EXHIBIT 4-A

Construction Bidding Document Template
for
NEW MEXICO
COMMUNITY DEVELOPMENT BLOCK GRANT
PUBLIC WORKS PROJECTS

Project Manual
Specifications and Contract Documents for the Construction of:

2019 - 2020 NEW HONDO SENIOR CITIZEN CENTER

LINCOLN COUNTY

April 2020

CDBG Project No: **18-C-RS-I-01-G-13**
Project Location: **Hondo, NM**
County IFB No.: **19-20-004**

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Note: These documents are issued by the Owner for use for Small Cities Community Development Block Grant construction projects and include pertinent federal and state procurement statutes and regulations. The document format promulgated by the Construction Specifications Institute, CSI Document MP-2-1 and was used as a guideline in formulating the organization of these documents. These documents have important legal consequences; consultation with an attorney is encouraged with respect to its modification or completion and approval by the Funding Agency with respect to its modification. Any approved modifications are to be included at the end of each section. This Document has been formatted and pages numbered so copies can be run on both sides (front and back).

PART 2 of 2

TECHNICAL SPECIFICATION

DIVISION 1 - 32 – TECHNICAL SPECIFICATIONS

Section Number – Section Name (# of pages)

END OF TABLE OF CONTENTS

INDEX OF DRAWINGS

SHEET #:	**SHEET TITLE:**
COVER	(CODE INFORMATION)
C – 002	CIVIL GENERAL NOTES
CD – 101	CIVIL DEMOLITION PLAN
CS – 101	CIVIL SITE PLAN
CS – 501	CIVIL SITE DETAILS
CS – 502	CIVIL SITE DETAILS
CC – 101	CIVIL CONTROL PLAN
CG – 101	CIVIL GRADING PLAN
CU – 101	CIVIL UTILITY PLAN
CU – 501	CIVIL UTILITY DETAILS
S – 1	STRUCTURAL FOUNDATION, DETAILS
A – 1.0	FLOOR PLAN
A – 1.1	REFLECTED CEILING PLAN
A – 1.2	FINISH PLAN
A – 2.0	EXTERIOR ELEVATIONS
A – 3.0	SECTIONS
A – 6.0	SCHEDULES & DETAILS
M – 1.0	MECHANICAL GENERAL NOTES
M – 2.0R	MECHANICAL PLAN
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P – 1.0	PLUMBING GENERAL NOTES
P – 2.0	DOMESTIC WATER PLUMBING PLAN
P – 3.0	SEWER & VENT PLUMBING PLAN
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E – 1.0	ELECTRICAL GENERAL NOTES
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END OF INDEX OF DRAWINGS

SECTION 011100 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. General description of Work and Contractor's duties.
2. Work by others.
3. Work sequence.
4. Contractor use of site.
5. Definitions.
6. Abbreviations.

B. Related documents and sections:

1. Document 00700 - General Conditions of the Contract
    a. Article 2: Basic responsibilities and rights of Owner.
    b. Article 3: Basic responsibilities of Contractor.
    c. Article 6: Owner's right to award separate contracts.
2. Section 01230 - Alternates: Alternates which increase scope of Project.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of this Contract covers general construction of a new 3,200 sf Senior Center, pre-fabricated metal building located in Hondo, New Mexico and includes, but not limited to the following:

1. Site work.
2. Utilities.
3. Additive Alternates as described in Section 012300 – Alternates.

1.3 CONTRACTOR'S DUTIES

A. Except as noted, provide and pay for all labor, materials, and equipment.

B. Pay required sales, gross receipts, and other taxes. Owner will pay Contractor applicable New Mexico gross receipts tax including local option tax and any increase in tax becoming effective after Contract date. Tax is to be excluded from bid prices but included as separate amount on Applications for Payment.

C. Secure and pay for permits, fees, and licenses necessary for execution of Work as applicable at time of receipt of bids.

D. Give required notices.

E. Comply with codes, ordinances, regulations, and other legal requirements of public authorities, which bear on performance of Work.

F. Request required inspections from public authorities, correct any noted deficiencies, and obtain certifications of satisfactory inspection. Deliver certificates to Owner in accordance with Section 01780 - Closeout Submittals.

1.4 WORK BY OTHERS

A. Utility Company will install/remove/relocate utility lines at the site. Coordinate schedule and requirements as required.

B. Owner may award separate contracts for purchase and installation of:

1. Furniture and furnishings.

2. Other items indicated or designated as “not in contract” (NIC) on Drawings.

C. Owner's responsibilities: Schedule work by others and delivery of Owner supplied products.

D. Contractor's responsibilities: Coordinate work with other installers or contractors.

1. Inform Owner of required delivery dates for Owner supplied products and installation dates for work by others.

1.5 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner and Architect.

B. Construct Work in one phase to accommodate Owner’s occupancy requirements. Refer to Construction Duration Period as determined by the Architect.

1.6 CONTRACTOR USE OF SITE

A. Contractor will have restricted use of site.

B. The Owner will occupy the site and existing Senior Center Building during the construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the work so as not to interfere with the Owner’s operations. Coordinate and notify Owner of necessary utility “shut-downs” a minimum of 2 weeks in advance.

C. Existing natural vegetation at the site shall be retained to the extent possible. Limit movement and storage of equipment and materials to minimize damage to natural vegetation and terrain.

D. Construction activities shall be limited to areas of actual construction. Restrict workmen from entering adjacent areas.

E. Do not allow debris to blow onto adjacent areas.

F. Owner reserves right to place and install equipment and furnishings in completed areas of building prior to Substantial Completion, provided such occupancy does not interfere with construction. Placing of equipment and furnishings does not constitute acceptance of Work.

1.7 IDENTIFICATION OF ENTITIES

A. Where the term "Architect" is used in the Contract Documents it is defined as the authorized representative designated by Owner and acting within the scope of the particular duties entrusted to such representative.

1. Architect:
Gary Yabumoto
YABUMOTO-Architects-LLC
PO Box 2484 (Mailing)
110 Corrida de Rio (Physical)
Alto, NM 88312
(575) 644-6986
gary@yabumoto-architects-llc.com

B. Where the term "Owner" is used in the Contract Documents, it is defined as the “Owner”.

1. Owner:

Lincoln County
PO Box 711 (Mailing)
300 Central Ave. (Physical)
Carrizozo, NM 88301

2. Representative: Nita Taylor, County Manager
3. 575.648.2385 x101

1.8 DEFINITIONS

A. Refer of Document 00700- General Conditions, Article 2. for definitions of terms used within Contract Documents.

B. Additional terms used within Specifications but not defined by Document 00700 - General Conditions shall have the following definitions:

1. Products: Materials, manufactured items, components, fixtures, machinery, equipment, or systems forming the Work but not including machinery, equipment, and other aids used for preparing, fabricating, conveying, and installing the Work.

2. Supply: Furnish, deliver, and unload at Project site. Same meaning as furnish.

3. Furnish: Supply, deliver, and unload at Project site. Same meaning as supply.

4. Install: Operations at Project site to incorporate products into the Work such as unpacking, assembling, anchoring, erecting, applying, placing, curing, finishing, and preparing for use.

5. Provide: To supply or furnish a product and to also install it.

6. Execution: Operations at Project site including preparatory actions, installing, and post-installation adjusting, testing, cleaning, and demonstrating.

1.9 ABBREVIATIONS

A. Abbreviations used within the Specifications are defined as follows. For abbreviations not listed, contact Architect for definitions.

ADA - Americans with Disabilities Act.
ASTM - American Society for Testing and Materials.
ANSI - American National Standards Institute.
CF - Cubic feet.
CFM - Cubic feet per minute.
F - Fahrenheit.
LF - Linear feet.
LB - Pound.
SF - Square feet.
SY - Square yards.
PSI - Pounds per square foot.
UBC - Uniform Building Code as published by International Conference of Building Officials.
UL - Underwriters Laboratory.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 012000 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes procedures for:

1. Schedule of Values.
2. Applications for Payment.
3. Contract modifications.

B. Related documents and sections:

1. Document 0052 13 - Agreement Between Owner and Contractor.
2. Document 0072 13 - General Conditions of the Contract:
    a. Article 7: Procedures for Change Orders and Construction Change Directives.
    b. Article 9: General procedures for Schedule of Values, Applications for Payment, Certificates for Payment, and Progress Payments.
3. Section 0121 00 - Allowances: Cash and contingency allowances to cover unspecified items of Work authorized by Owner during construction period.

1.2 SCHEDULE OF VALUES

A. Procedures:

1. Submit for review by Architect three (3) copies of preliminary Schedule of Values within ten (10) calendar days after date of Agreement between Owner and Contractor.
2. Submit to the Architect a schedule of values allocated to the various portions of the work, prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. Review comments made by Architect, revise and resubmit.
3. If applicable, update Schedule of Values to incorporate approved Change Orders and Construction Change Directives; submit three (3) copies.
4. Final Schedule of Values: Revise Schedule to incorporate review comments and submit three (3) copies at least seven (7) days before submittal of initial Application for Payment.
5. If applicable, Updated Schedule of Values shall be revised and resubmitted with three (3) copies of Schedule of Values to incorporate approved Change Orders and Construction Change Directives.

B. Format:

1. Schedule of Values shall be a complete schedule and breakdown of costs for the entire project.
2. Type schedule on standard form or electronic media printout approved by Architect.
3. Round values to nearest whole dollar. Sum of all values shall equal total Contract Sum.

C. Content: Use Project Manual Table of Contents as basis for line items. Cross reference line items with number and title of corresponding specification section. Provide sufficient detail to allow computation of values for progress payments during construction.

1. Include within each line item a directly proportional amount of Contractor's overhead and profit.

2. Provide separate line items for materials and for installation when materials will be stored on site prior to installation such that cost of suitably stored materials will be included separately on an Application for Payment.

3. The schedule format shall contain columns for each portion of the work as follows:

   a. Column 1 - Scheduled Value
   b. Column 2 - Previous Application
   c. Column 3 - Work in Place
   d. Column 4 - Stored Materials
   e. Column 5 - Total Stored and Completed to Date
   f. Column 6 - Percentage Completed
   g. Column 7 - Balance to Finish

4. Provide separate line items for:

   a. Each allowance included in Contract Sum.

   b. Each Contract modification.

   c. For bonds.

   d. Insurance.

1.3 APPLICATIONS FOR PAYMENT

A. Format: AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet or Contractor's electronic media driven form as approved by Architect.

B. Payment period: Monthly or as otherwise stipulated in Document 0052 13 - Agreement Between Owner and Contractor.

C. Preparation:

1. Use Schedule of Values for listing items in Applications for Payment.

2. Complete each entry on Application of Payment form. Incomplete forms will be returned without action.

3. List each authorized Change Order and Change Order Directive as a separate line item and in same format as other line items.

4. Provide subtotals and total.

5. Indicate actual and percent of time used and time remaining.

6. Applications shall be signed and dated by authorized officer of Contractor. Signature shall be notarized.

D. Include with Application for Payment appropriate invoices for materials stored on site.

E. At request of Architect, provide substantiating data justifying dollar amounts in question.

F. Submittal: Submit 3 executed copies of each Application for Payment.

1. Initial Application for Payment: Submit after the following have been submitted and accepted by Architect and Owner.

   a. Certificates of insurance required by Document 0072 13 - General Conditions of the Contract.

   b. Copy of building permit.

   c. Schedule of Values as required by Paragraph 1.2.A.

d. Progress schedule as required by Section 0131 00 - Project Management and Coordination.

e. List of subcontractors and principle suppliers and fabricators as required by Section 01330 - Substitution Procedures.

f. Submittal schedule as required by Section 0133 00 - Submittal Procedures.

2. Subsequent Applications for Payment:

a. Submit with Application of Payment:

(1) Include the Updated Progress Schedule specified in Section 0131 00 - Project Management and Coordination.

(2) Construction photographs specified in Section 0131 00 - Project Management and Coordination.

(3) Updated Submittal Schedule specified in Section 0133 00 - Submittal Procedures.

b. Prior to acceptance of each Application for Payment, Architect will review Project Record Drawings specified in Section 01780 - Closeout Submittals to ensure that recorded data is current.

3. Application of Payment at Substantial Completion: Submit after issuance of Certificate of Substantial Completion and in accordance with Section 01 70 00 - Execution and Closeout Requirements.

4. Final Application for Payment: Submit after completion of final cleaning, final inspection, final submittals, and other final completion procedures specified in 01 70 00 - Execution and Closeout Requirements.

1.4 CONTRACT MODIFICATION PROCEDURES

A. Changes in the Work shall be determined and Change Orders executed in accordance with Document 00700 - General Conditions.

1. Minor changes: Architect will advise of minor changes in Work not involving adjustment to Contract Sum or Time by issuing supplemental instructions.

2. Architect requested Change Order: Architect may issue a Proposal Request with detailed description of proposed change and supplementary drawings and specifications as required.

3. Architect will prepare Change Orders to adjust Contract Sum for:

a. Differences in costs between products purchased and cash allowances stated in Section 01210 - Allowances.

b. Differences in costs for unit price work based on estimated quantities and costs computed with actual measured quantities.

4. Contractor proposed Change Order: Contractor may propose change by submitting Request for Change Order to Architect describing proposed change, reason for change, and its effect on Contract Sum and Time. Document requested substitutions in accordance with Section 01630 - Product Substitution Procedures.

5. Construction Change Directive: Architect may issue Construction Change Directive signed by the Owner and instructing Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes and designate method of determining changes in Contract Sum and Time.

B. Documentation: Maintain adequate records and provide full information required for evaluation of proposed changes and to substantiate costs. On request, provide:

1. Product, labor, and equipment quantities.

2. Amounts for taxes, insurance, and bonds.

3. Overhead and profit amounts.

4. Justification for changes in Contract Time.

5. Documented credits for deletions.

C. Methods for determining adjustments to Contract Sum:

1. Stipulated sum: Based on Architect's Proposal Request and Contractor's price quotation or Contractor's Request for Change Order as approved by Architect.

2. Unit prices: Computed from unit prices stated in Contract Documents or subsequently agreed upon and actual measured quantities installed.

3. Time and material: Maintain detailed records for work performed on time and material basis. Submit itemized account and full supporting data after completion of change within stated time limitations. Architect will determine allowable change in Contract Sum and Time. Supporting data shall include:

a. Names of personnel performing work.

b. Dates and times work was performed and by whom.

c. Time records and wage rates paid.

d. Invoices for products, equipment, and subcontracts.

D. Revision of documents: After authorization of Change Order revise:

a. Schedule of Values and Application for Payment forms to record each Change Order as a separate line item and adjust Contract Sum and Time.

b. Progress Schedules to reflect changes in Contract Time and to adjust times for other work items affected by changes. Resubmit revised schedule.

c. Record changes in Project Record Documents.

PART 2 - PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 012100 - **ALLOWANCES**

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Allowances: Descriptions, amounts, and procedures for allowances covering unspecified products to be selected by Owner and Architect during construction period.

B. Related documents and sections:

1. Document 00510 - Agreement Between Owner and Contractor, Article 7 – General and Special Provisions.

2. Section 012000 - Price and Payment Procedures: Procedures for processing change orders, unit prices, and including allowances as separate line items on Schedule of Values.

1.2 ALLOWANCES

A. Costs included in allowances:

1. Cost of product to Contractor or subcontractor less applicable trade discounts.

2. Delivery to site.

3. Applicable taxes.

B. Cost not included in allowance but included in Contract Sum:

1. Product handling and storage at the site.

2. Contractor's overhead and profit.

C. Depending on the product, cost of installation, finishing, testing, and demonstration may be included in cash allowance. Refer to individual allowance descriptions.

D. Architect's responsibilities:

1. Consult with Contractor for consideration and selection of allowance products.

2. Select products in consultation with Owner and transmit decision to Contractor.

3. Prepare Change Orders.

E. Contractor's responsibilities:

1. Assist Architect in selection of allowance products.

2. Obtain proposals from suppliers and offer recommendations.

3. On notification of selection by Architect and Owner, execute purchase agreement with designated supplier.

4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.

5. Promptly inspect allowance products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

F. Differences in costs between allowances and products purchased with be adjusted by Change Order.

1.3 MODIFICATION ALLOWANCE

F. Include in Contract Sum an allowance amount of $20,000.00 to be used for Owner's purposes related to modifications in the design and construction of the Project as directed by Owner through written instruction issued by Architect.

