Requirements for Lightning Protection Systems.

D. Perform Work in accordance with UL 96A and furnish Master Label.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination with Concrete Work: Coordinate the embedding of lightning protection components in concrete.

B. Coordination with Roofing Installation:
   1. Ensure adequate attachment of strike terminals and conductors without damage to roofing.
   2. Sealing and flashing of all lightning protection roof penetrations with roofing contractor.

C. Coordinate with all trades to ensure a correct, neat and unobtrusive installation.

D. Pre-installation Meeting: Convene a meeting at least two weeks prior to commencement of any work affected by lightning protection system requirements to discuss prerequisites

and coordination required by other installers; require attendance by representatives of installers whose work will be affected.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Shop Drawings: Indicate location and layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.
   1. Where conductors or grounds are to be embedded or concealed in other construction, submit shop drawings at least 30 days prior to start of construction.
   2. If concrete-encased grounds are to be used and are not shown in the contract documents, provide sufficient data to determine concrete encasement dimensions and location.
   3. Include data on actual ground resistance determined by field measurement in accordance with NFPA 780.
   4. Include engineering analysis of equalization of potential to metal bodies within the structure.
   5. Include access panels, test holes, and disconnecting means for maintenance.

C. Product Data: Provide dimensions and materials of each component, indication of testing agency listing, and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installation Certification: Submit copy of certification agency's approval UL Master Label.

F. Operation and Maintenance Data: Provide recommended inspection and testing plan, including recommended intervals, to achieve periodic maintenance as recommended in NFPA 780; provide customized plan reflecting actual installation configuration with specific installed components identified.

G. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.6 QUALITY ASSURANCE

A. Maintain one copy of each referenced system design standard on site.

B. Manufacturer Qualifications: Company specializing in lightning protection equipment with minimum three years documented experience.

C. Designer Qualifications: Person or entity, employed by installer, who specializes in lightning protection system design with minimum three years documented experience.

D. Installer Qualifications: Capable of providing the specified certification of the installed system.

E. Installer Qualifications: Company specializing in lightning protection system design with minimum three years documented experience.

F. Field Quality Control Testing Agency Qualifications: Firm capable of and experienced in grounding and bonding testing with documented experience and minimum of three project references.

G. Products: Listed, classified, and labeled as suitable for the purpose intended.

H. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

I. Design lightning protection system under direct supervision of NFPA 780 Certified Designer or Professional Engineer experienced in design of this Work and licensed in State where work is performed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Lightning Protection Components:
   1. Advanced Lightning Technology (ALT)
   2. Harger Lightning and Grounding
   3. thermOweldae, subsidiary of Continental Industries; division of Burndy LLC;
   4. Substitutions: See Division 01- General Requirements.

2.2 LIGHTNING PROTECTION SYSTEM

A. Lightning Protection System: Provide complete system complying with NFPA 780, including air terminals, bonding, interconnecting conductors and grounding electrodes.
   1. Provide system that protects:
      a. The entire structure.
      b. Open air areas within 100 feet of exterior walls at grade level.
      c. Open air areas within building footprint.
      d. Metal fences identified on site plan.
      e. Aboveground metal water tank (grounding only).
      f. Aboveground concrete water tank.
      g. Metal communications towers (grounding only).
   2. Coordinate with other grounding and bonding systems specified.
   3. Treat isolated non-grounded protruding metal items as specified by NFPA 780 for heavy-duty stacks.
   4. Determine ground resistance by field measurement.
   5. Provide copper or aluminum components, as specified in following sections..
   6. Provide disconnecting means and access panels or similar devices to allow complete periodic inspection and testing as described by NFPA 780 Annex D. check GR
   7. Provide materials that are galvanically compatible with the structure and system components.

8. Provide system certified by Underwriters Laboratories or the Lightning Protection Institute.
9. Conceal all downleads within structure.

B. Strike Terminals: Provide strike (air) terminals where indicated on the drawings, or as required by delegated design

C. Strike Terminals: Provide strike (air) terminals on the following:
1. Roofs.
2. Penthouse roofs.
3. Parapets.
4. Roof mounted equipment.
5. Stacks.
6. Chimneys.
7. Steeple.
8. Water storage tanks.
9. Trees.

2.3 COMPONENTS

A. All Components: Complying with applicable requirements of UL 96.

B. Strike (Air) Terminals: Copper, solid, with adhesive bases for single-ply roof installations.

C. Strike Terminal for Chimney: Lead-coated copper.

D. Grounding Rods: Solid copper.

E. Ground Plate: Copper.

F. Conductors: Copper cable.

G. Connectors and Splicers: Bronze.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate work with installation of roofing and exterior and interior finishes.

3.2 INSTALLATION

A. Install in accordance with referenced system standards and as required for specified certification.

B. Connect conductors using mechanical connectors or exothermic welding process; protect adjacent construction elements and finishes from damage.

C. Connect conductors using mechanical connectors.

D. Connect conductors using exothermic welding process; protect adjacent construction elements and finishes from damage.

E. Downleads from roof to grade shall be routed within building envelope. Exposed downleads are not acceptable.

3.3 FIELD QUALITY CONTROL

A. See Division 01, for additional requirements.

B. Perform visual inspection as specified in NFPA 780 as if this were a periodic follow-up inspection.

C. Perform continuity testing as specified in NFPA 780 as if this were testing for periodic maintenance.

D. Obtain the services of the specified certification agency to provide inspection and certification of the lightning protection system, including performance of any other testing required by that agency.

E. Perform inspection and testing in accordance with UL 96A.

END OF SECTION 26 4113

SECTION 26 5100 - LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Exterior luminaires.

C. Exit signs.

D. Drivers.

E. Luminaire accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 0533 – Raceways and Boxes for Electrical Systems.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.

D. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

E. Lighting Fixture Schedule as indicated on drawings.

1.3 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

C. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

D. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; 2015.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

G. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

H. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2015.

I. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

J. UL 924 Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

K. UL 1598 - Luminaires; Current Edition, Including All Revisions.

L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility, installed by other sections or others.
4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Shop Drawings:
1. Indicate dimensions and components for each luminaire of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories,

and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA LM-79 and IESNA LM-80.
    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    b. Testing Agency Certified Data: Photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    c. TM-21 report for L70 rating at color temperature specified.
6. Drivers: Include wiring diagrams and list of compatible lamp configurations.
7. LED arrays: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

E. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

F. Samples:
1. Provide one sample(s) of each specified luminaire upon request.
2. Provide one sample(s) of each custom luminaire.
3. Provide one sample(s) of each luminaire proposed for substitution upon request.
4. Provide one sample(s) of each product finish illustrating color and texture upon request.
5. Provide a mockup of selected luminaires upon request.
6. Submit two color chips 3 x 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

G. Certificates for Dimming Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.

H. Field quality control reports.

I. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.6 EXTRA PRODUCTS

A. Provide [6] universal exit signs complete with all labor and materials required for installation as directed by the Local Authority Having Jurisdiction.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 – General Requirements.
   2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
   3. LED Drivers: Furnish two of each driver type
   4. Furnish one replacement battery for each battery type and size.

C. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 QUALIFICATION DATA: For testing laboratory providing photometric data for luminaires.

A. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

1.9 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.10 FIELD CONDITIONS

A. Maintain field conditions within the manufacturers required service conditions during and after installation.

1.11 WARRANTY

A. See Division 01 – General Requirements.

B. Section 26 0400 – General Requirements for Electrical Trades.

C. Unless otherwise noted in Lighting Fixture Schedule, Provide three year manufacturer warranty for all LED luminaires, including drivers. Warranty shall begin from the moment of installation.

D. Provide five year manufacturer warranty for batteries for lighting inverters.

E. Provide ten year manufacturer warranty for batteries for self-powered exit signs. Warranty shall begin from the moment of installation.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in Lighting Fixture Schedule included on the drawings.