G. Upon request from Architect, Contractor shall submit proposal similar to that required for change order showing all itemized costs. Items considered for deduction from Modification Allowance shall include costs for products, delivery, installation, labor, and equipment rental. Overhead, profit, and bond for Modification Allowance items are not part of Modification Allowance, but instead are to be included in Contract Sum. Contractor shall not proceed with Modification Allowance item until authorized by Architect. Total cost of modifications shall not exceed Modification Allowance.

H Subcontractor mark-up on modification allowance changes shall be limited to 10% for overhead and 10% for profit.

I. At Contract closeout, funds remaining in Modification Allowance will be credited to Owner by Change Order.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Procedures and descriptions for alternates, which decrease or increase scope of project.

B. Related documents and sections:

1. Document 00100 - Instructions to Bidders:

a. Requirements for bidding all alternates.

b. Owner's intention to accept alternates in order Listed on Bid Form.

2. Document 00500 - Agreement Between Owner and Contractor: Incorporation of accepted alternates to determine Contract Sum.

1.2 CONDITIONS

A. All requirements of General and Supplementary Conditions, applicable sections of Specifications, and applicable portions of Drawings shall govern scope, quality, and execution of alternates.

B. Owner shall have right to accept one or more alternates prior to award of the Contract, at no change in price listed on Bid Form. Alternates will be selected in order listed on Bid Form.

C. Work not specifically identified in the following Additive Alternate descriptions shall be included in Base Bid.

1.3 ADDITIVE ALTERNATES

A. Additive Alternate No. 1 – “ADDITIONAL WEST PORCH & SLAB” requires construction of**:**

a) Addition of 5’-0” of sidewalk and 10’-0” of roofing and support columns to make a covered porch on the west side of the building as shown on drawings.
b) All electrical requirements associated with the addition of the porch noted above.
c) Solar Water Heating Package with 1 collector, circulation system and 80 gal. storage tank – Contractor to submit package to Architect and Owner for approval prior to the Bid.

1.6 PROCEDURES

A. Consider all work that must be accomplished for complete incorporation of alternates including modifications to Base Bid items.

B. Include in lump sum prices for alternates all costs of labor, materials, equipment, permits, fees, insurance, bonds, overhead, and profit.

C. Where work is shown in Additive Alternates that represent an “up-grade” to the Base Bid, include additional costs only (separate from costs already included in Base Bid) for the “up-grade” in the designated Additive Alternate.

D. Immediately after award of Contract, advise all necessary personnel and suppliers as to which alternates have been selected by Owner. Use all means necessary to alert those personnel and suppliers involved as to all changes in the work caused by Owner's selection or rejection of alternates.

E. Coordinate related work and modify surrounding work to integrate work of each alternate.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The Conditions of the Contract and other Sections of Division l, General Requirements apply to this section.

1. 2 SUMMARY

A. Section includes:

1. General requirements for coordination of Work.

2. Field engineering.

B. Related documents and sections:

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

2. Related Specification Sections include the following:

a. Section 014000 Quality Control
b. Section 015000 Temporary Facilities and Controls

1.3 SUBMITTALS

A. Provide in accordance with Section 013300 - Submittal Procedures:

1. Coordination drawings:

a. Provide where coordination is critical for installation of components fabricated off site and where space is limited and maximum utilization of space is required.

b. Show relationship and integration of components and construction entities, required installation sequence, dimensions, and tolerances.

B. Staff assignment list:

1. List of Contractor's principal staff assignments for Project. Indicate names, duties and responsibilities, addresses, and telephone numbers.

2. Distribute and post in field office and elsewhere on site as appropriate to provide coordination information.

1.4 GENERAL COORDINATION REQUIREMENTS

A. The General Contractor shall employ a Superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The Superintendent shall represent the Contractor, and communications given to the Superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

B. The Superintendent shall be a competent and responsible employee, satisfactory to the Owner, who is regularly employed by the Contractor and is designated by the Contractor as its representative to be in full time attendance at the Project site throughout the construction of the Work.

C. The Superintendent shall be responsible for coordinating all the Work of the Contractor and the Subcontractors. The Superintendent shall be licensed consistent with Construction Industries Division (CID).

D. The Superintendent's resume shall be submitted to the Owner prior to commencement of construction and must demonstrate to the Owner's reasonable satisfaction that the Superintendent has performed the same duties on previous construction projects similar to the project.

E. The Superintendent shall attend each job meeting.

F. The Contractor must supply to the Owner & Architect the mobile telephone number of the Project Superintendent and the Project Manager who may be contacted during non-work-hours for emergencies on the project.

G. Coordinate scheduling, submittals, and work of various specification sections to ensure efficient and orderly sequence of installation of interdependent construction elements. Ensure that work of one specification section is not installed in such a manner as to limit, preclude, or restrict work of another section.

H. Coordinate completion and clean up of work of separate specification sections in preparation for final inspection specified in Section 017700 - Closeout Procedures.

I. After acceptance of Work, coordinate access to facility for required maintenance, monitoring, adjusting, and correcting deficiencies to manner to minimize disruption of Owner's activities.

1.5 FIELD ENGINEERING

A. Existing control datum for field engineering is indicated on Drawings.

B. Locate or establish survey control and reference points prior to starting site construction. Protect points during construction and record locations with horizontal and vertical data on Project Record Documents in accordance with Section 017800 - Closeout Submittals.

C. Prior to start of construction, verify location of control points and layout information on Drawings relative to property, setback, and easement lines.

D. Provide competent field engineering services. Establish elevations, lines, and levels utilizing recognized engineering survey practices. Periodically verify layouts.

E. Promptly replace dislocated control and reference points based on original survey control.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Verify utility requirements and characteristics of equipment are compatible with facility utilities. Coordinate work of various specification sections having interdependent requirements for installing, connecting to, and placing in service such equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Space requirements:

1. Coordinate space requirements and installation of mechanical, electrical, and other work shown diagrammatically on Drawings. Follow routing shown for pipes, ducts, and wireways as closely as practicable. Utilize spaces efficiently to maximize accessibility for other installations, maintenance, and repairs.

2. Where space is limited, coordinate installation of components to ensure maximum access for maintenance. Ensure space provided around equipment and fixtures complies with applicable codes.

B. Concealment: In finished areas, conceal pipes, ducts, and wireways within construction except as otherwise indicated. Where practical, conceal supports, fasteners, and other attachment devices.

C. Arrangement:

1. Unless otherwise indicated, installations shall be aligned vertically and horizontally. Place piping, conduit, wireways, and other linear items parallel with lines of building.

2. Coordinate mounting heights and spacings of components so that finished work is neat and orderly with organized appearance.

3. Repetitive items such as hangers and fasteners shall be equally spaced unless indicated otherwise.

D. Finished surfaces: Coordinate locations of fixtures, boxes, and other recessed or surface mounted items with finish elements and grades to ensure proper installation and neat appearance.

3.2 COORDINATION WITH INSTALLED CONSTRUCTION

A. Openings made in installed exterior surfaces shall be closed to protect construction from weather and extremes of temperature and humidity.

B. Cutting and patching of installed construction shall be accomplished in accordance with Section 01700 - Execution Requirements.

C. Remove, cut, and patch previously installed construction in a manner to minimize damage and to provide a means of restoring finishes to original or better condition.

D. Where refinishing is required, provide a neat transition to adjacent surfaces.

E. Patched work shall match existing adjacent work in texture and appearance.

END OF SECTION

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes submittal procedures for:

1. Shop drawings.
2. Product data.
3. Samples.
4. Manufacturer's instructions.
5. Design data and calculations.
6. Manufacturer's certificates.
7. Reports for testing, inspecting, and demonstrating.

B. Related documents and sections:

1. Document 0072 13- General Conditions: Contractor's responsibilities regarding submittals.
2. Section 0120 00 - Price and Payment Procedures: Submittal of Schedule of Values and Applications for Payment.
3. Section 0130 00– Administrative Requirements: Submittal of Progress Schedule, coordination drawings, and construction photographs.
4. Section 0140 00 - Quality Requirements: Manufacturers' field services and reports.
5. Section 0160 00 Product Requirements: Submittal of substitution requests.
6. Section 0178 00 - Closeout Submittals: Submittal of project record drawings, operation and maintenance manuals, warranties, certifications of inspection, extra materials and other closeout submittals.
7. Refer to individual specification sections for unique submittal requirements related to a specific product.

1.2 SUBMITTAL SCHEDULE

A. Procedure:

1. Submit for review by Architect three (3) copies of Submittal Schedule within twenty (20) days of date of Agreement Between Owner and Contractor.
2. Revise to address review comments and resubmit.
3. Update Submittal Schedule to reflect change orders, Progress Schedule revisions, and status of individual submittals. Submit three (3) copies with each Application for Payment.

B. Format: Tabular arrangement indicating:

1. Submittal number and title.
2. Related specification section number and title.
3. Proposed submittal date, actual submittal date, and date reviewed submittal is required.

1.3 SUBMITTAL PROCEDURES

A. Schedule submittals to expedite Work. Unless otherwise noted, submittals shall be submitted within 30 (thirty) days of date of Agreement between Owner and Contractor.

B. Preparation:

1. Provide separate submittal for each specification section requiring submittals. Include all material requested for that section. Provide folders or binders for material.

2. Coordinate submission of related items. Group submittals of related products (or a system)in a single transmission.

3. Identify variations from requirements of Contract Documents. State product and system limitations which may adversely affect Work.

4. Mark or show dimensions and values in same units as specified.

5. Provide 4 by 6 inches minimum space for Architect and Contractor review stamps.

C. Contractor review: **Note: Submittals not reviewed and stamped by the Contractor will be returned without review by the Architect or his consultants. Any delay caused by returning non-reviewed submittals shall be the responsibility of the Contractor.**

1. Review submittals prior to transmittal. Verify compatibility with field conditions and dimensions, product selections and designations, and conformance of submittal with requirements of Contract Documents. Return non-conforming submittals to preparer for revision rather than submitting to Architect.

2. Coordinate submittals to avoid conflicts between various items of work.

3. **Apply Contractor's stamp with signature** certifying that review, verification of products required, field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the Contract Documents.

4. Failure of Contractor to review submittals prior to transmittal to Architect shall be cause for rejection.

D. Transmittal:

1. Transmit each submittal with a separate Submittal Transmittal Form. Copy of Form follows this Section.

2. Sequentially number transmittal forms. Resubmittals shall have original number with an alphabetic suffix.

3. Identify project, Contractor, subcontractor, supplier, pertinent drawing sheet and detail numbers, and associated specification section numbers.

4. Sign Submittal Transmittal Form and deliver submittals to Architect.

E. Review: Architect will review and return submittals with comments.

F. Do not fabricate products or begin work, which requires submittals until return of submittal with Architect acceptance.

G. On return promptly distribute reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

H. Resubmission:

1. Revise and resubmit submittals as required within fifteen (15) days of return from Architect.

2. Make re-submittals under procedures specified for initial submittals.

3. Identify all changes made since previous submittal.

I. Submittals or samples requiring selection of colors of interior finishes or millwork shall be submitted together and reviewed at one time by the Architect. Partial submittals will not be reviewed independently unless approved by the Architect.

1.4 SHOP DRAWINGS

A. Submission:

1. Submit one reproducible transparency and three (3) copies to be retained by Architect.

2. Fold drawings to fit submittal folders.

B. Form:

1. Size: 8-1/2 by 11 inches minimum and 36 by 48 inches maximum except for full size details and templates.

2. Present in a clear and thorough manner. Title each drawing with Project name. Identify each element of drawing with reference number.

3. Plans, elevations, sections, and detail shop drawings shall be to scale with scale indicated.

4. Indicate field verified dimensions. Show relationship of products to adjacent work. Note coordination requirements.

5. Schematics and wiring and other diagrams shall be logically arranged and presented in a clear understandable manner with all items labeled.

1.5 PRODUCT DATA

A. Submission: Submit the number of copies which Contractor requires plus three (3) originals to be retained by Architect.

B. Form:

1. Provide all critical information such as reference standards, performance characteristics, capacities, power requirements, wiring and piping diagrams, controls, component parts, finishes, dimensions, and required clearances.

2. Submit only data which is pertinent. Mark each copy of manufacturer's standard printed data to identify products, models, options, and other data pertinent to project.

3. Modify manufacturer's standard schematic drawings and diagrams and supplement standard data to provide specific information applicable to project. Delete information not applicable.

4. Colors and patterns: Unless color and pattern is specified for product, submit accurate color and pattern charts or samples illustrating manufacturer's full range for selection by Architect. **Refer to Paragraph 1.3, Item I noted above.**

1.6 SAMPLES

A. Submission:

1. Submit the number of samples specified in individual specification sections. One (1) sample will be retained by Architect.

2. Label each sample with identification related to Submittal Transmittal Form.

3. Submit samples at least Thirty (30) days prior to date Contractor needs approval for ordering or incorporation into Work.

B. Type: Submit samples to illustrate functional and aesthetic characteristics of the products, with all integral parts and attachment devices. Include full range of manufacturer's standard finishes, indicating colors, textures, and patterns for Architect selection.

C. Reviewed product samples may be used in work with approval of Architect.

1.7 MANUFACTURER'S INSTRUCTIONS

A. Submission: Submit the number of copies which Contractor requires plus three (3) to be retained by Architect.

B. Form:

1. Manufacturers' printed instructions for activities such as delivery, storage, assembly, installation, wiring, start-up, adjusting, finishing, and maintaining.

2. Indicate pertinent portions and identify conflicts between manufacturers' instructions and Contract Documents.

1.8 DESIGN DATA AND CALCULATIONS

A. Submission: Submit the number of copies which Contractor requires plus three (3) to be retained by Architect.

B. Form:

1. Provide basic calculations, analyses, and data to support design decisions and demonstrate compliance with specified requirements. State assumptions and define parameters. Give general formulas and references. Provide sketches as required to illustrate design method and application.

2. Arrange calculations and data in a logical manner with suitable text to explain procedure.

3. Indicate name, title, and telephone number of individual performing design and include professional seal of designer where applicable or required.

1.9 MANUFACTURERS' CERTIFICATES

A. Submission: Submit the number of copies which Contractor requires plus three (3) to be retained by Architect.

B. Form:

1. Certificates shall indicate that products conform to or exceed specified requirements. Submit supporting reference data, affidavits, and certifications as required.

2. Certificates may be based on recent or previous test results if acceptable to Architect.

1.10 REPORTS

A. Submission:

1. Submit the number of copies which Contractor requires plus three (3) to be retained by Architect.

2. Submit reports within fifteen (15) days after completion of activity.

B. Form:

1. Present complete information in a clear concise manner.

2. Typed or computer printed on 8-1/2 by 11 inch white paper.

3. Bind with titled cover in folder, plastic binder, or three ring binder as appropriate for quantity of material.

C. Reports shall include:

a. Time, location, conditions, and duration of activity.

b. Names of persons performing and witnessing activity.

c. Equipment used.

d. Description of activity, data recorded, and results.

e. Deficiencies found, corrective measures, and results of retesting.

f. Other pertinent data.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SUBMITTAL #_____

SUBMITTAL TRANSMITTAL FORM

PROJECT 2018 Hondo Senior Center
10686 Highway 380
Hondo, NM 88336

TO: YABUMOTO-Architects-LLC
ATTN: Gary Yabumoto
PO Box 2484.
Alto, NM 88021

ASA Project No.: 00000.00

Date:_____

Attached is the following submittal for your review as required by the Contract Documents:

1. We understand separate transmittal forms are required for each Specification Section for which submittal is required.
2. If submittal contains material not applicable for review, delete text that is not applicable prior to submission.
3. We further understand that submittals not dated and signed per Contract Documents will be returned without review and must be resubmitted.

PRODUCT DATA, QUALITY CONTROL, AND CLOSEOUT SUBMITTALS

Submit number of copies per Section 013300 and the following:

Section Number and Title:_____

Article and Paragraph:_____

Description of Item:_____

Manufacturer's Name:_____

Supplier's Name: Date:_____

SHOP DRAWING SUBMITTAL

Submitted reproducible transparencies and opaque reproductions per Section 013300 and the following:

Section Number and Title:_____

Article and Paragraph:_____

Description of Item:_____

Manufacturer's Name:_____

Supplier's Name: Date:_____

SAMPLES

Submit Samples per Section 013300 and the following:

Section Number and Title:_____

Article and Paragraph:_____

Description of Item:_____

Manufacturer's Name:_____

Supplier's Name: Date:_____

Submitted by:

Subcontractor's signature and date:_____

Contractor's signature and date:_____

SECTION 014000 - **QUALITY REQUIREMENTS**

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Installation quality control.
2. Reference standards.
3. Field samples.
4. Inspection and testing laboratory services.
5. Manufacturer's field services and reports.