B. Substitutions: See Division 01- General Requirements, except where individual luminaire types are designated with substitutions not permitted and the following:
   1. Section 26 04 00 – Product Requirements and as follows:
      a. Approved equals to the basis of design fixture as listed in the Lighting Fixture Schedule shall be accepted for review with the proposed substitute fixture meeting the following minimum requirements:
         1) Be of the same general size, style and shape, including but not limited to lens construction and shading.
         2) Be of equal or better quality and construction.
         3) Be supplied with all required accessories to match the specified fixture.
         4) Be supplied with all remote drivers, power supplies and cabling lengths to meet specified performance and control.
         5) Provide the same or better distribution, efficiency, source lumen output, and L70 lumen depreciation metric.
      b. Provide point by point photometric calculations at the request of the Engineer for evaluation.
      c. The basis of design fixture listed in the Lighting Fixture Schedule lists part numbers, specifications, options, accessories and source output available at the time of design. Substitutions shall meet these requirements as scheduled.
      d. The evaluation of an approved equal shall be at the sole discretion of the Architect and Engineer.

2.2 INTERIOR LUMINAIRES

A. Manufacturers:
   1. Manufacturers represented by Lighting Affiliates.
   2. Manufacturers represented by Apex Lighting.
   3. Manufacturers represented by Illuminate.
   4. Substitutions: See paragraph 2.1, B.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Provide products complying with Federal Energy Management Program (FEMP) requirements.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning. Continuous rows shall be provided with seamless joiner sections and lenses.

K. Luminaires in Special Environments:
   1. Wet Locations: Provide with sealed and gasketed lens.

2.3 EXIT SIGNS

A. Manufacturers:
   1. Manufacturers represented by Lighting Affiliates.
   2. Manufacturers represented by Apex Lighting.

3. Manufacturers represented by Illuminate Lighting.
4. Substitutions: See paragraph 2.1, B.

B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
1. Number of Faces: Single or double as indicated or as required for the installed location.
2. Directional Arrows: Universal type for field adjustment sized so that they are clearly visible at a distance of 40 feet as required by local codes.
3. Mounting: Wall, ceiling or pendant as indicated. Provide universal mount exit signs where indicated.
4. Housing: Varies, refer to Lighting Fixture Schedule.
5. Face: Varies, refer to Lighting Fixture Schedule.

C. Self-Powered Exit Signs:
1. Product Description: UL 924 self-contained emergency lighting unit.
2. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
3. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
4. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
5. Provide low-voltage disconnect to prevent battery damage from deep discharge.
6. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

D. Self-Luminous Exit Signs: Internally illuminated by tritium gas sealed inside phosphor lined gas tubes, requiring no electrical power to operate, with a service life of 20 years unless otherwise indicated.

E. Photoluminescent Exit Signs: Powder-coated sheet aluminum with photoluminescent pigmented material.

F. Special Wording Signs: Provide with special wording as indicated.
1. Where indicated, provide with international symbol of accessibility complying with state and local codes.
2. Provide combination exit/special wording signs where indicated.

G. Accessories:
1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
2. Provide compatible accessory wire guards where indicated.

2.4 EXTERIOR LUMINAIRES

A. Manufacturers:

1. Manufacturers represented by Lighting Affiliates.
2. Manufacturers represented by Apex Lighting.
3. Manufacturers represented by Illuminate Lighting.
4. Substitutions: See paragraph 2.1, B.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Provide products complying with Federal Energy Management Program (FEMP) requirements.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Provide IESNA full cut-off classified products unless otherwise indicated or provide products with backlight, uplight and glare (BUG) ratings as indicated.

I. Provide products with IESNA light distribution as indicated.

J. Provide products with internal/external house-side shields as indicated.

K. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data or as indicated.

2.5 MATERIALS

A. Parts:
1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.
4. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
5. Diffusers and Globes:
   a. Refer to Interior Lighting Fixture Schedule for types.

b. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
c. Glass: Annealed crystal glass unless otherwise indicated.
d. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

6. Housings:
   a. Extruded-aluminum housing and heat sink unless otherwise indicated.
   b. Powder-coat finish unless otherwise indicated, color selection by Architect.
7. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   a. Label shall include the following lamp characteristics:
      1) "USE ONLY" and include specific lamp type.
      2) Lamp diameter, shape, size, wattage, and coating.
      3) CCT and CRI for all luminaires.

B. METAL FINISHES
1. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 DRIVERS

A. Manufacturers:
1. eldoLED.
2. General Electric Company.
3. Lutron Electronics Company.
4. Osram Sylvania.
5. Philips Lighting Electronics/Advance.
6. Substitutions: See Division 01- General Requirements, Product Requirements.
7. Manufacturer Limitations: Where possible, for each type of luminaire provide drivers produced by a single manufacturer.
8. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.
9. Provide drivers compatible with the approved lighting control systems.

B. Drivers - General Requirements:
1. Minimum Efficiency/Efficacy: Provide drivers complying with all current applicable federal and state efficiency/efficacy standards.
2. Electronic Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

C. LED Drivers:
1. Product Description: LED dimming driver.
   a. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
2. General:

a. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

b. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

c. Driver must limit inrush current.
   1) Base specification: Meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 Amps (^2) – seconds.
   2) Preferred Specification: Meet or exceed 30mA(^2)s at 277VAC for up to 50 watts of load and 75A at 240us at 277VAC for 100 watts of load.

d. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.

e. No visible change in light output with a variation of plus/minus 10 percent line voltage input.

f. Total Harmonic Distortion less than 20% percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.

g. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
   1) Adjustment of forward LED voltage, supporting 3V through 55V.
   2) Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1mA
   3) Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.

h. Driver must be able to operate for a (+/- 10%) supply voltage of 120V through 277VAC at 60Hz.

i. Driver should be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.

3. Light Quality

a. Over the entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 percent to 1 percent and 10% relative light output where indicated, or 100 – 10% light standard. Driver shall respond similarly when raising from 1% to 100%

b. 1) Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels

c. Drivers to track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.

d. Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-1 percent luminaire shall have:

1) LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.

2) Base specification: Flicker index shall less that 5% at all frequencies below

3) 1000 Hz.

4) Preferred specification: Flicker index shall be equal to incandescent, less that 1% at all frequencies below 1000 Hz.

4. Control Input

a. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers

1) Must meet IEC 60929 Annex E for General White Lighting LED drivers

2) Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.

3) Must meet ESTA E1.3 for RGBW LED drivers

5. Driver: Approved by dimming system manufacturer as suitable for operation with control unit and suitable for LED source type and quantity specified for luminaire.

2.7 LED DRIVER EMERGENCY POWER SUPPLY UNITS - INVERTER

A. Manufacturers:

1. Manufacturers represented by Lighting Affiliates.
2. Manufacturers represented by Apex Lighting.
3. Manufacturers represented by Illuminate Lighting.
4. Substitutions: See paragraph 2.1, B.

B. Description: Per lighting fixture schedule. Emergency power supply lighting inverter units, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Compatibility:

1. LED Drivers: Compatible with LED driver and LED arrays.

D. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lighting circuits to the emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

E. Battery: Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.

F. Emergency Illumination Output: Refer to Lighting Fixture Schedule.

G. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

H. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.

I. Operating Temperature: From 32 degrees F (0 degrees C) to 122 degrees F (50 degrees C) unless otherwise indicated or required for the installed location.

J. Accessories:
1. Provide remote test switches as required. Provide with mounting brackets to securely support the unit(s) at locations shown on plans.

2.8 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 “Hangers and Supports for Electrical Systems” for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with heavy duty swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage minimum.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

F. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Existing to be re-used fixtures: Disconnect, remove, clean, re-lamp, reinstall, and connect to new circuits as shown on plans.

B. Repair existing luminaires to be re-used. Provide a new similar fixture if the fixture is found to be beyond repair.

C. Re-lamp existing to be re-used light fixtures with lamps to match existing. Test at substantial completion.

3.2 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.3 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.4 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533 as required for installation of luminaires, emergency lighting units and exit signs provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
      a. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   5. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box, heavy-duty swivel hangers and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.

6. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
7. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
8. See Division 09 - Finishes where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
2. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
3. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
4. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
5. Install recessed luminaires to permit removal from below.

H. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.
4. Install canopies tight to mounting surface.
5. Secure pendant-mounted luminaires to building structure.
   a. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
6. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box, heavy-duty swivel hangers and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
7. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
8. Unless otherwise indicated, support pendants from swivel hangers.