B. Related requirements:

1. Document 00700 - General Conditions:

a. Article 07: Inspection and Testing of Materials.
b. Article 11: Contractor's Obligations.
a. Article 14: Inspections.

2. Section 016000 - Product Requirements: Requirements for material and product quality.

1.2 INSTALLATION QUALITY CONTROL

A. Monitor and maintain quality control over manufacturers, suppliers, subcontractors, work force, site conditions, products, and services to ensure Work is of specified, consistent quality.

B. Workmanship:

1. Specified requirements represent a minimum acceptable quality for Work. Comply with industry standards except when more stringent specified requirements and tolerances indicate higher standards or more precise workmanship.
2. Perform work with suitable qualified personnel to produce work of specified quality.
3. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and distortion.

C. Manufacturer's instructions:

1. Comply fully with manufacturer's instructions. Perform steps in manufacturer's recommended sequence.
2. Should instructions conflict with Contract Documents, request clarification from Architect before proceeding.

1.3 REFERENCE STANDARDS

A. When specifications require conformance to a reference standard, applicable standard shall be the edition current at date of receiving bids.

B. Should specified reference standard conflict with Contract Documents, request clarification from Architect.

C. Contractual relationship, duties, and responsibilities of the parties to the Contract nor those of Architect shall not be altered from that stated in the Contract Documents by mention or inference to the contrary in a specified reference standard.

1.4 FIELD SAMPLES

A. When required by an individual specification section, install field samples for review by Architect.

B. Acceptable installed sample shall remain as part of Work and shall represent quality level for that item of work. Unacceptable sample shall be removed and replaced, repaired, or refinished as directed by Architect.

1.5 INSPECTION AND TESTING LABORATORY SERVICES

A. Contractor shall make arrangements, bear costs, and employ an independent firm acceptable to Architect-Owner to perform inspections and compliance testing for: *[REVISE AS APPLICABLE]*

1. Earthwork compaction.

2. Asphalt Paving

3. Concrete.

4. Masonry mortar.

5. HVAC systems.

6. Other materials, components, and systems where testing to determine compliance with Contract Documents is required.

B. Submit within fourteen (14) days of date of Agreement Between Owner and Contractor, testing laboratory qualifications for acceptance by the Architect.

C. Testing firm shall perform inspections, tests, and other services specified in individual specification sections and as required.

D. Testing firm shall submit directly to Architect three (3) copies of reports indicating observations and results of inspections and tests with indication of compliance or non-compliance with Contract Documents. Additional copies may be required to be distributed to Owner and/or other Engineering Consultants at the direction of the Architect.

E. Contractor's responsibilities:

1. Cooperate with testing firm and furnish materials and other products to be tested. Provide assistance in accessing and obtaining samples. Provide storage for samples and testing equipment.

2. Notify Architect two (2) days prior to operations requiring testing services.

3. Make arrangements with testing firm and pay for additional samples and tests required for Contractor's use.

F. Retesting: Retesting required because of non-conformance to specified requirements shall be performed by same testing firm and paid for by Contractor.

1.6 MANUFACTURER'S FIELD SERVICES AND REPORTS

A. When required by an individual specification section, provide services of manufacturer's field representative to observe site conditions, installation, quality of workmanship, starting of equipment, testing and adjusting equipment, and as applicable, to instruct and supervise field operations.

B. Submit qualifications of manufacturer's field representative to Architect for approval fifteen (15) days in advance of required observation.

C. Manufacturer's field representatives shall report observations, site decisions, and instructions given to installers that are supplemental or contrary to manufacturer's written instructions.

D. Submit report of field representative within thirty (30) days of observation and in accordance with Section 013300 - Submittal Procedures.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Site mobilization plan.
2. Temporary services: Electrical, lighting, heating, ventilating, water, telephone, and facsimile.
3. Fencing, barriers, and other temporary controls.
4. Construction facilities: Temporary buildings, sanitary facilities, access, and parking.
5. Protection of Work and existing facilities.
6. Project sign.
7. Bulletin board.

B. Related documents and sections:

1. Document 007213 - General Conditions:
   a. Article 3.15: Contractor's responsibility for cleaning.
   b. Article 10: Safety precautions and programs.
2. Section 017000 - Execution Requirements: Progress cleaning.

1.2 REFERENCES

A. NFPA 10 - Standard for Portable Fire Extinguishers.

B. NFPA 241 - Safeguarding Building Construction, Alterations, and Demolition Operations.

1.3 SITE MOBILIZATION PLAN

A. Coordinate locations for temporary facilities with Architect.

B. Prepare site mobilization plan for each building site showing:

1. Field office.
2. Storage areas, sheds, and fencing.
3. Project identification sign.
4. Access routes.
5. Temporary utility routes and connections.
6. Sanitary facilities.
7. Trash and rubbish receptacles.
8. Parking arrangements.

C. Present 3 copies of plans at Pre-Construction Conference in accordance with Section 013100 - Project Management and Coordination.

1.4 TEMPORARY ELECTRICITY

A. Contractor shall provide and pay for temporary electricity required during construction. Connect to existing power source at site. Contractor shall furnish and maintain all temporary poles and overhead construction, feeders, transformers, meters, disconnects, drops, over-current protection, and other wiring and fittings for electrical service as required by the project. Do not disrupt Owner's need for continuous service. Owner will pay cost of electricity used. Exercise measures to conserve power.

B. Provide power outlets for construction operations with branch wiring, distribution boxes, and flexible power cords as required.

C. Permanent convenience receptacles may be utilized during construction.

D. All temporary power service, materials and utilization shall conform to all applicable codes. Upon completion, remove temporary facilities.

1.5 TEMPORARY LIGHTING

A. Provide lighting for construction operations. Lighting levels shall be appropriate for type and difficulty of work. Use these minimums as guidelines:

1. 200 footcandles: Intricate assembly, very fine finishing, and very difficult inspection.

2. 100 footcandles: Detailed assembly, fine finishing, and difficult assembly.

3. 50 footcandles: Rough assembly and fabrication, ordinary finishing, and ordinary inspection.

4. 20 footcandles: Egress and circulation lighting.

B. After dark, provide security lighting for interior and exterior work and storage areas.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

D. Maintain lighting and provide routine repairs.

E. Permanent building lighting may be utilized during construction.

1.6 TEMPORARY HEATING AND VENTILATING

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, and gases.

B. Provide temporary fan units to maintain clean air for construction operations.

C. Maintain minimum ambient temperature of 50 degrees F in interior areas where construction is in progress.

D. Provide and pay for supplemental heating devices and energy needed to maintain specified conditions.

E. Permanent building heating and ventilating equipment may be utilized during construction only if approved in advance with the Owner and Architect.

1.7 TEMPORARY WATER SERVICE

A. Contractor shall provide and pay for temporary water required during construction. Connect to existing water source at site for construction operations. Contractor shall furnish and maintain all temporary mains, laterals, branch lines, meters, and other service piping and fittings to supply temporary water as required by the project. Owner will pay cost of water used. Exercise measures to conserve water. If existing available water source is insufficient for earthwork operations, Contractor shall provide and pay for water required.

B. Assume responsibility for temporary connections and water lines. Upon completion, remove temporary facilities.

1.8 COMMUNICATIONS

A. Provide, maintain, and pay for telephone service to field office. (Cell phone service will be acceptable).

B. Provide, maintain, and pay for facsimile service to field office. (Landline shall be required).

1.9 FENCING

A. Provide temporary fencing around new construction and materials storage area. Completely separate construction from existing facilities and related exterior areas.

B. Type: 4 foot high nylon fabric mesh with steel posts approximately 8 feet o.c..

1.10 BARRIERS AND PROTECTION

A. Security: Provide to protect Work and existing facilities from unauthorized entry, vandalism, and theft.

B. Barriers: Provide to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from construction operations.

C. Enclosures: Provide temporary, insulated, weather tight closures of exterior openings to provide acceptable working conditions, protect Work, and prevent unauthorized entry. Fit with self-closing, lockable doors.

D. Temporary partitions: Provide to separate work areas from completed Work. Prevent penetration of dust and moisture into completed portions of building.

E. Emergency exits shall be maintained during construction. Provide separate barriers as appropriate.

F. Protect existing trees and plants designated to remain. Replace damaged plant material.

1.11 PROTECTION OF INSTALLED WORK

A. Protect installed Work. Control activity in immediate work area.

B. Provide temporary and removable protection for installed products.

C. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, and movement of heavy objects with durable sheet materials.

D. Prohibit traffic and storage on roof surfaces and landscaped areas.

1.12 TEMPORARY FIRE PROTECTION

A. Install and maintain temporary fire protection components. Establish and follow procedures to protect against fire losses. Comply with NFPA 241.

B. Fire extinguishers: Provide hand carried, portable, UL rated fire extinguishers of type and size recommended by NFPA 10 for building exposure conditions. Place in accessible, convenient locations in clear view with a minimum of one extinguisher per floor.

C. Access: Maintain unobstructed access to fire hydrants, water supply, fire extinguishers, stairways, and access routes for fighting fires.

D. Heating devices: Exercise care and monitor use of temporary heaters to minimize fire risk.

E. Store combustible materials in fire-safe containers.

F. Volatile products: Do not store paints, varnishes, paint removers, solvents, adhesives, cleaning rags, and other volatile products in building. Take precautionary measures to prevent fire hazards and spontaneous combustion.

G. Cutting and welding: Approve in advance use of open flame cutting, welding, and soldering equipment. Ensure that safe conditions exist before granting approval.

1.13 ACCESS

A. Acceptable access routes and site entrances shall be determined at Pre-Construction Conference.

B. Identify access to Contractor's work and office area with appropriate signs so that delivery personnel and others may contact Contractor.

C. Prevent unauthorized personnel from proceeding outside of Contractor's work and office area.

1.14 FIELD FACILITIES

A. Provide and maintain a weather-tight, fully equipped field office at the construction site. Include sufficient space for progress meetings and work area for use by the Architect during field inspections.

B. Provide and maintain storage sheds and other facilities as required.

C. Arrange for parking for work force. Do not limit Owner's requirements for parking.

1.15 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required sanitary facilities for work force.

B. New toilet facilities shall not be used by work force.

1.16 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary above grade and buried utilities, equipment, facilities, and excess materials prior to final inspection.

B. Clean and repair damage caused by installation of temporary facilities.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. General product requirements.

2. Transportation and handling.

3. Storage and protection of products.

B. Related sections:

1. Section 011100 - Summary: Definitions for "products", "supply", "furnish", "provide", and "execution".

2. Section 014000 - Quality Requirements: Product quality monitoring.

3. Section 016200 - Product Options: Procedures for requesting use of unspecified products.

1.2 GENERAL PRODUCT REQUIREMENTS

A. Products shall be new and currently in production.

B. Do not use products removed from other facilities except where use of salvaged products is required in Contract Documents.

C. Products of the same category shall be products of a single manufacturer. Where possible, products under a single specification section shall be of the same manufacturer.

1.3 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, and damage.

D. Deliver packaged products in unopened and undamaged cartons and wrappings.

1.4 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

B. For exterior storage of fabricated products, place on supports above ground, sloped to drain.

C. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

D. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

E. Arrange storage of products to permit access for inspection. Periodically inspect to ensure products are undamaged and are maintained under specified conditions.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 016200 - PRODUCT OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for product options and substitution procedures.

1.2 PRODUCT OPTIONS

A. For products specified by reference standards or by description only, provide any product meeting those standards or description.

B. For products specified by naming one or more manufacturers with the designation that no substitutions are allowed, provide only named products.

C. For products specified by naming one or more manufacturers, provide named products or approved substitute products. Request to use unspecified products shall be made in accordance with Paragraph 1.3.

1.3 SUBSTITUTION REQUESTS

A. Where products are specified by naming specific products of one or more manufacturers, these products shall establish minimum acceptable level of quality and performance.

B. Prior approvals: Unless stated otherwise in individual specification sections, Architect will **not** consider requests made during bidding to use unspecified products.

1. When substitution requests are allowed during bidding by individual specification sections, requests shall be made in accordance with Paragraph 1.4.

2. If product is acceptable, Architect will approve it in addendum issued to know recipients of Bidding Documents.

C. After signing of Agreement between Owner and Contractor, Architect will consider written requests for substitutions.

1. Requests shall be made in accordance with Paragraph 1.4.

2. Architect will determine acceptability of proposed substitutions and notify Contractor of decision in writing. If approved substitution request requires modification of Contract Amount or Contract Time, Architect will process change order incorporating substitution.

3. Substitutions will not be considered if indicated or implied on shop drawings and product data submittals.

D. Request for substitution and use of approved substitution shall constitute representation that Contractor:

1. Has investigated product and determined it meets or exceeds quality level of specified product.

2. Will provide same warranty for substitution as for specified product.

3. Will coordinate installation and make changes to other work required to accommodate accepted substitution and complete Work.

4. Waives claims for additional costs or time extensions related to substitutions which later become apparent.

1.4 SUBSTITUTION REQUEST PROCEDURES

A. Submit separate request for each substitution with Form 016213 - Substitution Request Form. Copy of form follows this Section.

B. Submit 3 copies of request for substitution. Include in request:

1. Complete data substantiating compliance of proposed substitution with Contract Documents.
2. For products:
    a. Product identification, including manufacturer's name and address.
    b. Manufacturer's literature containing product description, performance and test data, and reference standards.
    c. Samples as required.
3. For construction methods:
    a. Detailed description of proposed method.
    b. Drawings illustrating methods.
4. Itemized comparison of proposed substitution with product specified.
5. Data relating to changes in construction schedule.
6. Give cost data comparing proposed substitution with specified product.
7. For substitution requests made after signing Agreement, include proposed changes to Contract Amount and Time if substitution is accepted.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION - FORMS FOLLOW

SUBSTITUTION REQUEST FORM

Please read **SECTION 016200-PRODUCT OPTIONS** prior to submission of this form.

The undersigned requests that the following product be accepted for use in the Project.

Product: _____ Model No.: _____

Manufacturer: _____

Address: _____

The above product would be used in lieu of:

Product: _____

Specified in: Section: _____ Paragraph: _____

Reason for substitution request: _____

_____

Attached are the following items:

- ☐ Product description including specifications, performance and test data, and applicable reference standards
- ☐ Drawings
- ☐ Photographs
- ☐ Samples
- ☐ Tabulated comparison with specified product
- ☐ For items requiring color selections, full range of manufacturer's color samples
- ☐ Documentation of reason for request.
- ☐ Cost data for comparing proposed substitution with specified product
- ☐ Other: _____

The undersigned certifies that the following statements are correct. Explanations for all items which are **not** true are attached.

1. Proposed substitution has been thoroughly investigated and function, appearance, and quality meet or exceed that of specified product. ☐True ☐ False
2. Same warranty will be provided for substitution as for specified product. ☐True ☐ False
3. **No** aspect of Project will require re-design. ☐True ☐ False

4. Use of substitution will **not** adversely affect:

   a. Dimensions shown on Drawings. ☐True ☐ False

   b. Construction schedule and date of completion.c ☐True ☐ False

   c. Work of other trades. ☐True ☐ False

5. Maintenance service and replacement parts for proposed substitution will be readily available in the New Mexico area. ☐True ☐ False

6. Proposed substitution does **not** contain asbestos in any form. ☐True ☐ False

7. All changes to Contract Sum related to use of proposed substitution are included in price listed below. Contractor waives claims for additional costs related to acceptance of substitution which may subsequently become apparent. ☐True ☐ False

8. Costs of modifying project design caused by use of proposed substitution which subsequently become apparent will be paid for by Contractor. ☐True ☐ False

If substitution requested after signing of Agreement between Owner and Contractor is accepted:

Contract Sum will be [decreased] [increased] by $ _____

Contract Time will be [decreased] [increased] by ____ calendar days.

Submitted By:

Company: _____

Address: _____

Telephone Number: _____

Name: _____ Date: _____

Signature: _____

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Closeout procedures.
2. Final cleaning.
3. Final inspection.
4. Inspection held immediately prior to end of one year correction period.

B. Related documents and sections:

1. Document 00700 - General Conditions of the Contract,
    a. Article 26: Acceptance of Final Payment as Release.
2. Section 017500 – Starting and Adjusting: Starting and adjusting items of equipment and complete systems and demonstrations and training for Owner's personnel.
3. Section 017800 - Closeout Submittals: Submittal of project record documents, operation and maintenance manuals, warranties, certificates of inspection, extra materials, and keys.