I. Exterior Luminaires:
1. Bond and ground luminaries in accordance with Section 26 05 26.
2. Aim and adjust luminaires with distribution aimed towards coverage area and parallel to curb line or to provide illumination levels and distribution as indicated.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

M. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.
3. Install plumb and adjust to align with building lines and with each other. Secure to prevent movement.
4. Install suspended exit signs using pendants from swivel hangers. Install pendant lengths required to suspend sign at height indicated or as instructed by the Authority Having Jurisdiction.

N. Emergency Power Supply Units - Inverters:
1. Install lock-on device on branch circuit breaker serving units.

O. Remote Ballasts/drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

P. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

Q. Install accessories furnished with each luminaire.

R. Connect luminaires to branch circuit using flexible conduit, except for emergency lighting which shall be in conduit completely.

S. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

T. Ground and bond interior luminaires in accordance with Section 26 05 26.

3.5 FIELD QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.6 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.7 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean photometric surfaces as recommended by the manufacturer.

3.8 CLOSEOUT ACTIVITIES

A. See Division 01- General Requirements

B. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

C. Just prior to Substantial Completion, replace all lamps that have failed.

3.9 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 5100

SECTION 27 0529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for communications equipment, conduit, cable, boxes, and other communications work.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Section 260400 – General Conditions for Electrical Trades

C. Section 260529 – Hangers and Supports for Electrical Systems

D. Section 271000 – Structured Cabling

1.3 REFERENCE STANDARDS

A. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. See Division 01: General Requirements.

B. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components being installed.
   2. Coordinate the work with other trades and provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

C. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Division 03.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with latest adopted version of applicable building code, including any addendum or supplements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D. Installer Qualifications for Field-Welding: As specified in Section 260400 General Requirements for Electrical Trades.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 Refer to Section 260529 – Hangers and Supports for Electrical Systems. All Part 2 Product requirements listed in this Section shall also apply to Division 27 Communications, except where specified otherwise herein.

2.2 J-HOOK SUPPORTS

A. Manufacturers:
1. Easton/Cooper B-Line – "BCH" Series
2. Caddy
3. Chatsworth
4. Substitutions: Division 01 - General Requirements

B. Product Description: Low-voltage and communication fasteners for routing of cabling from telecommunication room to work area outlet. J-hooks shall support all communications cabling in the project. Including, but not limited to, Category 6, 6A, fiber, speaker cabling, coaxial, security, and others.

C. Specifications:
1. Pre-galvanized steel finish
2. Static load capacity: 30 lbs
3. Quick latching cable retainer

D. Furnish with all required connectors, fasteners and accessories.

E. J-Hooks shall be sized to correctly support the number of cables, which pass through them. Under no circumstances shall cable quantity exceed 50 in any given support. Fill capacity shall be as required by code for conduit. That is to say that every J-Hook shall have a maximum of 40 percent fill capacity. Install additional supports as required.

PART 3 EXECUTION

3.1 Refer to Section 260529 – Hangers and Supports for Electrical Systems. All Part 3 Execution requirements listed in this Section shall also apply to Division 27 Communications, except where specified separately herein.

3.2 INSTALLATION – COMMUNICATIONS SYSTEM SUPPORT COMPONENTS

A. Backboxes for communications devices shall be permitted to be supported from a grid ceiling. A tile bridge shall be furnished for this purpose. Refer to Section 26 05 33.

B. Overhead speakers, plenum boxes, audiovisual equipment, and other devices weighing more than a standard electrical backbox shall be supported via a threaded rod fastened to the building structure.

C. J-hooks shall be furnished with cable-to-beam fasteners and shall be fastened to the building structure.

D. Separate J-hooks shall be furnished and installed for different systems. The following systems shall be routed in separate j-hook pathways:

1. Data cabling
2. Speaker cabling
3. Security cabling

E. J-hook pathways shall be separated from power cabling by a minimum of 12 inches.

F. J-hook pathways shall be separated from the load side wiring of dimmer controls by a minimum of 24 inches.

G. Cable Tray Support and Attachment: Also comply with Section 27 05 36.

END OF SECTION 26 0529

SECTION 27 0533 - RACEWAY AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Raceway and Boxes for Communications Systems.

B. Related Sections:
   1. Section 260400 – General Conditions for Electrical Trades.
   2. Section 260526 - Grounding and Bonding for Electrical Systems.
   3. Section 260533 - Raceway and Boxes for Electrical Systems.
   4. Section 260534 - Floor Boxes for Electrical Systems.
   5. Section 270529 - Hangers and Supports for Communications Systems.
   6. Section 270553 - Identification for Communications Systems.

1.2 REFERENCES

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC);

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S);

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A);

D. NECA 1 - Standard for Good Workmanship in Electrical Construction;

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT);

F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit;

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC);

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable;

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit;

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit;

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing;

L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT);

M. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

N. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

O. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

R. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

S. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

T. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

U. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

V. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

W. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

X. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

Y. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

Z. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

AA. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.3 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for all conduits and fittings outlined in Part 2.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within or under structural concrete slabs, where permitted.
   2. Include proposed locations of roof penetrations and proposed methods for sealing.

E. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs (where permitted), and conduits 2 inch trade size and larger.

F. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

G. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 – General Requirements.
   2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

D. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

1.8 COORDINATION

A. See Division 01 – General Requirements

B. Coordinate installation of outlet boxes for equipment connected under Section 260503.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

D. Communications contractor is responsible to fully coordinate with the site and concrete contractors and all other trades when routing conduit underslab. Routing of conduit underslab may be acceptable, provided spacing of conduits is adequate for proper backfilling of area surrounding conduits. Adequate spacing shall mean using factory made conduit spacers that allow for a minimum of 3-inches for backfilling with sand or 3 times the pipe diameter for backfilling with a structural fill. Proposed conduit routing, installation and methods and backfilling procedures shall be submitted to the Engineer for review prior to installation.

PART 2 PRODUCTS

2.1 Refer to Section 260533 – Raceway and Boxes for Electrical Systems. All Part 2 Product requirements listed in this Section shall apply to Division 27 Communications.

PART 3 EXECUTION

3.1 Refer to Section 260533 – Raceway and Boxes for Electrical Systems. All Part 3 Execution requirements listed in this Section shall apply to Division 27 Communications.

END OF SECTION 27 0533

SECTION 27 0553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Communication system identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

1.2 RELATED REQUIREMENTS (follow the most currently adopted amended version)

A. See Division 01 – General Requirements

B. Division 09 - Finishes.

C. Section 260400 – General Conditions for Electrical Trades.

D. Section 260553 – Identification for Electrical Trades.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 70 - National Electrical Code.

~~D.~~ NFPA 70E - Standard for Electrical Safety in the Workplace

E. UL 969 - Marking and Labeling Systems.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.8 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature and humidity is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 Refer to Section 260553 – Identification for Electrical Systems. All Part 2 Product requirements listed in this Section shall also apply to Division 27 Communications.

PART 3 EXECUTION

3.1 Refer to Section 260553 – Identification for Electrical Systems. All Part 3 Execution requirements listed in this Section shall also apply to Division 27 Communications, except where specified separately herein.

3.2 INSTALLATION – COMMUNICATIONS SYSTEM LABELING

A. Label Installation:
1. All labeling standards shall be confirmed with and approved by owner’s IT staff prior to performing work. It is the responsibility of the contractor to coordinate with owner’s staff.

2. Labeling procedures shall meet TIA/EIA 568B Series standard and BICSI Standards and shall be pre-approved by the Owner.
3. Permanently label, using pre-printed labels, all cables and terminations.
   a. Patch panels and cross-connect blocks, numerically from top to bottom.
   b. Patch panel port with work area outlet label.
   c. Cable segments.
4. Install label parallel to equipment lines.
5. Use industry standard TIA/EIA and BISCI color codes.
6. Each work station outlet jack and corresponding patch panel port shall be marked with the same, unique label.
7. Mark the plate with standard nomenclature as required by the configuration. Mark the outlet plainly and neatly with its station identification, as indicated in above paragraph. The station identification shall also be marked inside the outlet plate on the backing plate of the outlet, and shall match the ID used at the patch panel port. Make the outlet marking using the Panduit system or equal, except for the inside marking which may be by indelible marker. Place exposed marking on outlet plates under a transparent window for protection. Label cable with permanent marker compliant with EIA/TIA 606, six (6) inches back from the termination at both ends.

B. Wire Label Installation:
   1. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
   2. Install labels at data outlets identifying patch panel and port designation as specified.