1.2 SUBSTANTIAL COMPLETION PROCEDURES

A. Prior to or in conjunction with submission of Notice of Substantial Completion, submit the following items specified in Section 017800 - Closeout Procedures:

1. Project record documents.
2. Operation and maintenance data and manuals.
3. Warranties.
4. Certificates of inspection.
5. Extra materials.
6. Keys.

B. Comply with Document 00700 - General Conditions of the Contract. When Work is sufficiently complete:

1. Inspect Work and prepare comprehensive list of items to be completed or corrected.
2. Perform final cleaning of portions of Work for which approval of substantial completion is being requested.
3. Submit 3 copies of Notice of Substantial Completion and comprehensive list of items to be completed to Architect. Indicate portions of Work suitable for Owner occupancy and for which approval of substantial completion is being requested.
4. Submit Application for Payment in accordance with Section 012000 - Price and Payment Procedures.

C. After inspection by Architect and issuance of Certificate of Substantial Completion, Owner will occupy all of Project for installation of equipment and furnishings under provisions stated in Certificate of Substantial Completion.

1.3 FINAL COMPLETION PROCEDURES

A. Perform final cleaning as specified in Paragraph 1.4.

B. Prior to or in conjunction with submission of Notice of Final Completion, submit the following items:

1. Contractor's Affidavit of Payment of Debts and Claims, AIA G706.

2. Consent of Surety Company to Final Payment, AIA G707.

3. Contractor's Affidavit of Release of Liens, AIA G706A.

4. Final Application for Payment as specified in Section 012000 - Price and Payment Procedures. Identify total adjusted Contract Sum, previous payments, and sum due.

C. Submit Notice of Final Completion certifying that Contract Documents have been reviewed, work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect's inspection.

D. Remove temporary utilities, controls, and facilities in accordance with Section 015000 - Temporary Facilities and Controls.

E. Request final inspection by Architect.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; and vacuum carpeted and soft surfaces.

C. Sanitize equipment and fixtures.

D. Clean or replace filters of operating equipment.

E. Clear debris from roof, gutters and drainage systems, ceiling spaces, plenums, storage areas, and interior spaces.

F. Clean site, sweep paved areas, and rake landscaped areas and other ground surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from the site. Dispose of legally.

1.5 FINAL INSPECTION

A. Architect and Owner's representative will make inspection within 7 days of receipt of Certification of Final Completion. Separate inspections shall be conducted for each building.

B. If Work is incomplete or defective:

1. Architect will provide Contractor written list of deficiencies.

2. Contractor shall immediately correct deficiencies and submit certification that Work is complete.

3. Architect and Owner's representative will re-inspect Work.

1.6 CORRECTION PERIOD INSPECTION

A. 30 days prior to end of one year correction period, schedule and attend a one year correction period inspections. Separate inspections shall be conducted for each building. Appropriate subcontractors shall attend.

B. Coordinate time of inspection with Architect.

C. Representatives of Owner, Architect, and appropriate consultants will attend.

D. Correct deficiencies noted.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 017800 - CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes procedures for preparing and submitting closeout submittals:

1. Project Record Documents.
2. Operation and maintenance manuals and data.
3. Warranties.
4. Insurance information.
5. Certificates of inspection.
6. Extra materials.
7. Keys.

B. Related documents and sections:

1. Document 00700- General Conditions of the Contract:
    a. Contractor's warranty that Work is of good quality and free from defects and confirms to contract Documents.
    b. Commencement of warranties and correction period.
    c. One year correction period for Contractor to correct defective work.
2. Section 012000 - Price and Payment Procedures: Submittal of Applications of Payment.
3. Section 013300 - Submittal Procedures: Submittal of shop drawings, product data, samples, installation instruction, reports and other submittals during construction prior to closeout.
4. Section 017500 - Starting, Adjusting, and Demonstrating: Use of operation and maintenance manuals for demonstration and training sessions.

1.2 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to work:

1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed submittals.

B. Store Record Documents separate from documents used for construction. Label "Project Record Documents".

C. Record information concurrent with construction progress. Use erasable colored pencil. Date all entries. Call attention to entry by circling area affected.

D. Specifications: Legibly mark and record in each section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and modifications.

E. Contract Drawings and shop drawings: Legibly mark each item to record actual construction including:

1. Actual items of equipment and system components installed.

2. Actual locations of components and routing of piping and raceways.

3. Measured horizontal and vertical locations of underground water, sewer, irrigation, electrical, and other utilities and appurtenances, referenced to permanent surface improvements.

4. Measured locations of piping, raceways, and other items concealed in construction, referenced to visible and accessible features.

5. Field changes of dimension and detail.

6. Details not on original Contract Drawings.

F. Documents will be reviewed by Architect at each submittal of Application for Payment to ensure that entries are current.

G. Submit documents to Architect prior to or in conjunction with submission of Notice of Substantial Completion.

1.3 OPERATION AND MAINTENANCE DATA

A. Provide operation and maintenance data for:

1. Kitchen equipment.

2. Fire-protection systems, including fire alarm, fire pumps and fire-extinguishing systems.

3. Intrusion detection systems.

4. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping and water distribution piping.

5. Plumbing & Mechanical systems specified in Division 22 & 23.

6. Electrical systems specified in Division 26, 27 & 28.

7. Other items and systems as designated by Architect or requested by Owner.

B. Submission:

1. Submit data to Architect in one or more binders.

2. Submit for review one (1) draft copy thirty (30) days prior to need date or as otherwise specified. This copy will be returned after review with Architect's comments. Revise content as required.

3. Once approved, submit five (5) copies of final operation and maintenance manuals. All manuals shall be submitted prior to or in conjunction with Notice of Substantial Completion.

C. Contents:

1. Appropriate design criteria.

2. Equipment and parts lists.

3. Operating instructions.

4. Maintenance instruction for equipment and finishes.

5. Shop drawings and product data.

6. Testing, balancing, and other field quality reports.

7. Copies of warranties.

8. Other material and information as indicated in individual specification sections and as necessary for operation and maintenance by Owner's personnel.

D. Form:

1. Manuals shall be 8-1/2 x 11 inch text pages bound in three ring expansion binders with a hard durable plastic cover for original warranties and documents. Provide one electronic copy on a disk or thumb drive. All documents to be originals unless otherwise noted.

2. Prepare binder covers with printed subject title of manual, title of project, date, and volume number when multiple binders are required. Printing shall be on face and spine.

3. Internally subdivide the binder contents with divider sheets with typed tab titles under reinforced plastic tabs. Place dividers at beginning of each chapter, part, section, and appendix.

4. Provide a table of contents for each volume.

5. Provide directory listing as appropriate with names addresses, and telephone numbers of Architect, Contractor, subcontractors, equipment suppliers, and nearest service representatives.

1.4 WARRANTIES

A. Provide duplicate notarized copies of special and extended warranties as required by individual specifications sections.

B. Submit warranties to Architect prior to or in conjunction with submission of Notice of Substantial Completion.

C. Execute and assemble warranties from subcontractors, suppliers, and manufacturers.

D. Provide Table of Contents and assemble in three ring binder with a hard durable plastic cover. Internally subdivide the binder contents with permanent page dividers, with tab titling clearly typed under reinforced laminated plastic tabs.

E. For items of work delayed beyond date of Substantial Completion, provide updated warranty submittal within ten (10) days after acceptance, listing date of acceptance as start of warranty period.

1.5 CERTIFICATES OF INSPECTION

A. For inspections throughout the construction period required by regulatory agencies, obtain and maintain certificates issued to show compliance.

B. Assemble certificates in three ring binder with table of contents and submit to Architect prior to or in conjunction with submission of Notice of Substantial Completion.

C. Certificate of Occupancy: Prior to Substantial Completion, obtain from authorities having jurisdiction Certificate of Occupancy. Submit with Notice for Substantial Completion.

1.6 INSURANCE INFORMATION

A. Submit prior to or in conjunction with submission of Notice of Substantial Completion information regarding insurance including change over requirements and insurance extensions.

1.7 EXTRA MATERIALS

A. Provide spare parts and maintenance materials in quantities specified in individual sections.

B. Extra materials shall be produced by the same manufacturer of and compatible with the installed products.

C. Prior to or in conjunction with submission of Notice of Substantial Completion deliver extra materials in unopened containers to Owner's representative at designated storage area at project site and place in location as directed. Obtain receipt from Owner's representative.

D. During one year correction period:

1. Extra materials may be used by Contractor to replace expendable and normally worn parts.

2. Extra materials used by Contractor for replacement of defective products shall be replaced at no additional cost to Owner.

1.8 KEYS

A. Prior to or in conjunction with submission of Notice of Substantial Completion, provide Owner with all keys for:

1. Door hardware locks after rekeying in accordance with Section 08710 - Door Hardware.

2. Access doors and panels.

3. Electrical panel boards and other equipment.

B. Provide a minimum of three (3) keys for each lock.

C. Clearly label each key as to function and location of lock.

D. Obtain receipt from Owner's representative.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.
5. Concrete toppings.

B. Related Sections:

1. Division 03 Section "Cast-in-place Concrete" for concrete pavement and walks.
2. Division 07 Section “Under Slab Vapor Retarder”.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.04 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

E. Samples: For waterstops vapor retarder.

F. Qualification Data: For testing agency.

G. Welding certificates.

H. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
13. Joint-filler strips.
14. Repair materials.

I. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates.

J. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

K. Field quality-control reports.

L. Minutes of pre-installation conference.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
3. Laboratory performing tests shall comply with ASTM E329 and C1077.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Mockups: Cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, installation on vapor retartder and standard of workmanship.

1. Build panel approximately 200 sq. ft. (18.6 sq. m) for slab-on-grade in the location indicated or, if not indicated, as directed by Architect.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Pre-installation Conference: Conduct conference at site to be determined by project Architect.

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 concrete finish subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

   a. High-density overlay, Class 1 or better.
   b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
   c. Structural 1, B-B or better; mill oiled and edge sealed.
   d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

   1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 706/A 706M, deformed bars, assembled with clips.

D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

E. Deformed-Steel Wire: ASTM A 496/A 496M.

F. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut 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 and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F or C.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 1 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94/C 94M and potable.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Axim Italcementi Group, Inc.; CATEXOL CN-CI.
b. BASF Construction Chemicals - Building Systems; Rheocrete CNI.

c. Euclid Chemical Company (The), an RPM company; ARRMATECT, EUCON BCN, EUCON CIA.
d. Grace Construction Products, W. R. Grace & Co.; DCI.
e. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Construction Chemicals - Building Systems; Rheocrete 222+.
b. Cortec Corporation; MCI- 2000.
c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
d. Sika Corporation; FerroGard 901.

2.06 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

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

a. CETCO; Volclay Waterstop-RX.

2.07 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum perm rating of .03. Include manufacturer's recommended adhesive or pressure-sensitive tape and mastic.

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

a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
b. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
c. Raven Industries Inc.; Vapor Block 15.
d. Reef Industries, Inc.; Griffolyn 15 mil Green.
e. Stego Industries, LLC; Stego Wrap 10 mil Class A.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.08 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. ChemMasters; Chemisil Plus.
    b. ChemTec Int'l; ChemTec One.
    c. Conspec by Dayton Superior; Intraseal.
    d. Curecrete Distribution Inc.; Ashford Formula.
    e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
    f. Edoco by Dayton Superior; Titan Hard.
    g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
    h. Kaufman Products, Inc.; SureHard.
    i. L&M Construction Chemicals, Inc.; Seal Hard.
    j. Meadows, W. R., Inc.; LIQUI-HARD.
    k. Metalcrete Industries; Floorsaver.
    l. Nox-Crete Products Group; Duro-Nox.
    m. Symons by Dayton Superior; Buff Hard.
    n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
    o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

2.09 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, white burlap-polyethylene sheet.

B. Water: Potable.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

    1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

    1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
5. Silica Fume: 10 percent.
6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

C. Slabs-on-Ground: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (27.6 MPa) at 28 days.
2. Maximum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. m).
3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
5. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

D. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Minimum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. m).
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

E. Concrete Toppings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 5000 psi (34.5 MPa) at 28 days.
2. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m).
3. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: Do not allow air content of trowel-finished toppings to exceed 3 percent.

F. Building Frame Members: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (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.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.03 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 48 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.05 VAPOR RETARDERS

A. Sheet Vapor Retarders: (See Section 072614 for under-slab) Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
2. Repair penetrations with tape and / or mastic in accordance with manufacturer's recommendations.
3. Provide notice to Architect at least 48 hours in advance before placing concrete to allow for observation of vapor retarder installation / placement.

3.06 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder in accordance with manufacturer's recommendations before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.07 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls 6”. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.09 CONCRETE PLACEMENT

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

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

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

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (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. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system .
2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

2. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

E. Dry concrete slabs on ground and floors that will receive moisture sensitive floor finishes to manufacturer's requirements. Protect from re-wetting and from unacceptable curing compounds.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture 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.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; 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.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
11. 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.
12. 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.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 055000 –
MISCELLANEOUS METALS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A . Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the miscellaneous metal work as indicated on the drawings and/or specified herein including, but not limited to, the following:

1. Rough hardware.
2. Vertical steel ladders and ship's ladders.
3. Folding ship's ladder (wall ladder).
4. Open riser steel spiral stairs.
5. Steel pipe handrails and railings not part of steel pan stair assemblies.
6. Light steel framing and supports, not included as part of work of other trades.
7. Steel gratings and frames.
8. Elevator divider beams, guide rail beams and elevator pit hold down beams.
9. Steel bollards.
10. Miscellaneous steel trim, corner guards, angle guards and channels.
11. Sleeves in concrete walls and slabs.
12. Site gate.
13. "Strong-eye".
14. Exterior rigging tree.
15. Steel framing, bracing, supports, anchors, bolts, shims, fastenings, and all other supplementary parts indicated on drawings or as required to complete each item of work of this Section.

1 6 . Prime painting, touch-up painting, galvanizing and separation of dissimilar metals for work of this Section.

17. Cutting, fitting, drilling and tapping work of this Section to accommodate work of other Sections and of concrete, masonry or other materials as required for attaching and installing work of this Section.

1.3 RELATED SECTIONS

A. Painting — Section 099000.

1.4 QUALITY ASSURANCE

A . Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

C. Reference Standards: The work is subject to requirements of applicable portions of the following standards:

1. "Manual of Steel Construction," American Institute of Steel Construction.

2. AWS D1-1 "Structural Welding Code," American Welding Society.

3. SSPC SP-3 "Surface Preparation Specification No. 3, Power Tool Cleaning," Steel Structures Painting Council.

4. SSPC PA-1 "Painting Application Specification," Steel Structures Painting Council.

5. "Handbook on Bolt, Nut and Rivet Standards," Industrial Fasteners Institute.

D. Steel Materials: For steel to be hot dip-galvanized, provide steel chemically suitable for metal coatings complying with the following requirements: carbon below 0.25 percent, silicon below 0.24 percent, phosphorous below 0.05 percent, and manganese below 1.35 percent. Notify galvanizer if steel does not comply with these requirements to determine suitability for processing.

E. Engage the services of a galvanizer who has demonstrated a minimum of five (5) years' experience in the successful performance of the processes outlined in this specification in the facility where the work is to be done and who will apply the galvanizing and coatings within the same facility as outlined herein. The Architect has the right to inspect and approve or reject the galvanizer/galvanizing facility.

F. The galvanizer/galvanizing facility must have an ongoing Quality Control/Quality Assurance program which has been in effect for a minimum of five years and shall provide the Architect with process and final inspection documentation. The galvanizer/galvanizing facility must have an on-premise testing facility capable of measuring the chemical and metallurgical composition of the galvanizing bath and pickling tanks.

G. Inspection and testing of hot-dip galvanized coating shall be done under the guidelines provided in the American Hot-Dip Galvanizers Association (AGA) publication "Inspection of Products Hot-Dip Galvanized After Fabrication."

1.5 PERFORMANCE STANDARDS

A. Stairs and railings shall be constructed to conform to the following performance standards:

1. Stairs and platforms shall support a live load of one hundred (100) psf and a concentrated live load of three hundred (300) lbs. and shall have a live load deflection limited to 1/360 of the span. Loads shall not apply simultaneously.

2. Railings shall be designed to resist loads per State of New Mexico Building Code.

1.6 SUBMITTALS

A. Manufacturer's Literature: Submit manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions for products to be used in the fabrication of miscellaneous metal work, including paint products.