C. Conduit Marker Installation:
   1. Install conduit marker for each conduit longer than 10 feet.
   2. Conduit Marker Spacing: 20 feet on center.

END OF SECTION 27 0553

SECTION 28 0529 - HANGERS AND SUPPORTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for communications equipment, conduit, cable, boxes, and other communications work.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Section 260400 – General Conditions for Electrical Trades

C. Section 260529 – Hangers and Supports for Electrical Systems

D. Section 281000 – Integrated Security Systems

E. Section 283100 – Fire Detection and Alarm

1.3 REFERENCE STANDARDS

A. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. See Division 01: General Requirements.

B. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components being installed.

2. Coordinate the work with other trades and provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

C. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Division 03.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with latest adopted version of applicable building code, including any addendum or supplements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D. Installer Qualifications for Field-Welding: As specified in Section 260400 General Requirements for Electrical Trades.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 Refer to Section 260529 – Hangers and Supports for Electrical Systems. All Part 2 Product requirements listed in this Section shall also apply to Division 28 Electronic Safety and Security, except where specified otherwise herein.

2.2 J-HOOK SUPPORTS

A. Manufacturers:
1. Easton/Cooper B-Line – "BCH" Series
2. Caddy
3. Chatsworth
4. Substitutions: Division 01 - General Requirements

B. Product Description: Low-voltage and communication fasteners for routing of cabling from telecommunication room to work area outlet. J-hooks shall support all communications cabling in the project. Including, but not limited to, Category 6, 6A, fiber, speaker cabling, coaxial, security, and others.

C. Specifications:
1. Pre-galvanized steel finish
2. Static load capacity: 30 lbs
3. Quick latching cable retainer

D. Furnish with all required connectors, fasteners and accessories.

E. J-Hooks shall be sized to correctly support the number of cables, which pass through them. Under no circumstances shall cable quantity exceed 50 in any given support. Fill capacity shall be as required by code for conduit. That is to say that every J-Hook shall have a maximum of 40 percent fill capacity. Install additional supports as required.

PART 3 EXECUTION

3.1 Refer to Section 260529 – Hangers and Supports for Electrical Systems. All Part 3 Execution requirements listed in this Section shall also apply to Division 28 Electronic Safety and Security, except where specified separately herein.

3.2 INSTALLATION – SECURITY SYSTEM SUPPORT COMPONENTS

A. Backboxes for communications devices shall be permitted to be supported from a grid ceiling. A tile bridge shall be furnished for this purpose. Refer to Section 26 05 33.

B. Overhead speakers, plenum boxes, audiovisual equipment, and other devices weighing more than a standard electrical backbox shall be supported via a threaded rod fastened to the building structure.

C. J-hooks shall be furnished with cable-to-beam fasteners and shall be fastened to the building structure.

D. Separate J-hooks shall be furnished and installed for different systems. The following systems shall be routed in separate j-hook pathways:

1. Data cabling
2. Speaker cabling
3. Security cabling

E. J-hook pathways shall be separated from power cabling by a minimum of 12 inches.

F. J-hook pathways shall be separated from the load side wiring of dimmer controls by a minimum of 24 inches.

END OF SECTION 28 0529

SECTION 28 0533 - RACEWAY AND BOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Raceway and Boxes for Electronic Safety and Security Systems.

B. Related Sections:
   1. Section 260400 – General Conditions for Electrical Trades.
   2. Section 260526 - Grounding and Bonding for Electrical Systems.
   3. Section 260533 - Raceway and Boxes for Electrical Systems.
   4. Section 260534 - Floor Boxes for Electrical Systems.
   5. Section 280529 - Hangers and Supports for Electronic Safety and Security.
   6. Section 280553 - Identification for Electronic Safety and Security.

1.2 REFERENCES

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC);

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S);

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A);

D. NECA 1 - Standard for Good Workmanship in Electrical Construction;

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT);

F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit;

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC);

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable;

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit;

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit;

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing;

L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT);

M. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

N. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

O. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

R. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

S. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

T. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

U. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

V. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

W. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

X. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

Y. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

Z. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

AA. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

BB. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

CC. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

1.3 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for all conduits and fittings outlined in Part 2.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Shop Drawings:
1. Indicate proposed arrangement for conduits to be installed within or under structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

E. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs (where permitted), and conduits 2 inch trade size and larger.

F. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

G. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 – General Requirements.
2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

D. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

1.8 COORDINATION

A. See Division 01 – General Requirements

B. Coordinate installation of outlet boxes for equipment connected under Section 260503.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

D. Security contractor is responsible to fully coordinate with the site and concrete contractors and all other trades when routing conduit underslab. Routing of conduit underslab may be acceptable, provided spacing of conduits is adequate for proper backfilling of area surrounding conduits. Adequate spacing shall mean using factory made conduit spacers that allow for a minimum of 3-inches for backfilling with sand or 3 times the pipe diameter for backfilling with a structural fill. Proposed conduit routing, installation and methods and backfilling procedures shall be submitted to the Engineer for review prior to installation.

PART 2 PRODUCTS

2.1 Refer to Section 260533 – Raceway and Boxes for Electrical Systems. All Part 2 Product requirements listed in this Section shall apply to Division 28 Electronic Safety and Security.

PART 3 EXECUTION

3.1 Refer to Section 260533 – Raceway and Boxes for Electrical Systems. All Part 3 Execution requirements listed in this Section shall apply to Division 28 Electronic Safety and Security.

END OF SECTION 28 0533

SECTION 28 0553 - IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Security system identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

1.2 RELATED REQUIREMENTS (follow the most currently adopted amended version)

A. See Division 01 – General Requirements

B. Division 09 - Finishes.

C. Section 260400 – General Conditions for Electrical Trades.

D. Section 260553 – Identification for Electrical Trades.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 70 - National Electrical Code.

~~D.~~ NFPA 70E - Standard for Electrical Safety in the Workplace

E. UL 969 - Marking and Labeling Systems.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.8 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature and humidity is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 Refer to Section 260553 – Identification for Electrical Systems. All Part 2 Product requirements listed in this Section shall also apply to Division 28 Electronic Safety and Security.

PART 3 EXECUTION

3.1 Refer to Section 260553 – Identification for Electrical Systems. All Part 3 Execution requirements listed in this Section shall also apply to Division 28 Electronic Safety and Security, except where specified separately herein.

3.2 INSTALLATION – SECURITY SYSTEM LABELING

A. Label Installation:
1. All labeling standards shall be confirmed with and approved by owner’s IT staff prior to performing work. It is the responsibility of the contractor to coordinate with owner’s staff.

2. Labeling procedures shall meet TIA/EIA 568B Series standard and BICSI Standards and shall be pre-approved by the Owner.
3. Permanently label, using pre-printed labels, all cables and terminations.
   a. Patch panels and cross-connect blocks, numerically from top to bottom.
   b. Patch panel port with work area outlet label.
   c. Cable segments.
4. Install label parallel to equipment lines.
5. Use industry standard TIA/EIA and BISCI color codes.
6. Each work station outlet jack and corresponding patch panel port shall be marked with the same, unique label.
7. Mark the plate with standard nomenclature as required by the configuration. Mark the outlet plainly and neatly with its station identification, as indicated in above paragraph. The station identification shall also be marked inside the outlet plate on the backing plate of the outlet, and shall match the ID used at the patch panel port. Make the outlet marking using the Panduit system or equal, except for the inside marking which may be by indelible marker. Place exposed marking on outlet plates under a transparent window for protection. Label cable with permanent marker compliant with EIA/TIA 606, six (6) inches back from the termination at both ends.

B. Wire Label Installation:
   1. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
   2. Install labels at data outlets identifying patch panel and port designation as specified.

C. Conduit Marker Installation:
   1. Install conduit marker for each conduit longer than 10 feet.
   2. Conduit Marker Spacing: 20 feet on center.

END OF SECTION 28 0553

SECTION 28 3100 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections with DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Attention is directed Section 26 0400 – GENERAL CONDITIONS FOR ELECTRICAL TRADES, which is hereby made a part of this Section of the Specifications.

1.2 SUMMARY

A. Section includes fire alarm control panels, manual fire alarm stations, automatic smoke and heat detectors, fire alarm signaling appliances, and auxiliary fire alarm equipment and power and signal wire and cable.

B. Related Sections:
1. Division 07 – Firestopping
2. Division 08 – Hardware (for magnetic door hold open devices)
3. Division 21 – Fire Protection (for flow detection devices)
4. Division 23 – HVAC (for smoke dampers and fire/smoke dampers)
5. Section 26 05 19 – Building Wire and Cable
6. Section 26 05 26 – Grounding and Bonding
7. Section 26 05 33 – Identification for Electrical Systems, for labeling and identification requirements.

C. Allowances: Refer to Division 01 Section “Allowances” for lump-sum allowance for additional fire alarm devices.

D. Alternates: Refer to Division 01 Section “Alternates” for description of Work of this Section affected by alternates.

E. Unit Prices: Administrative and procedural requirement for unit prices for fire alarm and carbon monoxide devices are specified in Division 1 Section “Unit Prices”.

1.3 REFERENCES

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; current edition.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 72 - National Fire Alarm and Signaling Code

D. NFPA 101 - Life Safety Code

E. NFPA 601 - Standard for Security Services in Fire Loss Prevention

1.4 SYSTEM DESCRIPTION

A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Local Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.
   1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 24 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.

C. Basic Performance:
   1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on Class B circuits, unless otherwise indicated on drawings.
   2. Notification Appliance Circuits (NAC) shall be wired Class B as part of an addressable device connected by the SLC Circuit, unless otherwise indicated on drawings.
   3. All circuits shall be power-limited, per UL864 9th edition requirements.
   4. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm when wire NFPA Style 6/7.
   5. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.

D. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
   1. Local fire alarm signaling devices sound and display with signal.
   2. Zone-coded signal transmits to municipal connection (where applicable).
   3. Location of alarm zone indicates on fire alarm control panel and on remote annunciator panel.
   4. Signal transmits to building mechanical controls, shutting down fans and operating dampers.
   5. Signal transmits to building elevator control panel, initiating return to main floor or alternate floor and lockout for fire service.
   6. Signal releases magnetic door hold opens, if applicable.
   7. Refer to drawings for additional actions required to occur during alarm state.

E. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:

1. Visual and audible trouble alarm indicates by zone at fire alarm control panel.
2. Visual and audible trouble alarm indicates at remote annunciator panel.
3. Trouble signal transmits to municipal connection.

1.5 SUBMITTALS

A. Division 01: Submittal procedures.

B. Shop Drawings: Indicate system wiring diagram showing each device and wiring connection; indicate annunciator layout, and design calculations.

C. Product Data: Submit catalog data showing electrical characteristics and connection requirements.

D. Test Reports: Indicate procedures and results for specified field testing and inspection.

E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

G. Submit complete fire alarm battery calculations, taking all devices within building into account.

1.6 CLOSEOUT SUBMITTALS

A. Division 01: Closeout procedures.

B. Project Record Documents: Record actual locations of fire alarm equipment.

C. Operation and Maintenance Data: Submit manufacturer’s standard operating and maintenance instructions.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

D. Installer Qualifications: Company specializing in installing the products specified in this section with minimum three years documented experience, and certified by the State as fire alarm installer.

E. Products: Listed and classified by Underwriters Laboratories, Inc as suitable for the purpose specified and indicated.

1.8 MAINTENANCE SERVICE

A. Division 01: Maintenance service.

B. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Division 01: Spare parts and maintenance products.

B. Provide (2) manual fire alarm pullstations, complete with all labor, material, and programming, to be located in the field as directed by the Local Authority having Jurisdiction.

C. Provide (6) fire alarm audio/visual appliances, complete with all labor, material, and programming, to be located in the field as directed by the Local Authority having Jurisdiction.

D. Provide (6) addressable ceiling type smoke detectors, complete with all labor, material, and programming, to be located in the field as directed by the Local Authority Having Jurisdiction.

E. Provide (2) addressable duct mounted smoked detectors, including all labor, material, and programming, to be located in the field as directed by the Local Authority having Jurisdiction.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.11 COORDINATION

A. Division 01: Pre-Installation conferencing.

B. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.

C. Coordinate all connections to the building's HVAC system with the Division 23 contractor.

D. Coordinate all connections to the building's fire suppression system with the Division 21 contractor.

E. Coordinate all connections to door hardware with the Division 08 contractor.

1.12 WARRANTY

A. Contractor's Warranty: Warranty the installation to be free of defect for a period of two (2) years.

B. Equipment Warranty: Each piece of equipment shall carry a two(2) year manufacturer's warranty.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Silent Knight (by Honeywell)

B. Substitutions: Not Allowed – Owner Standard

2.2 CONTROL PANEL

A. Basis of design:
   1. Silent Knight 6000-Series, Addressable control panel

B. Product Description: Modular fire alarm control panel (FACP) with surface wall-mounted enclosure and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, annunciators, and other system controlled devices.

C. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
   1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
   2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
   3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.

D. Power supply: Adequate to serve control panel modules, remote detectors, remote annunciators, relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.

E. Batteries

1. The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
2. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
3. If necessary to meet standby requirements, external battery cabinet and charger systems may be used.

F. Remote Transmissions:
1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

G. Field Programming
1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. All field defined programs shall be stored in non-volatile memory.

H. Digital Voice Command Center (DVC)
1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
2. Function: The Voice Command Center equipment shall perform the following functions:
    a. Operate as a supervised multi-channel emergency voice communication system.
    b. Operate as a two-way emergency telephone system control center.
    c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
    d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
    e. Provide all-call Emergency Paging activities through activation of a single control switch.
    f. As required, provide vectored paging control to specific audio zones via dedicated control switches.
    g. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.

h. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
i. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
j. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
k. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

3. Audio Amplifiers
   a. The Audio Amplifiers will provide audio power for distribution to speaker circuits.
   b. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
4. Audio Message Generator (Prerecorded Voice)/Speaker Control:
   a. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
   b. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers.
   c. A built-in microphone shall be provided to allow paging through speaker circuits.

I. Digital Alarm Communicator Transmitter (DACT, or UDACT). The DACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station.
1. The DACT shall be an integral component of the fire alarm control panel requiring no interconnecting wiring or supervisory circuitry.
2. The DACT 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 two different telephone numbers.
3. The DACT shall be completely field programmable locally from the control panel keypad or remotely over a phone line using upload/download PC software.
4. The DACT 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:
   a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
   b. Independent Addressable Device Status
   c. AC (Mains) Power Loss
   d. Low Battery and Earth Fault
   e. System Off Normal
   f. 12 and 24-Hour Test Signal
   g. Abnormal Test Signal (per UL requirements)

h. EIA-485 Communications Failure
i. Phone Line Failure

6. The DACT shall support independent zone/point reporting when used in the Contact ID format. In this format, the DACT shall support the transmission of up to 50 addressable points with the system. This enables the central station to have exact details concerning the location of the fire for emergency response.
7. Provide connections to the building LAN and hardwired POTS dial-out lines as indicated in drawings.
8. Provide two (2) hardwired POTS dial-out lines to the DACT, and program two (2) phone numbers for the system.

2.3 REMOTE EMERGENCY VOICE EVACUATION MICROPHONES

A. Remote Microphones “EVAC”
1. Provide a remote microphone with enclosure and annunciator selector switches. Remote microphone shall override digitized voice message and shall allow for manual page override for the area. Rooms indicated with remote microphones on drawings shall have the ability for all speakers in area to be overridden.
2. Remote microphone shall be connected to main fire alarm control panel. Supervision and backup power shall be provided to all remote microphone locations.
3. Provide flushed cabinet for mounting microphone, Dimensions: 6.0”W x 8.3”H, 3.6”D.

2.4 INITIATING DEVICES

A. Addressable Manual Pull Station
1. Product Description: Manual addressable double-action station with break-glass rod.
2. Mounting: Semi-Flush in finished spaces and Surface in unfinished spaces.
3. Type: Non-coded.
4. Backbox: Manufacturer's standard.
5. Provide manual station guards on EACH manual station within the building. Station guards equal to "Stopper II" with audible horn.

B. Addressable Heat Detector
1. Product Description: Addressable combination rate-of-rise and fixed temperature, spot heat detector.
2. Temperature Rating: 135 degrees F (57 degrees C).
3. Rate-of-Rise: 15 degrees F (8.3 degrees C).
4. The choice of alarm reporting as a fixed temperature detector or a combination of fixed and rate of rise shall be made in system software and be changeable at any time without the necessity of hardware replacement.
5. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet.