B. Shop Drawings: Shop drawings for the fabrication and erection of all assemblies of miscellaneous iron work which are not completely shown by manufacturer's data sheets. Include plans and elevations at not less than 1" to 1'-0" scale, and include details of sections and

connections at not less than 3" to 1'-0" scale. Show anchorage and accessory items.

C. Engineering Data

1. Before any stairs, ladders and railings are fabricated, submit engineering data drawings to the Architect for review indicating how performance standards specified here shall be met. The Contractor is responsible for the structural design and supports for these systems and must show his proposed systems o n these drawings.

2. These drawings must show all load conditions and design calculations relative t o connections, fastening devices and anchorage, as well as size and gauge o f members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of New Mexico and shall be signed and sealed by this Engineer.

D. Welding shall be indicated on shop drawings using AWS symbols and showing length, size and spacing (if not continuous). Auxiliary views shall be shown to clarify all welding. Notes such as 1/4" weld, weld and tack weld are not acceptable.

E. Certification: For items to be hot-dip galvanized, identify each item galvanized and to show compliance of application. The Certificate shall be signed by t h e galvanizer and shall contain a detailed description of the material processed and t h e ASTM standard used for the coating and, the weight of the coating. In addition, and as attachment to Certification, submit reports of testing and inspections indicating compliance with the provisions of this Section.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metals

1. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free o f surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

2. Steel Plates, Shapes and Bars: ASTM A 36.

3. Steel Bar Grating: ASTM A 1011/A or ASTM A 36.

4. Steel Tubing: Cold formed, ASTM A 500; or hot rolled, ASTM A 501.

5. Structural Steel Sheet: Hot rolled, ASTM A 570; or cold rolled, ASTM A 611, Class 1; of grade required for design loading.

6. Galvanized Structural Steel Sheet: ASTM A 924, of grade required for design loading. Coating designation G90.

7 . Steel Pipe: ASTM A 53, type and grade as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (Schedule 40), unless otherwise indicated.

8. Gray Iron Castings: ASTM A 48, Class 30, unless another class is indicated o r required by structural loads.

9. Malleable Iron Castings: ASTM A 47, grade as selected by fabricator.

1 0 . Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

11. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers and shims as required,

hot-dip galvanized, ASTM A 153.

B. Grout: Non-shrink, non-metallic grout conforming to the requirements of Section 033000.

C. Fasteners

1 . General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

2. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

3. Anchor Bolts: ASTM F 1554, Grade 36.

4. Lag Bolts: ASME B18.2.1.

5. Machine Screws: ASME B18.6.3.

6. Plain Washers: Round, carbon steel, ASME B18.22.1.

7. Masonry Anchorage Devices: Expansion shields, FS FF-S-325.

8 . Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.

9. Lock Washers: Helical spring type carbon steel, ASME B18.21.1.

D. Shop Paint: Shop prime all non-galvanized miscellaneous metal items using Series 88 Azeron Primer made by Tnemec, ICI Devoe “Rust Guard“ quick dry alkyd shop coat No. 41403, or “Interlac 393“ by International Protection Coatings.

1. If steel is to receive high performance coating as noted in Section 099000, shop prime using primer noted in Section 099000.

E. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D 1187.

F . Galvanize Repair Coating: For touching up galvanized surfaces after erection, provide repair coating that is V.O.C. compliant, equal to “Silver Galv“ made by Z.R.C. Worldwide or approved equal. Apply to a dry film thickness of 1.5 to 3.0 mils.

2.2 PRIME PAINTING

A. Scope: All ferrous metal (except galvanized steel) shall be cleaned and shop painted with one coat of specified ferrous metal primer. No shop prime paint required on galvanized steel or aluminum work.

B . Cleaning: Conform to Steel Structures Painting Council Surface Preparation Specification SP 3 (latest edition) “Power Tool Cleaning“ for cleaning of ferrous metals which are to receive shop prime coat.

1 . Steel to get high performance coating as noted in Section 099000 shall be cleaned as per SSPC SP.6 “Commercial Blast Cleaning.“

C. Application

1. Apply shop prime coat immediately after cleaning metal. Apply paint in dry weather or under cover. Metal surfaces shall be free from frost or moisture when painted. Paint all metal surfaces including edges, joints, holes, corners, etc.

2 . Paint surfaces which will be concealed after shop assembly prior to such assembly. Apply paint in accordance with approved paint manufacturer’s printed instructions, and the use of any thinners, adulterants or admixtures shall be only as stated in said instructions.

3 . Paint shall uniformly and completely cover the metal surfaces, 2.0 mils minimum dry

film thickness. No work shall be shipped until the shop prime coat thereon has dried.

D. Touch-Up: In the shop, after assembly and in the field, after installation of work of this Section, touch-up damaged or abraded portions of shop prime paint with specified ferrous metal primer.

E. Apply one shop coat to fabricated metal items, except apply two (2) coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat t o distinguish it from the first.

2.3 GALVANIZING

A. Scope: All ferrous metal exposed to the weather, and all ferrous metals indicated o n drawings or in specifications to be galvanized, shall be cleaned and then hot-dipped galvanized after fabrication as provided by Duncan Galvanizing or approved equal.

B. Avoid fabrication techniques that could cause distortion or embrittlement of steel items to be hot-dip galvanized. Fabricator shall consult with hot-dip galvanizer regarding potential warpage problems or handling problems during the galvanizing process that may require adjustment of fabrication techniques or design before finalizing shop drawings and beginning of fabrication.

C. Cleaning: Thoroughly clean metal surfaces of all mill scale, rust, dirt, grease, oil, moisture and other contaminants prior to galvanizing.

D. Application: Hot-dip galvanizing shall be applied in accordance with:

1 . ASTM A 143: Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel.

2. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A 153: Galvanized Coating on Iron and Steel Hardware - Table 1.

4. ASTM A 385: Practice for Providing High Quality Zinc Coatings.

5. ASTM A 924: Galvanized Coating on Steel Sheets.

6. Minimum weight of galvanized coating shall be two (2) oz. per square foot of surface.

E. Fabricate joints which will be exposed to weather in a manner to exclude water o r provide weep holes where water may accumulate.

F. All galvanized materials must be inspected for compliance with these specifications and marked with a stamp indicating the name of the galvanizer, the weight of t h e coating, and the appropriate ASTM number.

G. To minimize surface imperfection (eg: flux inclusions), material to be galvanized shall be dipped into a solution of Zinc Ammonium Chloride (pre-flux) immediately prior to galvanizing. The type of galvanizing process utilizing a flux blanket overlaying the molten zinc will not be permitted.

H. After galvanizing all materials not exposed to view must be chromated by dipping material in a 0.2% chromic acid solution.

I . Galvanized surfaces, where exposed to view, must have a smooth, level surface finish. Where this does not occur, piece shall be rejected and replaced to t h e acceptance of the Architect.

2.4 PROTECTIVE COATINGS

A. Whenever dissimilar metals will be in contact, separate contact surfaces by coating each contact surface prior to assembly or installation with one coat of specified bituminous paint, which

shall be in addition to the specified shop prime paint. Mask off those surfaces not required to receive protective coating.

2.5 WORKMANSHIP

A. General

1. Miscellaneous metal work shall be fabricated by an experienced fabricator or manufacturer and installed by an experienced tradesman.

2. Materials, methods of fabrication, fitting, assembly, bracing, supporting, fastening, operating devices, and erection shall be in accordance with drawings and specifications, approved shop drawings, and best practices of the industry, using new and clean materials as specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected.

3. All work shall be accurately and neatly fabricated, assembled and erected.

B. Shop Assembly: Insofar as practicable, fitting and assembly of work shall be done in shop. Shop assemble work in largest practical sizes to minimize field work. It is the responsibility of the miscellaneous metal subcontractor to assure himself that the shop-fabricated miscellaneous metal items will properly fit the field condition. In the event that shop-fabricated miscellaneous metal items do not fit the field condition, the item shall be returned to the shop for correction.

C. Cutting: Cut metal by sawing, shearing, or blanking. Flame cutting will be permitted only if cut edges are ground back to clean, smooth edges. Make cuts accurate, clean, sharp and free of burrs, without deforming adjacent surfaces or metals.

D. Holes: Drill or cleanly punch holes; do not burn.

E. Connections: Make connections with tight joints, capable of developing full strength of member, flush unless indicated otherwise, formed to exclude water where exposed to weather. Locate joints where least conspicuous. Unless indicated otherwise, weld or bolt shop connections; bolt or screw field connections. Provide expansion and contraction joints to allow for thermal movement of metal at locations and by methods approved by Architect.

1. Welding

a. Shall be in accordance with “Standard Code for Welding in Building Construction“ of the American Welding Society, and shall be done with electrodes and/or methods recommended by the manufacturer of the metals being welded.

b. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth with and to match finish of adjoining surfaces; undercut metal edges where welds are required to be flush.

c. All welds on or behind surfaces which will be exposed to view shall be done so as to prevent distortion of finished surface. Remove weld spatter and welding oxides from all welded surfaces.

2. Bolts and Screws: Make threaded connections tight with threads entirely concealed. Use lock nuts. Bolts and screw heads exposed to view shall be flat and countersunk. Cut off projecting ends of exposed bolts and screws flush with nuts or adjacent metal.

F. Operating Mechanism: Operating devices (i.e. pivots, hinges, etc.) mechanism and hardware used in connection with this work shall be fabricated, assembled, installed and adjusted after installation so that they will operate smoothly, freely, noiselessly and without excessive friction.

G. Built-In Work: Furnish anchor bolts, inserts, plates and any other anchorage devices, and all other items specified under this Section of the Specifications to be built into concrete, masonry or

work of other trades, with necessary templates and instructions, and in ample time to facilitate proper placing and installation.

H. Supplementary Parts: Provide as necessary to complete each item of work, even though such supplementary parts are not shown or specified.

I . Coordination: Accurately cut, fit, drill and tap work of this Section t o accommodate and fit work of other trades. Furnish or obtain, as applicable, templates and drawings to or from applicable trades for proper coordination of this work.

J. Exposed Work

1. In addition to requirements specified herein and shown on drawings, all surfaces exposed to view shall be clean and free from dirt, stains, grease, scratches, distortions, waves, dents, buckles, tool marks, burrs, and other defects which mar appearance of finished work.

2. Metal work exposed to view shall be straight and true to line or curve, smooth arrises and angles as sharp as practicable, miters formed in true alignment, profiles accurately intersecting, and with joints carefully matched to produce continuity of line and design.

3. Exposed fastenings, where permitted, shall be of the same material, color and finish as the metal to which applied, unless otherwise indicated, and shall be o f the smallest practicable size.

K. Preparation for Hot-Dip Galvanizing: Fabricator shall correctly prepare assemblies for galvanizing in consultation with galvanizer and in accordance with applicable Reference Standards and applicable AGA publications for the “Design of Products t o be Hot-Dip galvanized After Fabrication.“ Preparation shall include but not be limited to the following:

1. Remove welding flux.

2 . Drill appropriate vent holes and provide for drainage in inconspicuous locations of hollow sections and semi-enclosed elements. After galvanizing, plug vent holes with shaped lead and grind smooth.

2.6 MISCELLANEOUS METALS ITEMS

A. Rough Hardware

1 . Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete o r other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.

2. Fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood connections; elsewhere, furnish steel washers.

B. Ladders

1 . Vertical steel ladders shall be eighteen (18) inches wide with 3/4” diameter non-slip steel rungs spaced twelve (12) inches o.c. Stringers shall be 3/8” thick by 2-1/2” wide steel bars; rungs welded to bars. Attach ladders to walls six (6) inches from top and bottom and maximum thirty-six (36) inches o.c. from these points.

2 . Provide sloping ladders (ship’s ladders) where noted. Fabricate open type construction with structural steel channel or steel plate stringers, pipe handrails, and open steel grating treads. Provide all necessary brackets and fittings for installation.

3. Ladders shall be fabricated to support a live load of one hundred (100) lbs. per square foot and a concentrated load of three hundred (300) lbs. per rung; loads not to act simultaneously.

C. Folding Ship's Ladder (Wall Ladder): "Model 465 — 70° Mezzanine Access Folding Wall Ladder" by ALACO Ladder CO., or approved equal.

1. Height: As indicated on drawings.

2. Width: 24"

3. Finish: Mill finish aluminum. D.

Spiral Stair

1. Provide metal fully assembled spiral stairs by Stairways Inc., or approved equal.

2. Fabricate spiral stair and rails of hot dip galvanized steel. a.

   Treads shall be No. 133 galvanized steel radial grate.
   b. Railings shall be No. 312, 1/2" square galvanized steel.

3. Stair and railing shall be fabricated and installed to meet Code and performance requirements.

E. Steel Pipe Handrails

1. Steel pipe of size shown on Drawings, Schedule 40. Fittings shall be flush type, malleable of cast iron. Brackets shall be malleable iron, design as selected by the Architect.

2. Construction: Form direction changes in rails using solid bar stock or elbows. Connections shall be shop welded and ground smooth and flush, except where field connections and expansion joints are required. Field connections may be welded, internal sleeve and plug weld, or internal sleeve and set screw.

3. Secure handrails to walls with wall brackets. Provide brackets of malleable iron castings, with not more than three (3) inches clearance from inside face of handrail to wall surface. Neatly drill wall plate portion of the bracket into concrete or masonry to receive bolts for concealed anchorage. For installation at drywall, Drywall trades shall provide plate to receive wall plate portion of bracket and anchor or bolt wall plate through drywall to supporting steel plate. Locate brackets at not more than 5'-0" o.c. unless otherwise shown.

4. Provide wall return fittings of cast iron, flush type, with the same projection as that specified for wall brackets.

5. Longitudinal members shall be parallel with each other and with floor surface or shape of stair to a tolerance of 1/8" in 10'-0" linear feet. Center line of members within each run of railing shall be in the plane.

6. For steel pipe posts where indicated, anchor posts in concrete by means of pipe sleeves set and anchored into concrete. Provide sleeves of galvanized steel pipe, not less than six (6) inches long and having an inside diameter not less than 1/2" greater than outside diameter of the inserted pipe. Provide steel plate closure secure to bottom of sleeve and of width and length not less than one (1) inch greater than outside diameter of sleeve. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non- shrink, non-ferrous grout. Cover anchorage joint with a round steel flange welded to post. Posts shall be set plumb within 1/8" vertical tolerance.

7. Steel pipe handrails shall be capable of resisting a two hundred (200) lb. force applied to rail from any direction and a uniformly distributed load of fifty (50) lbs. per linear foot applied downward or horizontally, loads not to act simultaneously.

F. Miscellaneous Light Steel Framing

1. Light steel framing, bracing, supports, framing, clip angles, shelf angles, plates, etc., shall be

of such shapes and sizes as indicated on the drawings and details o r as required to suit the condition and shall be provided with all necessary supports and reinforcing such as hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, etc., as required to properly support and rigidly fasten and anchor same in place and to steel, concrete, masonry and all other connecting and adjoining work.

2. All light steel framing steel shall be furnished and erected in accordance with the applicable requirements of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" by the American Institute o f Steel Construction and as specified herein.

G. Steel Bollards: Provide six (6) inches O.D. extra strong (Schedule 80) steel pipe, concrete filled, with base of steel plate for mounting to anchor bolts in concrete foundation. Rabbet top of steel pipe and insert 1/4" steel plate cap, flush with t o p of pipe. Weld top of cap to pipe and grind smooth and flush.

H. Sleeves in Concrete Walls and Slabs

1. Sleeves through concrete walls shall be of Schedule 40 steel pipe with i.d. two (2) inches larger than o.d. of pipe or conduit (including insulation, if any) to be accommodated. Sleeves shall project one-half (1/2) inch on each side o f finished wall. Provide rectangular one-quarter (1/4) inch steel plate collar a t center, continuously welded to the perimeter of the sleeve, and six (6) inches wider than the o.d.

2. Slots in slabs shall be 12 gauge steel sheet, galvanized, of dimensions indicated, with strap anchors welded in place not more than twelve (12) inches o n centers.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where miscellaneous metal is to be installed and correct any conditions detrimental to the proper and timely completion of t h e work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 ERECTION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through- bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry, or similar construction.

C . Fitting Connections: Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces o f exterior units which have been hot dip galvanized after fabrication, and are intended for bolted or screwed field connections.

D . Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance, and quality of welds made, and methods used in correcting welding work.

E . Touch-Up Painting: Immediately after erection, clean field welds, bolted

connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

F. Field Touch-Up of Galvanized Surfaces: Touch-up shop applied galvanized coatings damaged during handling and installation. Use galvanizing repair coating specified herein for galvanized surfaces.

3.3 FOLDING WALL LADDER INSTALLATION

A. Establish centerline of mounting bracket on face of mezzanine 3” below floor. B.

Install top step even with floor line.

C. Check clear floor space required at bottom, and install ladder at 70 angular degrees. D. Install in accordance with manufacturer’s complete installation recommendations.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Concealed blocking, furring, roof curbs, nailers, other miscellaneous rough carpentry.
2. Fire and preservative wood treatments.

1.2 REFERENCES

A. American Wood Preservers Association (AWPA):

1. C1 - All timber Products Preservative Treatment by Pressure Process.
2. C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.

B. PS 20 - American Softwood Lumber Standard.

1.3 QUALITY ASSURANCE

A. Grade stamp shall be visible on wood products:

B. Fire retardant treatment: Conform to Underwriters' Laboratories (UL) requirements.

PART 2 - PRODUCTS

2.1 LUMBER

A. Lumber for rough carpentry:

1. Type: PS-20, S4S.
2. Species: Pine, fir, or spruce.
3. Stress grade: Construction.
4. Maximum moisture content: 19 percent.

2.2 ACCESSORIES

A. Fasteners: Size and type to suit condition:

1. Galvanized: Exterior and high humidity conditions.
2. Plain: All other conditions.

B. Self-drilling screws: Bugle head, steel, power driven type with length 3 times thickness of sheathing.

C. Anchors: Size and type to suit condition.

1. Toggle bolt type: Anchorage to hollow masonry.
2. Expansion shield and lag bolt: Anchorage to solid masonry and concrete.
3. Bolts: Anchorage to steel.
4. Ballistic type: Anchorage of plates to concrete slabs.

2.3 WOOD TREATMENT

A. Preservative: Pressure treated, waterborne type complying with AWPA C2. Treat:

1. Roof system nailers and curbs.

2. Other rough carpentry items exposed to moisture.

B. Fire retardant: Chemically treated and pressure impregnated in accordance with AWPA C20 and capable of providing a maximum flame spread of 25 and no significant progressive combustion. Treat:

1. Concealed blocking in metal stud partitions.

2. Roof system nailers and curbs.

PART 3 - EXECUTION

3.1 BLOCKING

A. Coordinate requirements for blocking with other sections to ensure quantity, size, locations, and mounting heights are sufficient for support of railings, cabinets, hardware, toilet accessories, identifying devices, plumbing fixtures, and other wall mounted items.

B. Install prior to start of application of gypsum board.

C. Accurately cut blocking to fit tightly between studs and securely fasten with screws. Face of blocking shall align with face of studs.

3.2 NAILERS

A. Install nailers and roof curbs as part of Section 07530 - Elastomeric Membrane Roofing.

B. Provide wood curbs for all roof openings except where prefabricated curbs are specified.

C. Form corner of multiple member nailers and curbs by lapping alternate members.

END OF SECTION

SECTION 064000 - **ARCHITECTURAL WOODWORK**

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes custom fabricated woodwork:

1. Work surfaces, custom cabinets, counter tops, and work stations.

2. Reception desks and counters where required.

3. Vanities for toilets.

4. Shelving and cabinets for utility type storage areas.

B. Related sections:

1. Section 055000 – Miscellaneous Metals: Welded steel angle support brackets.

2. Section 061000 - Rough Carpentry and Section 092100 - Gypsum Board Assemblies: Blocking in metal stud and gypsum board partitions for support of cabinets.

3. Section 096500 - Resilient Flooring: Rubber base for base cabinets.

1.2 REFERENCES

A. AWI 400 Quality Standards - Architectural Casework.

B. FS MM-L-736 - Lumber, Hardwood.

C. FS MMM-A-130 - Adhesive, Contact.

D. NEMA LD3 - High Pressure Decorative Laminates.

E. PS 1 - Construction and Industrial Plywood.

F. PS 20 - American Softwood Lumber Standard.

G. PS 51 - Hardwood and Decorative Plywood.

H. PS 58 - Basic Hardwood.

1.3 QUALITY ASSURANCE

A. Perform work to Custom Grade in accordance with AWI 400.

B. Fabricator: Company specializing in manufacture of custom casework with minimum five years experience.

1.4 SUBMITTALS

A. Submit in accordance with Section 013300 - Submittal Procedures:

1. Product data for plastic laminate, adhesives, hardware, access grommets, stain, sealer, and other materials.

2. Shop drawings indicating materials, dimensions, component profiles, assembly methods, joint details, fastening methods, hardware, and finishes.

3. Samples:

a. Plastic laminate.

b. Stain colors for selection by Architect.

c. Stained wood finish: For each stain color selected by Architect, stain and varnish 4 inch square piece of lumber taken from inventory being used for architectural woodwork. Prepare additional samples as requested by Architect to illustrate density of stain and color variations. Samples are not to be part of constructed work. Use accepted samples as standard for finishing actual work.

d. Samples are not to be part of constructed work.

e. Use accepted samples as standard for finishing actual work.

f. Hardware.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Refer to Section 12303 for specification of Premanufactured Modular Casework as referred to in Drawings.

B. Plastic laminate:

1. Formica Corporation, Cincinnati, Ohio; 800-524-0159.

2. Nevamar, Odenton, Maryland; 800-638-4380.

3. Wilsonart International, Temple, Texas; 800-433-3222.

C. Other manufacturers submitted and approved in accordance with Section 016300 - Product Substitution Procedures.

2.2 MATERIALS

A. Softwood lumber: PS 20, graded in accordance with AWI, maximum moisture content of 6 percent.

B. Hardwood lumber: FS MM-L-736, graded in accordance with AWI, maximum moisture content of 6 percent, red oak species.

C. Hardwood plywood: PS51, graded in accordance with AWI, face veneer as follows:

1. Exposed surfaces with natural stained finish: Red oak. Veneer leaves shall be book matched.

2. Semi exposed, concealed, and faced with plastic laminate: Fabricator's option.

D. Particleboard: AWI standard, high density with sanded faces.

E. Adhesive: FS MMM-A-130, types as recommended by manufacturers of materials to be adhered as appropriate for substrate to receive material:

2.3 PLASTIC LAMINATE

A. Plastic laminate: NEMA LD 3, general purpose GP-50.
B. Laminate backing sheet: LD-3 BK20 backing grade, undecorated plastic laminate.

2.4 HARDWARE

A. Acceptable manufacturers:

1. Grant Hardware Company, West Nyack, New York: 914-358-4400.

2. Stanley Hardware, New Britain, Connecticut; 00-54-7762.

3. Knapp and Vogt, Grand Rapids, Michigan; 616-459-3311.

4. Hafele American Company, Archdale, North Carolina; 800-334-1873.

5. Manufacturers of equivalent products submitted and approved in accordance with Section 016300 - Product Substitution Procedures.

B. Drawer and door pulls: Wire type, 4 inches long, aluminum with US28 finish, Stanley 4484, with bases, Stanley 4487.

C. Cabinet hinges: Concealed when door is closed, self-closing, 175 degree opening, suitable for overlap cabinet doors, steel with bright nickel finish, Stanley 1511.

D. Magnetic door catches.

E. Self adhering felt silencers.

F. Shelf standards: Heavy duty, 12 gage steel channel standard with slots to receive brackets and pre-drilled for screw attachment; Model 87 ANO as manufactured by Knape and Vogt.

G. Shelf brackets: Heavy duty, L shaped steel brackets, with tabs to fit standard slots; Model 187LL ANO as manufactured by Knape and Vogt.

H. Shelf fasteners: T shaped steel fastener to secure shelf to bracket; Model 154 ANO as manufactured by Knape and Vogt.

I. Drawer slides: Extension type, cold rolled steel, ball bearing action, Grant Hardware Company:

1. Full extension for file drawers.

2. Partial extension of drawer depth minus 5 inches for other applications.

3. Load capacity to fit specific application.

J. Wire access grommets: Round 3 inches diameter as manufactured by Hafele American Company.

2.5 FABRICATION

A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

B. Core material for cabinet bodies, doors, drawer faces and bodies, and shelves: Close grained hardwood plywood. Particleboard is not acceptable.

C. Fabricate counter tops to receive plastic laminate finish from 3/4 inch plywood.

D. Fit shelves, doors, and exposed edges with matching hardwood edging. Use full length pieces only.

E. Minimum thickness:

1. Door and drawer fronts, cabinet sides, shelves: 3/4 inch.

2. Drawer sides and backs: 1/2 inch.

3. Cabinet backs and drawer bottoms: 1/4 inch.

F. Shelving for cabinets shall be adjustable with recessed shelf brackets and rests.

G. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

H. Coordinate openings for fixtures, appliances, and equipment supplier indicated on Drawings. Provide filler panels as required to close openings around installed items.

I. Provide cutouts for plumbing fixtures, wire access grommets, inserts, appliances, outlet boxes, hardware, and other fittings.

J. Mechanically fasten backsplashes to counter tops with steel brackets.

K. Provided welded steel angle brackets for wall support of toilet vanities and work surfaces fabricated in accordance with Section 055000 - Metal Fabrications.

L. Provide keyed locks on all cabinet doors and drawers.

M. Provide metal number plates for cabinets in classrooms and laboratories for student storage.

2.6 FINISHING

A. Provide types of finishes indicated below for various woodwork items:

1. Natural Wood Exposed to view surfaces when doors and drawers are closed to have stained wood transparent finish. Countertops to have plastic laminate finish. Interiors of cabinets and drawers to be prefinished with white polyester overlay.

a. Factory apply transparent wood finish by staining with aniline water based dye and coating with sealer as specified in Section 099000 - Painting.

b. Do not start finishing until finish samples have been submitted and approved.

c. Thin stain to achieve desired color and intensity. Apply to wood surfaces in accordance with manufacturer's instructions.

d. Apply 2 coats of sealer. Sand lightly between coats.

2. Utility room storage shelving: Opaque painted finish field applied in accordance with Section 099000 - Painting.

3. All other custom fabricated architectural woodwork: Plastic laminate factory applied to all exposed surfaces of cabinets when doors and drawers are closed including counter tops. Interiors of cabinets and drawers are to be prefinished with white polyester overlay.

a. Apply laminate and surfacing in full sheets with no or minimum joints according to manufactured sizes.

b. Corner and butt joints to be hairline.

c. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

d. Cap exposed edges of counter tops, backsplashes, shelves, drawers, and other components with matching plastic laminate or solid surfacing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify adequacy of blocking and support framing.

B. Set and secure casework in place rigid, plumb, and level.

C. Secure cabinet bases to floor using appropriate angles and anchorages.

D. Use fixture attachments at concealed location for wall mounted components.

E. Counter-sink wall anchorage devices at exposed locations and conceal with solid plugs flush with surrounding surfaces and finished to match surrounding finish.

F. Use threaded steel concealed joint fasteners to align and secure adjoining cabinet units.

G. Carefully scribe casework which is against other building materials, leaving minimum gaps. Do not use additional overlay trim for this purpose.

H. Install access grommets in all surfaces required for access to electrical or data wiring.

3.2 ADJUSTING AND CLEANING

A. Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly and correctly.

B. Clean casework, hardware, fittings, and fixtures.

C. Clean and polish cast plastic fabrications with polishing cream in accordance with manufacturer's instructions.

END OF SECTION

SECTION 071354 - WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cold applied self adhered composite sheet waterproofing membrane for below grade concrete unit masonry perimeter walls. Includes preparation of surfaces, primer, and protection board.

1.2 SUBMITTALS

A. Provide in accordance with Section 01330 - Submittal Procedures:

1. Product data for waterproofing materials including material safety data sheets.

2. 6 by 6 inches samples of membrane and protection board.

3. Manufacturer's installation instructions and installation details.

1.3 QUALITY ASSURANCE

A. Conditioner, primer, liquid corner flashing, mastic, tape, protection board, and other accessories shall be compatible with waterproofing membrane and shall be products of a single manufacturer.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Do not apply during inclement weather or when air and surface temperatures are below 25 degrees F.

B. Do not apply concrete and masonry primers when temperature is below 40 degrees F.

C. Protect waterproofing membrane from UV and site damage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Products of the following manufacturers are acceptable and are listed in this Section to establish requirements for product type, characteristics, performance, and quality:

1. W. R. Grace and Company, Cambridge, Massachusetts; 617-498-4470.

B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Section 01630 - Product Substitution Procedures.

2.2 WATERPROOFING MATERIALS

A. Conditioner: Water-based surface conditioner; Bituthene System 4000 Surface Conditioner as manufactured W. R. Grace and Company.

B. Primer: Liquid type water-based latex primer for vertical concrete and masonry surfaces; Bituthene Water-Based Primer as manufactured W. R. Grace and Company.

C. Green concrete primer: Liquid rubber-based solvent primer for green concrete and damp surfaces;

Bituthene Green Concrete Primer as manufactured W. R. Grace and Company.

D. Waterproofing sheet membrane: Composite sheet membrane consisting of 0.1 mm cross-laminated polyethylene film and 1.4 mm self-adhesive rubberized asphalt; Bituthene System 4000 Waterproofing Membrane as manufactured W. R. Grace and Company.

1. Thickness: 1.5 mm.

2. Low temperature flexibility: Unaffected at minus 45 degrees F.

3. Minimum tensile strength:

a. Membrane: 325 pounds per square inch.

b. Film: 5,000 pounds per square inch.

4. Minimum elongation: 300 percent.

5. Lap adhesion: 5.0 pounds per inch of width minimum.

6. Peel strength: 9.0 pounds per inch of width minimum.

7. Minimum puncture resistance: 50 pounds.

8. Resistance of hydrostatic head: 231 feet minimum.

9. Water absorption in 72 hours: 0.1 percent maximum.

E. Liquid waterproofing membrane: Two component cold applied liquid membrane for flashing corners; Bituthene Liquid Membrane as manufactured by W. R. Grace and Company.

F. Mastic: Rubberized asphalt sealant for membrane terminations; Bituthene Mastic as manufactured W. R. Grace and Company.

G. Protection board: 1/2 inch asphalt wood fiberboard.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify concrete unit masonry retaining walls and concrete foundations are fully cured. Cure concrete walls 7 days minimum.

B. Verify surfaces are solid, free of oil, form release agents, curing compounds, frozen matter, loose particles, cracks, pits, rough projections, and foreign matter detrimental to adhesion and application of waterproofing.

C. Verify items which penetrate surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

B. Conditioner:

1. Spray at rate of 330 SF per Gallon.

2. Allow to dry sufficiently so that conditioner cannot be rubbed off.

C. Primer:

1. Use special green concrete primer for damp or green substrates. Use water based primer for other conditions.

2. Apply one coat at rate of 500 to 600 SF per gallon.

3. Allow to dry 1 hour minimum. Re-prime prior to application of waterproofing if contaminated by dust or curing time is exceeded.

3.3 MEMBRANE APPLICATION

A. Apply waterproofing in accordance with manufacturer's instructions to basement walls where finish grade is above finish floor grade.

B. Apply self-adhering waterproofing membrane in maximum lengths up to 8 feet.

C. Lap vertical sides 2-1/2 inches side laps. Lap horizontal ends 2-1/2 inches.

D. Immediately roll membrane with hand roller to ensure full adhesion to primer and adjacent panels.

E. Terminate membrane at grade level. Press membrane firmly to wall with hardwood tool exerting heavy pressure.

F. Provide 3/4 inch minimum fillet at juncture of wall and foundation.

G. Double cover outside and inside corners, joints, penetrations, and protrusions with additional 12 inches strip of membrane.

H. At locations where sheet membrane is difficult to apply, maintain water-tightness with application of liquid membrane.

I. Apply trowelled bead of mastic at terminations of sheet membrane.

J. After membrane is installed, thoroughly inspect for defects. Patch tears and inadequately lapped seams with sections of membrane. Slit fish-mouths and repair with patch extending 6 inches in all directions from slit and seal edges with mastic.

3.4 INSTALLATION OF PROTECTION BOARD

A. Coordinate installation of protection board with installation of perimeter rigid insulation specified in Section 07210 - Building Insulation.

B. Protect membrane from damage by immediately adhering protection board applied with waterproofing compound over waterproofing surface. Scribe and cut boards around projections and interruptions.

C. Neatly fit boards tight around pipe and other projections.

D. Backfill against waterproofing and protection board exercising care not to damage system.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at perimeter foundation wall and as indicated at exterior walls.