C. Addressable Photoelectric Ceiling Smoke Detector
1. Product Description: NFPA 72, addressable photoelectric type ceiling smoke detector with the following features:

a. Adjustable sensitivity.
b. Plug-in base
c. Visual indication of detector actuation.

2. Mounting: 4 inch (102 mm) outlet box.
3. Furnish two-wire detector with common power supply and signal circuits.
4. The smoke detector shall be capable of providing three distinct outputs from the control panel. The outputs shall be from an input of smoke obscuration, a thermal condition or a combination of obscuration and thermal conditions.
5. Low profile, white case shall not exceed 2.5 inches of extension below the finish ceiling.

D. Addressable Carbon Monoxide Detector
1. Detectors shall meet UL2034 and UL2075.
2. Detectors shall be ceiling mounted.
3. Detectors shall be connected to the fire alarm system and shall have supervised circuits.
4. Detectors shall be addressable and may be in combination with a smoke detector.
5. Detectors shall be connected as a separate zone or programmed as a separate zone and shall only activate a supervisory signal at the main fire alarm control panel and at the remote annunciator panel.
6. Detectors shall not activate the building evacuation system.

E. Addressable Duct Smoke Detector
1. Product Description: NFPA 72, addressable photoelectric type with the following features:
a. Auxiliary SPDT relay contact.
b. Duct sampling tubes extending width of duct.
c. Visual indication of detector actuation.
d. Duct-mounted housing.
2. Furnish two-wire detector with common power supply and signal circuits.
3. Furnish and install a remote test switch for each duct smoke detector, flushed into nearest accessible ceiling.

F. Addressable Dry Contact Monitor Module
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
3. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

G. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances.
2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;
4. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.

2.5 REMOTE ANNUNCIATOR PANEL

A. Serially Connected Annunciator Requirements
1. Product Description: Supervised remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble.
2. Mounting: Factory mounted in flush wall-mounted enclosure.
3. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop.
4. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.

2.6 SIGNALING APPLIANCES

A. Speakers
1. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.
6. Speakers shall receive a separate twisted pair from the fire alarm control panel for voice communications.
7. **Combination speaker/strobe devices shall meet the requirements specified under “Strobes” in addition to these specifications.**

B. Strobes
1. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable

candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.

2. Strobe lights shall meet the requirements of the ADA, UL Standard 1971and be fully synchronized.

2.7 CONDUIT AND WIRE

A. Fire alarm cabling shall be wire in conduit, unless metal clad (MC) cable is specifically permitted to be installed by the Authority Having Jurisdiction, and is specified as an acceptable means of installation on the drawings.

B. Metal Clad (MC) Cable:
1. Type FPLP cable with galvanized interlocking steel with continuous red stripe.
2. NEC Article 760 rating for fire alarm control cables.
3. Install multiconductor cabling in accordance with NEC article 730.
4. Use permitted above accessible ceilings and concealed within walls to devices. Provide conduit and wire for final homeruns to control panels , transponders and power supplies.
5. Conductors shall comply with "Wire" paragraph below.

C. Conduit:
1. Conduit shall be in accordance with the National Electrical Code (NEC), local and state requirements.
2. Where possible, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4 inch (19.1 mm) minimum.
7. All fire alarm junction boxes and raceways shall be identified and labeled in accordance with Section 26 05 33, "Identification for Electrical Systems".

D. Wire:
1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm

system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signaling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.

3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. Wiring used for the SLC multiplex communication loop shall be twisted and shielded and support a minimum wiring distance of 10,000 feet. The system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication loop.
6. All field wiring shall be completely supervised.
7. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs).

E. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.

F. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

G. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

PART 3 EXECUTION

3.1 EXISTING WORK

A. The existing fire alarm panel and devices shall be maintained in operation to the greatest extent possible during construction. New compatible devices shall be provided as required. Relocate the main control panel as indicated on plans.

B. Relocation and expansion of the equipment shall include testing and assessment of the existing battery equipment. Coordinate removal of the complete system and devices upon installation of the new specified fire alarm equipment and devices.

3.2 EXAMINATION

A. Division 01: Coordination and project conditions.

B. Verify products and systems receiving devices are ready for installation.

3.3 INSTALLATION

A. Division 1 - Quality Control: Manufacturer's instructions.

B. Install manual station with operating handle 4 feet above finished floor.

C. Install audible and visual signal devices 6 feet 8 inches above finished floor.

D. Install 16 AWG minimum size conductors for fire alarm detection and signal circuit conductors, or as indicated on drawings.

E. Connect conduit and wire to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors and fire protection storage tank level sensor.

F. Automatic Detector Installation: Conform to NFPA 72E and NFPA 720 (remotely located from heating appliances as possible).

G. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

H. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

I. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas, or on existing block constructed walls with no means to fish wiring.

J. Locate intelligent CO detectors as far away from CO source (fossil fuel burning appliance) as practical to minimize false alarms while maintaining manufacturer spacing criteria and NFPA required coverage.

K. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Field technicians shall be NICET Level 1 (minimum) certified.

L. The factory trained technician shall install initial data and artwork at each interactive firefighter’s display.

M. The factory trained technician shall design the graphic layout based on area diagrams and floor plans.

3.4 MANUFACTURER'S FIELD SERVICES

A. Division 01: Manufacturer’s field services.

B. Include services of factory certified technician to supervise installation, adjustments, final connections, and system testing.

3.5 TEST

A. The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72 and the following:
   1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
   2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
   3. Verify activation of all waterflow switches.
   4. Open initiating device circuits and verify that the trouble signal actuates.
   5. Open and short signaling line circuits and verify that the trouble signal actuates.
   6. Open and short notification appliance circuits and verify that trouble signal actuates.
   7. Ground all circuits and verify response of trouble signals.
   8. Check presence and audibility of tone at all alarm notification devices.
   9. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
   10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
   11. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

B. Test carbon monoxide detectors and any associated alarms in accordance with NFPA 72H, NFPA 720, manufacturer’s instructions and local fire department requirements.

3.6 FINAL INSPECTION/ ACCEPTANCE TESTING

A. Division 01 – Quality Control.

B. At the final inspection, a factory trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

C. Fire Alarm/Acceptance Testing Procedures:
   1. The fire alarm testing shall be as the authority having jurisdiction shall dictate. This will be as determined by the AHJ and shall include, but not be limited to, the requirements as set below:
      a. Protective Signaling Systems: All protective signaling systems shall meet with acceptance testing requirements of the applicable standards listed in NFPA 101 and NFPA 13.
      b. Prior Test Notification: At least five (5) working days prior to testing, the Electrical Contractor shall notify (in writing) the following people of the proposed date the acceptance tests are to be performed:
         1) Authority Having Jurisdiction
         2) General Contractor or Construction Manager

3) Engineer of Record
4) Equipment Supplier Representative
5) Sprinkler Contractor (if applicable)
6) HVAC Contractor (if applicable)
7) Elevator Contractor (if applicable)

D. Certificates of Compliance:
1. A Fire Alarm System Inspection and Testing Certification and Description form shall be prepared for each system per the requirements listed in NFPA 72, Chapter 7.
2. After the completion of the operational acceptance tests and sign-off of test witness (with stipulations noted), final copies of the Certificates shall be forwarded to the AHJ.

E. Tests:
1. All tests shall be conducted in accordance with the Manufacturer's Testing Recommendations.
2. All testing equipment, apparatus (i.e. sound level decibel meter, 2-way radio communication, test devices, ladders, tools, lighting, etc.) and personnel shall be supplied by the Electrical Contractor.

3.7 INSTRUCTION

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation" to the Owner.

C. Manufacturer's representative shall provide Owner with a minimum of four (4) hours of onsite training on system. This training shall be followed up with an additional four (4) hours of onsite instruction at the discretion of the Owner, at any time during the warranty period.

END OF SECTION 28 3100

SECTION 32 1313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. State of Connecticut, Department of Transportation, Form 816 Standard Specification of Roads, Bridges and Incidental Construction, 1995, and as amended.