B. Batt insulation in exterior wall and ceiling construction.

C. Acoustical batt insulation for interior partitions.

1.02 RELATED REQUIREMENTS

A. Section 07214-Foamed-in-Place Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2007.

B. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.

C. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2007.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

E. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2004.

1.04 SUBMITTALS

A. See Section 013300 – Submittal Procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store materials in dry location with labels intact and legible at time of installation.

B. Protect materials from moisture before, during, and after installation.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: ASTM C 578, Type IV; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
   1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E 84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
   3. Board Size: 24 x 96 inch, or 48 x 96 inch depending on location.
   4. Board Thickness: 1 inch at foundations and 2 inches at exterior walls where indicated.
   5. Compressive Resistance: 25 psi.
   6. Manufacturers: Contractor to submit.
      a. Dow Chemical Co: www.dow.com.
      b. Owens Corning Corp: www.owenscorning.com.
      c. Pactiv Building Products: www.pactiv.com/green-guard/.

B. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C 1289; Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 1.
   1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E 84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
   3. Compressive Strength: 16 psi
   4. Thermal Resistance: R-value of 6 per inch. Total value of R-30 required for all roofs.
   5. Manufacturers:
      a. Atlas Roofing Corporation: www.atlasroofing.com.
      b. Dow Chemical Co: www.dow.com.
      c. GAF Materials Corporation: www.gaf.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BATT INSULATION MATERIALS

A. Batt Insulation: ASTM C 665; preformed batt; friction fit, conforming to the following:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E 136, except for facing, if any.
   4. Thermal Resistance: R of 22 per nominal 6 inch batt in exterior walls.
   5. Facing: Unfaced.
   6. Other Acceptable Manufacturers:
      a. CertainTeed Corporation: www.certainteed.com.
      b. Johns Manville Corporation: www.jm.com.
      c. Owens Corning Corp: www.owenscorning.com.
      d. Eco Batt as manufactured by Knauf: www.ecobatt.us.

B. Acoustical Insulation: Unfaced, glass fiber thermal blanket; ASTM C 665, Type I.
   1. Size: As required to fit framing. Use maximum possible lengths.
   2. Thickness: 3-1/2 inches, or as otherwise indicated.
   3. Maximum flame spread including facing: 25 tested in accordance with ASTM E84.
   4. Maximum smoke development including facing: 450 tested in accordance with ASTM E84.

2.03 ACCESSORIES

A. Nails or Staples: Steel wire; electroplated, or galvanized; type and size to suit application.

B. Wire: 16 gage.

C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify mechanical and electrical services within walls have been installed and tested.

C. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 12 inch wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
   1. Extend sheet full height of joint.

B. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install on inside or outside face of foundation stem walls as indicated in Wall Sections on Drawings. Apply elsewhere as required to complete thermal barrier at perimeter of building.

3. Install in running bond pattern.
4. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Extend boards over expansion joints, unbonded to foundation on one side of joint.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
1. Pressure fit batts between studs.
2. Where multiple layers are inicated, stagger joints minimum 12 inches.
3. Install insulation blankets between roof joists and other framing members and tight against roof deck.
   a. Retain insulation blankets firmly in place with wires running perpendicular to insulation at 24 inches maximum and securely attached to joints.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Acoustical Insulation:
1. Metal stud partitions: Install acoustical insulation in partitions indicated on Drawings. Extend above ceilings to roof structure.
2. Floor framing: Install acoustical insulation in space between first floor ceiling and second floor slab. Extend to perimeter walls. Place insulation between floor joists and directly above gypsum board and furring channels attached to bottom chord of joists.
3. Place acoustical insulation in partitions and floor framing tight within spaces, around openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions and floors.
4. Perforated acoustical metal deck:
   a. Coordinate provision of acoustical insulation in flutes of perforated acoustical metal roof deck with Section 05 33123.
   b. Provide insulation in strips slightly wider than width of metal deck flutes. Compress into flutes so that insulation is continuous.
   c. Exercise care that insulation does not protrude through slots in roof deck. Maintain in place.
5. Do not install unfaced acoustical insulation such that it is exposed in mechanical plenums. Where acoustical insulation is indicated to be installed in exposed locations of mechanical plenums, install scrim reinforced foil faced insulation as a barrier for sound transmission.
6. Install acoustical sealant within partitions and around penetrations in accordance with manufacturer's instructions.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provides weather-resistive barriers including sealing joints and protrusions through membranes, with accessories as required for complete installation.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's literature for each type of membrane.

B. Samples: Submit samples of each type of material. Quality Assurance/Control Submittals: Submit either test reports or manufacturer's certificates indicating materials comply with specified requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Fortifiber Building Systems Group, 1-800-773-4777, www.fortifiber.com

B. Substitutions: Comply with provisions of Division 1.

2.02 MATERIALS

A. Vapor Permeable Weather-Resistive Barriers: Two-ply asphalt saturated kraft Grade D breather type sheathing paper.

1. Types:

   a. Premier: Fortifiber / Two-Ply Super Jumbo Tex® 60 Minute

2. Reference Standard; Federal Specification UU-B-790a, Type 1, Grade D, Style 2.

2. Moisture Vapor Transmission: 35 grams minimum; ASTM F 1249.

4. Water Resistance: 150 minutes (professional), ASTM D 779.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure items which pass through membrane are properly and rigidly installed, substrate is free of projections and irregularities which may be detrimental to proper installation of membrane.

3.02 INSTALLATION

A. Apply membrane in accordance with manufacturer's recommendations, laid smooth without folds or bunches of material.

1. Seam Overlap: As recommended by membrane manufacturer for specific membrane material and application indicated.

2. Sealing: Seal edges and items projecting through vapor retarders and vapor barriers.

B. Inspect and repair membrane prior to application of finish material over membrane; tape tears, perforations and similar damage.

END OF SECTION

SECTION 072614 - UNDER SLAB VAPOR RETARDER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Vapor retarder, seam tape, mastic, pipe boots or collars, and detail strip for installation under concrete slabs.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete."

1.3 QUALITY ASSURANCE

A. Reference Standards: Meet the requirements of the following codes, specifications and standards, as applicable.

1. American Concrete Institute (ACI) Publications;
   a. ACI 302.1R-96 Vapor Retarder Location, Addendum to Guide for Concrete Floor and Slab Construction.
2. American Society for Testing and Materials (ASTM)
   a. ASTM D4262 Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces
   b. ASTM D4263 - 83(2005) Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
   c. ASTM E 1745-97(2004) Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
   d. ASTM E 96-95 Standard Test Methods for Water Vapor Transmission of Materials
   e. ASTM E 1643-98 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
   f. ASTM F710 - 08 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
   g. ASTM F1869 - 04 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
   h. F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring;
   i. F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
   j. F2170 Test Method for Determining Relative Humidity in Concrete Floor Slabs Using Probes

B. Pre-installation Meeting: Convene a preinstallation meeting before start of installation of vapor retarder membrane. Require attendance of parties directly affecting work of this section, including Contractor, concrete Subcontractor, Architect, and installer. Review installation, protection, and coordination with other work

1.4 SUBMITTALS

A. Product Data:

1. Submit manufacturer's product data with application and installation instructions.
2. Submit test results from an independent laboratory showing compliance with ASTM & ACI Standards.
3. Submit manufacturer’s samples and literature.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area in accordance with manufacturer’s instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials complying with the referenced standards in 1.3A.1.

B. Vapor retarder (Performance based specification)

1. Vapor retarder membrane must meet the following requirements.
   a. Be manufactured from prime virgin resins.
   b. Meet or exceed Class A vapor retarder requirements in accordance with ASTM E 1745.
   c. Have a water vapor permeance less than or equal to 0.03 perms in accordance with ASTM E 96.
2. Manufacturers accepted that provide material meeting the above specification include:
   a. Fortifiber Corporation (800) 773-4777. Moistop Ultra 15.
   b. Raven Industries (800) 635-3456. VaporBlock 15.
   c. Reef Industries (800) 231-6074. Griffonlyn 15 mil.
   d. Stego Industries (877) 464-7834. Wrap.
   e. W. R. Meadows (800) 342-5976. Perminator.
   f. Epro (800) 882-1896. Ecoshield-E.
   g. Substitution of products from others will not be accepted.

C. Accessories:

1. General: Ensure accessories shall be from the same manufacturer as the vapor retarder membrane.
2. Seam tape: Four-inch (4”) wide tape with a permeance rating matching that of the vapor retarder and approved by the vapor retarder manufacturer.
3. Mastic: Mastic shall be approved by the vapor retarder manufacturer.
4. Pipe Boots or Collars: Pipe boots or collars shall be fabricated in accordance with requirements of the vapor retarder manufacturer explicitly for use with the membrane being used for this project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The area where vapor retarder will be installed has foundations and compacted aggregate base in place. Examine the area to receive vapor retarder and notify Architect if areas are not acceptable.

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

3.2 INSTALLATION, GENERAL

A. Comply with vapor retarder manufacturer's written instructions applicable to products and application indicated and in accordance with ASTM E 1643-98 (2005) "Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs," except the option for granular fill over the membrane is not allowed.

3.3 PLACEMENT

A. Level and tamp or roll granular base.

B. Place vapor retarder sheeting with the longest dimension parallel with the direction of concrete pour, completely covering the area where concrete slab will be placed.

C. Lap vapor retarder over footings or seal to foundation wall, or both, and seal around penetrations such as utilities and columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab and at the slab perimeter. NOTE: The area of adhesion should be free from dust, dirt and moisture to allow maximum adhesion.

D. Lap joints 6 in. (150 mm), or as instructed by the manufacturer, and seal with the manufacturer's recommended adhesive or pressure sensitive tape or both in accordance with manufacturer's instructions.

3.4 PROTECTION

A. Take precautions to protect vapor retarder from damage during installation of reinforcing steel and utilities and during placement of concrete.

B. Use only concrete brick type reinforcing bar supports, or provide 6 by 6 in. (150 by 150 mm) protective pads of asphaltic hardboard or other material recommended by the vapor retarder manufacturer to protect the vapor retarder from puncture.

C. Avoid use of stakes driven through vapor retarder. If stakes must be used, do so only in strict conformance with manufacturer's recommendations for stake and pin penetration sealing.

3.5 REPAIR

A. IMPORTANT: All penetrations must be sealed. All pipe, ducting, rebar and wire penetrations shall be sealed using boots, tape, mastic, and/or membrane as directed by the membrane manufacturer's instructions.

B. Repair vapor retarder damaged during placement of reinforcing or concrete with vapor barrier material or as instructed by manufacturer.

C. Lap beyond damaged areas a minimum of 6 in.; clean all adhesion areas of dust, dirt and moisture; and seal as prescribed for sheet joints.

END OF SECTION

SECTION 074233- FIBER REINFORCED PLASTIC COATED PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Fiberglass reinforced plastic coated wall panels, moldings, fasteners, and other accessories.

B. Related sections:

1. Section 092100 - Gypsum Board Assemblies: Gypsum board and metal stud framing to receive fiberglass reinforced plastic coated panels.

1.2 SUBMITTALS

A. Provide in accordance with Section 013300 - Submittal Procedures:

1. Product data.

2. Shop drawings showing layout of panels, dimensions, locations of joints, and attachment and trim details.

3. Standard finishes for selection by Architect.

4. Samples of panel, trim, and fasteners.

5. Installation instructions.

1.3 QUALITY ASSURANCE

A. Wall system shall be USDA approved for sanitary food processing plants.

B. Provide materials with identification marks indicating code compliance certification.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

B. Do not install fiber reinforced plastic coated panels until interior plastering and other wet construction work is completed and air temperature and moisture content has stabilized.

C. Maintain room temperature at 65 degrees F for two days prior to delivery of materials, during installation, and after installation.

D. Do not install adhesives in a closed, unventilated rooms.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Kemlite Company, Joliet, Illinois; 800-435-0080.

B. Nudo Products, Inc., Springfield, Illinois; 800-826-4132.

C. Sequentia, Inc., Strongville, Ohio; 44136.

D. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

2.2 WALL PANELS

A. Type: Fiberglass reinforced plastic wall panels; Fire-X Glasbord Surfaseal as manufactured by Kemlite Company.

B. Size: 0.09 inch thick by 4 feet wide by length as required.

C. Flame spread in accordance with ASTM E84: Class A, less than 25.

D. Smoke development in accordance with ASTM E84: Less than 450.

E. Impact resistance: 22 inch-pounds tested in accordance with ASTM D3029.

F. Barcol hardness: 55 tested in accordance with ASTM D3209.

G. Abrasion resistance: Less than 0.038 percent weight loss after 25 cycle Taber Abrasion Test.

H. Surface: Embossed.

I. Color: Selected by Architect from manufacturer's standard range.

2.3 ACCESSORIES

A. Fasteners: One piece nylon rivet suitable for attachment to gypsum board.

B. Moldings: Extruded PVC moldings provided in maximum possible lengths. Provide shapes for panel divisions, inside and outside corners, and edge caps.

C. Sealant: Silicone as specified in Section 07900 - Joint Sealers and approved by manufacturer for this application.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that framing and gypsum board surfaces to receive wall panel system is even, sound, and free from defects detrimental to installation.

B. Verify that plumbing, mechanical, and electrical services within walls have been installed, tested, and approved.

3.2 WALL INSTALLATION

A. Install panels in accordance with manufacturer's instructions in locations indicated in Finish Schedule on Drawings.

B. Install panels vertically. Fasten with nylon rivets.

C. Neatly cut moldings and trim for joints and around perimeter of exposed panel edges.

D. Apply sealant to interior edge of trim prior to placing panel in trim.

E. Neatly drill or cut panels for penetrations. Seal openings and provide closures.

F. Remove excess sealant from panels and moldings. Sealant should not be visible in completed system.

END OF SECTION

SECTION 076000 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Gutter and downspouts.
2. Parapet cap.
3. Trim.
4. Transition flashings from metal panel roof system.
5. Counter-flashings over elastomeric roof base flashings.
6. Counter-flashings at roof mounted mechanical equipment, roof hatches, skylights vent stacks and roof penetrations.
7. Other sheet metal not specifically described but required to prevent penetration of water through exterior building shell.

B. Related sections:

1. Section 006100 - Rough Carpentry: Wood blocking and nailers for parapet cap, roof curbs, and other sheet metal.
2. Section 074113- Standing Seam Metal Roof System: Prefinished caps and edge trim to match roof panels.
1. Section 075420- Thermoplastic-Polyolefin Roofing.
3. Section 079200 - Joint Sealers: Sealants to be used in conjunction with sheet metal.

1.2 REFERENCES

A. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

B. ASTM B32 - Solder Metal.

C. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

D. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

E. ASTM D4586 - Asphalt Roof Cement, Asbestos Free.

F. FS O-F-506- Flux, Soldering, Paste and Liquid.

G. NRCA (National Roofing Contractors Association) - Roofing Manual.

H. SMACNA - Architectural Sheet Metal Manual.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with applicable NRCA and SMACNA details and requirements.

1.4 SUBMITTALS

A. Provide in accordance with Section 013300 - Submittal Procedures:

1. Materials list and product data.

2. Shop drawings for shop fabricated items showing profile, dimensions, material gages, and fastening methods.

3. Samples of factory applied finishes.

4. Copy of warranty specified in Paragraph 1.6 for review by Architect.

1.5 HANDLING

A. Stack preformed material to prevent twisting, bending, or abrasion. Provide ventilation.

B. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.6 WARRANTY

A. Provide under provisions of Section 017700 - Closeout Procedures:

1. Provide 20 years warranty for factory applied fluorcarbon finish coating to cover cracking, peeling, and fading in accordance with Section 017700 - Closeout Procedures.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Copper fabric flashing:

1. Hohmann and Barnard, Inc., Hauppauge, New York; 800-645-0616.
2. Revere Copper Products, Inc., Rome, New York: 800-448-1776

B. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

2.2 MATERIALS

A. Galvanized sheet steel: ASTM A446, Grade A, G90 zinc coating, 24 minimum gauge or as otherwise indicated. **All fascias, downspouts, gutters and parapet caps exposed to public view shall be 24 gauge and shall be prefinished with a Kynar 500 coating, custom color as selected by Architect.**

B. Copper fabric flashing: Composite flashing consisting of 7 ounces per SF copper sheet bonded between 2 layers of asphalt impregnated fiberglass fabric; C-Fab Flashing as manufactured by Hohmann and Barnard, Inc.