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Concrete Sidewalk Pavement.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for footings of walls, stairs, signs, site furnishings, and other general building applications of concrete.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

a. Include statement indicating costs for each product having recycled content.

2. Product Certificates for Credit MR 5.1 and Credit MR 5.2: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

D. Qualification Data: For manufacturer.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates.

F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Joint fillers.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities".

B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete", unless modified by requirements in the Contract Documents.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete producer.
d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet (30.5 m) or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

C. Color: To match existing concrete at Health Sciences Building.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60(Grade 420); deformed.

D. Plain Steel Wire: ASTM A 82, as drawn.

E. Deformed-Steel Wire: ASTM A 496.

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars. Cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

A. Regional Materials: Provide concrete materials that have been manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type I and II. Supplement with the following:

a. Fly Ash: ASTM C 618, Class C or F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Aggregates: ASTM C 33, uniformly graded from a single source with coarse aggregate as follows:

1. Per governing jurisdictions as referenced in Section 1.2C.

D. Water: ASTM C 94/C 94M.

E. Air-Entraining Admixture: ASTM C 260.

F. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
3. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
4. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd.(305 g/sq. m) dry.

B. Water: Potable.

C. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

D. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: Concrete Sidewalk Pavement: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Detectable Warning Plates:

1. Varieties and Sources: Subject to compliance with requirements, provide the following:

a. Vitrified Polymer Composite (VPC) cast-in-place "Armor-Tile" as manufactured by Engineered Plastics Inc., or approved equal.

1) Material: Epoxy polymer composition with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes.
2) Tile Pattern: The tile shall incorporate an in-line dome pattern of truncated domes 0.2 inches in height, 0.9 inches at the base and 0.4 inches diameter at top of dome spaced 2.35 inches nominal as measured on a diagonal and 1.70 inches nominal as measured side by side. For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40 to 90 degrees raised points 0.045 inches high, per square inch.
3) Size: 24 by 36 inches.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture, high-range, water-reducing admixture, or high-range, water-reducing and retarding admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 deg F(30 deg C) and 90 deg F(32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F(32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) require correction according to requirements in Division 2 Section "Earthwork".

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 20 feet (15.25 m), unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch(25 mm) below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Use grooving tool to form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) radius. Repeat grooving of contraction joints after applying surface finishes.

E. Edging: Tool edges of paving, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes.

1. All Contraction, Isolation and Construction joints to be edged.

3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed pavement surfaces with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F(4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F(10 deg C) and not more than 80 deg F(27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

K. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F(32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

L. Curbs: When automatic machine placement is used for curb placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.8 SPECIAL FINISHES

A. VPC Cast-in-place Tiles: Install plates according to the manufacturer’s instructions, and according to the Drawings.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h(1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch (6 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/4 inch (6 mm).
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).
7. Joint Spacing: 3 inches (75 mm).
8. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
9. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd.(76 cu. m) or fraction thereof of each concrete mix placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F(4.4 deg C) and below and when 80 deg F(27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

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

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1313

SECTION 32 1373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.

B. Related Sections include the following:

1. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-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.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of joint sealant and accessory.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.7 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 (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

A. General: Pavement sealants shall be a polyurethane based complying with ASTM C-920, Type S (single componenent),or Type M (multicomponent), Use group T (traffic) or NT (non-traffic), Class 35 (minimium) and the following. Any sealants used shall be recommended for the

specific use by the manufacturer. Sealant and backer-rod materials shall be compatible as noted by the manufacturers submitted.

1. Horizontal joints in areas of vehicular traffic shall comply with: ASTM C-920, Grade P (pourable or self-leveling) Use T. Color Grey.
2. Horizontal joints in areas of pedestrian, or light vehicular traffic shall comply with ASTM C-920, Grade NS (non-sag), use T or NT. Submitted product shall be available in a minimum of 7 standard colors.
3. Vertical Joints: Shall comply with ASTM C-920, Grade NS (non-sag), use T or NT. Submitted product shall be available in a minimum of 7 standard colors.

B. Typical Manufacturers (non exclusive):

1. BASF.
2. Bostik.
3. Pecora.
4. Sika.
5. Tremco.
6. W. R. Meadows.

2.4 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install backer materials of type 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 backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. 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 provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 sealants from surfaces adjacent to joint.

2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for sealants in areas of vehicular traffic per manufacturers recommended recess depth and at locations indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 32 1373

SECTION 32 3200 - SITE 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 the following applications of stone masonry:
   1. Brick Veneer Seat Walls
   2. Pre-Cast Stone Wall Caps

B. Related Sections:

1.3 SUBMITTALS

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

   1. For brick varieties proposed for use on Project, include test data indicating compliance with physical properties specified or required by referenced ASTM standards.

   2. Edge Restraints

B. Shop Drawings: For the following:

   1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

   2. Shop drawings for Cast Stone Seat Wall Cap Units: Show sizes, profiles, and locations of each unit required.

C. Samples for Initial Selection: For colored mortar and other items involving color selection.

D. Samples for Verification:

   1. For each brick type indicated. Include at least three samples in each set for each type of brick, exhibiting extremes of the full range of color and other visual characteristics expected in completed Work. Samples will establish the standard by which stone provided will be judged.

E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, sources of supply, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

F. Qualification Data: For qualified Installer.

G. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Cementitious materials. Include brand, type, and name of manufacturer.
2. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
3. Grout mixes. Include description of type and proportions of ingredients.
4. Reinforcing bars.
5. Anchors, ties, and metal accessories.

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

1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

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

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.

B. Source Limitations for Stone: Obtain each variety of wall stone, regardless of finish, from one source (on-site or off-site) with resources to provide materials of consistent quality in appearance and physical properties.

C. 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.

D. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for each type of stone wall in sizes of approximately 48 inches (1200 mm) long by full height and by full thickness.
   a. Include stone cap at top of mockup.

b. Include a sealant-filled joint at least 18 inches (400 mm) long in mockup.

2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.

4. Approval of mockups is for size, arrangement, configuration, color, texture, and blending of stone; relationship of mortar and sealant colors to stone colors; tooling of joints; and aesthetic qualities of workmanship.

   a. Approval of mockups is also for other material and construction qualities Landscape Architect specifically approves in writing.
   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Landscape Architect specifically approves such deviations in writing.

5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

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

1.6 PROJECT CONDITIONS

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

1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone masonry.

1. Protect caps from mortar droppings.
2. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.
3. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F(4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.7 COORDINATION

A. Advise installers of other work about specific requirements for placement of reinforcement and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 STONEWALL

A. Wall Stone: Subject to compliance with requirements, provide the following stone material, or approved equal:

1) Material: Comply with ASTM C 568/C 568M.

2) Description: Red Brick to match existing site walls.

3) Pattern: To match existing site walls.

4) Thickness: As shown on drawings

PRE-CAST STONE CAP

B. Pre-Cast Stone caps to match existing pre-cast stone caps at Health Sciences Building.

2.2 MORTAR AND GROUT MATERIALS

A. To match existing mortar at Health Sciences Building.

B. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or III, and hydrated lime complying with ASTM C 207.

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

a. Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
b. Lafarge North America; Eaglebond.
c. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

C. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, used washed aggregate consisting of natural sand or crushed stone.

2. For joints less than ¼ inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

D. Aggregate for Grout: ASTM C 404.

E. Water: Potable.

2.3 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

2.4 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1 ½" (38 mm) into veneer but with at least a 5/8" (16mm) 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. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.109-inch- (2.78-mm-) thick, stainless-steel sheet.

2.5 STONE WALL CAP ANCHORS

A. Stone Wall Cap Anchors: Units fabricated with tabs or dowels designed to engage holes in stone wall cap units as indicated.

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

a. Halfen Anchoring Systems; Meadow Burke.
b. Heckmann Building Products Inc.
c. Hohmann & Barnard, Inc.

B. Materials: Fabricate anchors from stainless steel, ASTM A 240/A 240M, Type 304. Fabricate dowels from stainless steel, ASTM A 276, Type 304.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch (0.40 mm)
2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint ¼ inch (6 mm) to form a stop for retaining sealant backer rod.
4. Solder metal items at corners.

2.7 STONE ACCESSORIES

A. Weep/Vent Products: Use one of the following unless otherwise indicated:

1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.
2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
3. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.

B. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Configuration: Provide one of the following:

a. Sheets or strips not less than 1 inch (25 mm) thick and installed to full height of cavity with additional strips 4 inches (100 mm) high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.

C. Setting Shims: Strips of resilient plastic or vulcanized neoprene, Type A Shore durometer hardness of 50 to 70, nonstaining to stone, of thickness needed to prevent point loading of stone or anchors and of depths to suit anchors without intruding into required depths of pointing materials.

D. Sealants for Joints in Stone Cladding: Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants" and do not stain stone:

1. Joint Sealant: Silicone, nonstaining, S, NS, 100/50, NT.
2. Joint-Sealant Colors: Match existing sealant at Health Sciences Building.

2.8 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.

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

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. Prosoco, Inc.

2.9 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.
2. Limit cementitious materials in mortar to portland cement and lime.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the 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 Stone Masonry: Comply with ASTM C 270, Property Specification.

1. Mortar for Setting Stone: Type S.
2. Provide natural color mortar as approved by the Landscape Architect.

D. Grout for Stone Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

2.10 FABRICATION

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.

B. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.

C. Clean backs of stone to remove rust stains, iron particles, and stone dust.

D. Inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

1. Grade and mark stone for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved samples and mockups.

E. Wall Stone:

1. Control depth of stone and back check to maintain minimum clearance of 2 inch (50 mm) between backs of stone units and backup walls.
2. Wall Stone Size: Provide size indicated, unless otherwise approved by the Landscape Architect.
3. Shape stone for type of masonry (pattern) to match approved mockups as follows:
   a. Existing at Health Sciences Building.
4. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved mockups.

F. Cap Stones:

1. Cut and drill sinkages and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone securely in place.
2. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.
3. Cut stone to produce uniform joint 3/8 inch (10 mm) wide and in locations indicated.
4. Cap Stone Size: Provide size indicated, unless otherwise approved by the Landscape Architect, as indicated on drawings.
5. Finished exposed faces and edges of stone to comply with requirements indicated for finish and to match approved mockups.
   a. Finish: To match existing at Health Sciences Building.
6. Color: To match existing at Health Sciences Building.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine substrate to verify that items installed in substrates and required for or extending into stone masonry are correctly installed.

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

3.2 PREPARATION

A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING OF STONE MASONRY, GENERAL

A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones in uncoursed pattern with color and size variations uniformly dispersed for an evenly blended appearance, to match approved mockups.

D. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

E. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 3/8 inch (10 mm) at narrowest points or more than 1 inch (25 mm) at widest points.

1. Mortared stone walls shall have a dry-laid appearance. Mortar in joints shall be recessed to a depth so as not to be seen, to match approved mockups.

F. Provide sealant joints of widths and at locations indicated.

1. Seal joints between wall cap units.
2. Keep sealant joints free of mortar and other rigid materials.
3. Sealing joints is specified in Division 7 Section "Joint Sealants."

G. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

1. Install edge restraints to comply with manufacturer's written instructions. Install fasteners to concrete at intervals required to hold edge restraints in place during and after unit paver installation.
2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch (25 mm) below top edge.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed ¼ inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (10 mm in 6 m), or 1/2 inch in 40 feet (13 mm in 12 m) or more. For external corners and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (19 mm in 12 m) or more.

B. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (13 mm in 6 m) or 3/4 inch in 40 feet (19 mm in 12 m) or more.

C. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.

D. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

3.5 ADJUSTING AND CLEANING

A. Remove and replace stone masonry of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Landscape Architect.
2. Defective joints.
3. Stone masonry not matching approved samples and mockups.
4. Stone masonry not complying with other requirements indicated.

B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove any exposed mortar before mortar sets.

D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove all mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.

3.6 EXCESS MATERIALS AND WASTE

A. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in greatest dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earthwork."
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 32 3200

SECTION 32 9200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Seeding.

B. Related Sections:

1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
2. Division 31 Section "Earthwork" for excavation, filling and backfilling, and rough grading.
3. Division 31 Section “Soil Erosion and Sedimentation Control” for additional erosion control measures.
4. Division 32 Section “Soil Preparation” for planting medium.

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

C. Certification of Sod: From sod provider to show compliance with requirements outlined in Section 2.2 below.

D. Product Certificates: For soil fertilizers, from manufacturer.

E. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf and meadows during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in success on similar projects.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."

3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Lawncare Manager.
    c. Landscape Industry Certified Lawncare Technician.

5. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.9 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 15th to June 15th.
2. Fall Planting: August 15th to October 15th.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Grass seed mixture to match existing campus standard.

2.2 SOD: The sod shall be 1 year old sod cut to a uniform thickness of ¾" +/- ¼" and shall be free of weeds, disease and other imperfections. The sod shall come from a field in which the sod is grown without use of netting and shall have been mowed at a mowing height of no greater than 1 ½" high (bench setting). The names of the cultivars comprising the sod shall be submitted and approved by Owner before delivery to the site. Owner may inspect the sod prior to purchase and delivery. The sod shall be planted within 24 hours of the time of harvest. Owner reserves the right to reject sod pieces that are damaged or show injury. These shall be lifted and replaced with new sod immediately.

2.3 PLANTING SOILS

A. Topsoil: Amend topsoil for seed areas as outlined in topsoil test results as indicated in Division 32 Section 'Soil Preparation".

2.4 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.5 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

C. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

D. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

E. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.6 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.7 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 9115 "Topsoil and Planting Mix."

B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade according to Section 32 9115 "Topsoil and Planting Mix."

1. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft. (1.4 to 1.8 kg/92.9 sq. m).

C. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre (42 kg/92.9 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment. Straw mulch to be maintained in place by one of the following methods:

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. (38 to 49 L/92.9 sq. m). Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

F. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch, peat mulch, or planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch (4.8 mm), and roll surface smooth.

3.6 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre (5.2-kg/92.9 sq. m) dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre (10.4 kg/92.9 sq. m).

3.7 SODDING

A. The sod shall be of the composition stated in Part II.

B. The surface of the soil on which the sod is to be placed down on shall be moistened before the sod is installed if the soil is dry.

C. The first row of sod placed down will be in a straight line with subsequent rows placed parallel to each other.

D. Sod pieces will fit snuggly against one another with no gaps between the sod pieces.

E. There shall be no overlapping of sod pieces.

F. Lateral joints shall be staggered.

G. Grading by hand raking will accompany the sodding and topsoil (sandy loam) added where irregularities are present or formed due to disturbance of the finished grade.

H. The installed sod shall abut the existing grades on the outside of the sodded areas so that the upper portion of the thatch line of the new sod matches the existing grades.

I. Watering of the sod shall be done immediately to prevent drying during progress of the work.

J. When sodding is completed, the sod shall be rolled with a roller designed for rolling turf surfaces. The roller is to have a minimum width of 8 feet.

3.8 TURF RENOVATION

A. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

C. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

D. Mow, dethatch, core aerate, and rake existing turf.

E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).

H. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.

1. Soil Amendment(s): according to requirements of Division 32 Section "Topsoil and Planting Mix." Apply as recommended by topsoil analysis.
2. Initial Fertilizer: Commercial fertilizer or Slow-release fertilizer applied according to manufacturer's recommendations.

I. Apply seed and protect with straw mulch as required for new turf.

J. Water newly planted areas and keep moist until new turf is established.

3.9 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow to a height of 1-1/2 to 2 inches (38 to 50 mm).

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to turf area.

3.10 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.11 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.12 RESTORATION OF SETTLED GRADES

A. At the end, twelve months after the date of substantial completion of the soil installation work, inspect the site and restore any areas where the grades have settled beyond the elevations shown on the drawings.

1. Lawn areas: Remove the sod using mechanical sod cutter from the settled area and add the specified top soil or planting mix. Re sod the area using the sod cut from the lawn. In the event that the sod cannot be reused, install new sod that matches the seed mix on the lawn.
2. Planting Areas: Where the settlement is 3-inches or less, remove the mulch, top dress the area with the specified topsoil or planting mix and re mulch.
3. Planting Areas: Where the settlement is greater than 3-inches remove the mulch and plants, add the specified topsoil or planting mix and re mulch.

3.13 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

3.14 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded and Sodded Turf: 60 days from date of Substantial Completion.

a. When maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

END OF SECTION 32 9200