C. Fasteners: Corrosion resistant, galvanized steel with soft neoprene washers at exposed fasteners.

D. Underlayment: ASTM D266, No. 15 asphalt saturated roofing felt.

E. Protective backing paint: Aluminum or heavy-bodied bituminous.

F. Slip sheet: Rosin sized building paper.

G. Sealant: Silicone type specified in Section 07900 - Joint Sealers.

H. Plastic cement: ASTM D4586.

I. Solder: ASTM B32.

J. Flux: FS O-F-506.

2.3 FABRICATION

A. Fabricate sections to profiles and dimensions indicated on Drawings.

B. Linear components: Form in longest possible lengths with 8 foot as minimum.

C. Intersections: Cope to fit accurately and solder.

D. Corners: Fabricate as one piece with 18 inches minimum legs. Seam and solder.

E. Edges: Turn back all exposed edges to form 1/2 inch hem.

F. Lock seams: Flat, 1/2 inch minimum width, soldered, and lapped in direction of flow.

G. Unless shown otherwise on Drawings, fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

H. Soldering: Clean and tin materials. Completely fill seams with solder. Soldering on exposed finished surfaces shall be neat, full flowing, and smooth. After soldering, remove flux and wipe and wash joints clean.

I. Counter-flashings: Fabricate from galvanized sheet steel. Form to extend 4 inches over roofing. Where applicable provide flanges for embedment in mortar joints.

J. Masonry flashings: Install copper fabric at sill, bottom of wall, and other through wall flashings and as detailed on Drawings.

1. Extend flashings horizontally at bottom of walls. Turn up 8 inches minimum and bed into masonry joint or seal to metal stud and gypsum sheathing backup.

2. Lap ends joints 6 inches minimum and seal watertight.

K. Parapet cap:

1. Form from 22 gage (unless shown otherwise) galvanized sheet as channel profile with dimensions shown on Drawings. Vary width to accommodate different parapet wall thicknesses. Provide drip edges and pitch top 5 degrees minimum to roof surface. Provide cap in 10 feet lengths. Cut segments shall be 5 feet minimum.

2. Anchor cleats: Fabricate from 18 gage galvanized sheet steel in 12 inches minimum widths and shaped to interlock with front and back drip edges of parapet cap.

3. Splice plates: Fabricate from 24 gage galvanized sheet steel with finish to match parapet cap in 6 inches minimum widths. Shape to fit inside parapet cap and interlock with front and back drip edges. Splice plates shall be concealed when installed and shall lock adjoining cap segments in alignment while allowing for expansion and contraction of parapet cap.

4. Corners: Shop fabricate as one piece matching parapet cap profile. Extend legs 18 inches minimum. Miter cut pieces, seam, and solder.

L. Gutters: Fabricated from steel sheet finished with Kynar 500 with rectangular style profile. Provide with end caps, downspout outlets, straps, and support brackets.

M. Downspouts: Fabricated from steel sheet finished with Kynar 500 with rectangular profile. Provide with bracket supports, anchors, and bottom boot.

N. Pitch pans: Form sheet metal pans 6 inches square nominal size with 3 inches upstand and 4 inches flanges.

2.4 FINISHING

A. Shop prepare and prime exposed ferrous metal surfaces.

B. Back-paint concealed metal surfaces with protective backing paint.

C. Where required or shown on the Drawings, fabricate from material prefinished with fluorcarbon coating, Kynar 500, color selected by Architect:

1. Trim and flashings used in conjunction with standing seam metal roof system specified in Section 07415 - Standing Seam Metal Roof System. Color to match roof panel finish.

2. Trim and flashings used in conjunction with metal soffit panels specified in Section 07416 - Metal Soffit Panels. Color to match soffit panel finish.

3. Parapet caps – Custom color as selected by the Architect.

D. Field paint in accordance with Section 09900 - Painting. Color as selected by the Architect.

1. Miscellaneous flashings, counter flashing and trim not exposed to public view.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate installation of flashings with erection of masonry walls to ensure material is provided in timely manner for embedment in mortar joints.

B. Verify roof openings, curbs, cant strips, blocking, and nailing strips are in place.

C. Verify membrane termination and base flashings are in place, sealed, and secure.

D. Coat dissimilar materials in contact with sheet metal and flashings:

1. Concrete and masonry: One coat bituminous paint.

2. Wood: 2 coats aluminum paint.

E. Install double layer of underlayment on parapets to receive sheet metal caps.

3.2 INSTALLATION

A. Erect sheet metal plumb and level without bulges or waves.

B. Secure flashings in place using concealed fasteners unless shown otherwise. Lap and seal all joints. Exposed fasteners shall be covered with sealant.

C. Fit flashings tight in place. Make corners square, and surfaces true and straight in planes.

D. Masonry flashings: Install copper fabric as sill, bottom of wall, and other through wall flashings as detailed on Drawings.

1. Extend flashings horizontally at bottom of walls. Turn up 8 inches minimum and bed into masonry joint or seal to metal stud and gypsum sheathing backup.

2. Lap ends joints 6 inches minimum and seal watertight.

E. Parapet cap:

1. Attach anchor cleats to wood blocking bolted to parapet top. Space cleats at 5 feet maximum. Provide anchor cleats and all parapet cap joints and terminations.

2. Install splice plates at parapet cap joints. Attach splice plate by interlocking to cleat.

3. Locate parapet cap butt joints over splice plates. Allow 1/4 inch between abutting sections for expansion. Apply two beads of sealant to splice plate prior to installing lengths of parapet cap.

4. Interlock parapet cap to cleats and splice plates.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Installation of sealants in interior and exterior joints, around door frames and other components, around items penetrating structure, and wherever indicated or required to seal joints and prevent flow of air or water. Work includes:

1. Preparing sealant substrate surfaces.

2. Sealants and backing.

3. Fireproof fire-stopping materials and accessories.

B. Sealants specified in this Section are to be installed as part of work specified in the following sections. Coordinate requirements.

1.2 REFERENCES

A. ASTM C834 - Latex Sealing Compounds.

B. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

C. ASTM E814 - Methods for Fire Tests of Through-Penetration Fire Stops.

D. FS TT-S-001543 - Sealing Compound: Silicone Rubber Base for Caulking, Sealing, and Glazing in Buildings and Other Structures.

E. FS TT-S-001657 - Sealing Compound: Single Component, Butyl Rubber Based, Solvent Release Type.

F. FS TT-S-00227 - Sealing Compound: Elastomeric Type, Multi-Component For Caulking, Sealing, and Glazing in Buildings and Other Structures.

1.3 SUBMITTALS

A. Provide in accordance with Section 01330 - Submittal Procedures:

1. List of proposed products and data indicating sealant chemical characteristics, performance criteria, limitations, and colors available.

2. Samples of available colors to be selected by Architect so that appearance is compatible with surrounding surfaces.

3. 2 inches minimum length of manufactured foam expansion joint sealer.

4. Manufacturer's installation instructions.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Do not install solvent curing sealants in enclosed building spaces without proper ventilation.

B. Maintain temperature and humidity recommended by manufacturer during and after installation.

C. Do not apply fire-stopping materials when temperature of substrate and ambient air is below 60 degrees F.

D. Store expansion joint sealer at 65 degrees F minimum for 12 hours prior to installation.

PART 2 - PRODUCTS

2.1 SEALANTS

A. Type A - Polyurethane, FS TT-S-00227, Type I, Class A:

1. Multi-component, self-leveling.
2. Movement: 25 percent.
3. Joint size limitation:
    a. Minimum: 3/8 by 3/8 inch.
    b. Maximum: No width limitation, 1/2 inch deep.
4. Life expectancy: 10 years.
5. For application with colored concrete surfaces, provide colored sealant to match color of concrete.

B. Type B - Silicone sealant, FS TT-S-001543, Class A:

1. Single component, low modulus, ultraviolet resistant.
2. Movement: 100 percent expansion, 50 percent contraction.
3. Service temperature range: -65 to 300 degrees F.
4. Joint size limitation:
    a. Minimum: 1/8 by 1/8 inch.
    b. Maximum: 1 inch wide by 1/2 inch deep.
5. Life expectancy: 30 years.

C. Type C - Butyl, FS TT-S-001657, Type I:

1. Single component.
2. Movement: 5 percent.
3. Joint size limitation:
    a. Minimum: 1/4 by 1/4 inch.
    b. Maximum: 1/2 inch wide by 3/8 inch deep.
4. Life expectancy: 10 years.

D. Type D - Acrylic latex, ASTM C 834:

1. Single component, fast setting, paintable:
2. Movement: 12 percent.
3. Joint size limitation:
    a. Minimum: 1/4 by 1/4 inch.
    b. Maximum: 3/4 inch wide by 1/2 inch deep.
4. Life expectancy: 10 years.

E. Type E - Acoustical sealant, Meets ASTM C834 Standard Specification for Latex-Based Sealing compounds tested in accordance with ASTM C731, ASTM C732, ASTM C733, ASTM C734, ASTM C736, ASTM D217, ASTM D2202, ASTM D2203, and ASTM D2377. Also tested in accordance with ASTM E84 (surface burning characteristics), ASTM E90 (sound tests), ASTM E1966 (fire resistant joint systems), and ASTM E814 (through-penetration firestop systems).

1. Non-hardening.

2. Non-shrinking

3. Joint limitation: 1/2 inch maximum.

4. Life expectancy: 20 years.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint cleaner: Non-corrosive, non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint backing: ASTM D1056 round polyethylene foam rod oversized 30 percent larger than joint width.

D. Bond breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

2.3 FIRESTOPPING MATERIAL AND ACCESSORIES

A. Acceptable manufacturers:

1. Hilti, Tulsa, Oklahoma; 800-333-1150.

2. Specified Technologies Inc. (STI), Somerville, New Jersey; 800-992-1180.

3. Tremco, Beachwood, Ohio; 800-321-7906.

B. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

C. Fire-stopping material: Single component, latex, water based, resilient, intumescent sealant; SpecSeal Series 100 Sealant as manufactured by Specified Technologies Inc.

1. Volume increase in fire: 500 percent minimum.

2. Actuation temperature: 300 degrees F maximum.

3. Applicable for small and medium sized openings:

a. Combustible and non-combustible piping and conduit.

b. Insulated pipe with 1-1/2 inches maximum insulation thickness.

c. Loose cable.

4. Durability and longevity: Permanent.

5. Non-toxic during installation and no long-term side effects.

D. Accessories: Types recommended by fire-stopping manufacturer for specific conditions and substrate surfaces:

1. Backing material, temporary dams, clips, collars, fasteners, and other devices required to position and retain materials in place.

2. Primer.

3. Wrap strip: Intumescent material used in conjunction with sealant to achieve fire rating for large combustible piping and insulated piping with insulation greater than 1-1/2 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that joint openings are ready to receive sealants and firestopping.

B. Beginning installation implies installer accepts existing surfaces.

3.2 PREPARATION

A. Clean and prime joints in accordance with manufacturer's instructions.

B. Remove loose materials and foreign matter which might impair adhesion of sealant.

C. Protect surrounding surfaces from damage or disfiguration.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Sealants:

1. Completely seal joints indicated on Drawings and as required to render weather-tightness, close openings, and allow movement of materials. Seal around all conduit penetrations of structure.

2. Install joint backing to achieve a sealant depth no greater than 1/3 joint width. Install backing with blunt instrument; do not twist rod.

3. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these ranges.

4. Apply sealant with minimum exposure to air using pressure gun with nozzle cut to fit joint width.

5. Install sealant free of air pockets, foreign embedded material, ridges, and sags.

6. Tool joints concave unless otherwise noted.

7. Do not lap or feather onto adjacent surfaces.

C. Fire-stopping:

1. Firestop all interruptions to fire rated assemblies, materials, and components resulting from work of this Contract.

2. Install fire-stopping material where conduits, piping, and other items penetrate fire rated assemblies.

3. Apply fire-stopping material in sufficient thickness to achieve rating. Ensure uniform density and texture.

3.4 CLEANING AND REPAIRING

A. Clean adjacent soiled surfaces.

B. Repair or replace defaced and disfigured finishes caused by work of this Section.

C. Protect sealants until cured.

D. Visually inspect joints after 30 days. Replace joints showing bond failure, excessive shrinkage, cracking, or improper curing.

3.5 SCHEDULE

A. For the following locations provide type of sealants listed in Paragraph 2.1:

1. Concrete paving: Type A.
2. Flashing and sheet metal: Type B.
3. Glass block expansion joints: Type B.
4. Hollow metal frames: Type C.
5. Aluminum frames: Type B or as recommended by manufacturer of frames.
6. Under thresholds: Type B.
7. Glazing: Type C.
8. Gypsum board partitions and other general interior use: Type D.
9. Ceramic tile, plastic laminate countertops, and other interior locations subject to water exposure: Type B.
10. Around perimeter of sound barrier partitions and items penetrating them and other acoustical applications: Type E.

END OF SECTION

SECTION 081100 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Non-rated and fire-rated, interior and exterior hollow steel doors and hollow steel door and window frames. Includes grouting of hollow steel frames.

B. Related sections:

1. Section 081400 - Wood Doors: Interior wood doors to be installed in hollow metal frames.

1. Section 087000 - Door Hardware: Hardware for doors and removable mullions for door frames.

2. Section 088000 - Glazing: Glazing for full glazed steel doors, vision lights, and hollow metal window frames.

4. Section 099000 - Painting: Field painting of doors and frames.

C. See Door Schedule in Drawings for sizes and fire ratings of hollow metal doors and frames.

1.2 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI A250.6 - Hardware on Standard Steel Doors (Reinforcement Application).

2. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

3. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

4. ANSI A250.11 - Recommended Erection Instructions for Steel Frames.

B. American Society of Testing and Materials (ASTM):

1. ASTM A366 - Steel, Carbon, Cold Rolled Sheet, Commercial Quality.

2. ASTM A653 - Steel Sheet, Carbon, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

3. ASTM A780 - Practice for Repair of Damaged Hot-Dip Galvanized Coatings.

4. ASTM C236 - Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.

5. ASTM C665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

6. ASTM A924 - General Requirements for Sheet Steel, Metallic Coated by the Hot-Dip Process.

7. ASTM C578 - Rigid, Cellular Polystyrene Thermal Insulation.

C. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

D. Door Hardware Institute (DHI): Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.

E. International Conference of Building Officials (ICBO):

1. ICBO UBC 7-2 - Positive Pressure Fire Tests of Door Assemblies.

F. National Fenestration Rating Council (NFRC):

1. NFRC 400 - Procedure for Determining Fenestration Product Air Leakage.

G. National Fire Protection Association (NFPA):

1. NFPA 80 - Fire Doors and Windows.

2. NFPA 105 - Installation of Smoke-Control Door Assemblies.

H. Steel Door Institute (SDI) Publications:

1. SDI 117 - Manufacturing Tolerances Standard Steel Doors and Frames.

I. Steel Structures Painting Council (SSPC):

1. SSPC Paint 20 - Zinc-rich Primers (Type I, Inorganic, and Type II, Organic).

2. SSPC SP 5 - White Metal Blast Cleaning.

3. SSPC SP 8 - Pickling.

1.3 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittal Procedures:

1. Product data.

2. Shop drawings indicating door and frame elevations, dimensions, frame configurations and profiles, cutouts for hardware, reinforcement, anchors, and details for fabrication, glazing, and installation.

3. Door and frame schedule: Use same reference numbers as indicated in Contract Documents.

4. Certificates documenting:

a. Fire testing: Fire-rated units have been successfully tested in accordance with Paragraph 1.4.B.

b. R-value: Thermal units have been successfully tested in accordance with Paragraph 1.4.C.

c. Air leakage: Exterior doors and frames have been successfully tested in accordance with Paragraph 1.4.D.

5. Warranty information.

1.4 QUALITY ASSURANCE

A. Conform to the requirements of ANSI A250.8.

B. Fire rated doors and frames: Provide units identical to assemblies tested and listed by Factory Mutual (FM), Underwriters Laboratories (UL), Warnock Hersey, or other testing agency acceptable to Architect. Units shall bear testing agency labels.

1. Positive pressure: Provide certificate that fire rated doors have been tested for positive pressure in accordance with ICBO UBC 7-2.

C. Thermal resistance rating: Provide certificate that flush panel exterior doors have been tested to provide minimum R-value of 3.8 when tested in accordance with ASTM C236.

D. Air-leakage: Provide certificate that exterior doors and frames have been tested in accordance with NFRC 400 as door assembly with weatherstripping and gaskets specified in Section 08710 - Door Hardware to provide maximum air leakage of 0.4 cubic feet per minute per square foot.

E. Door and window glazing: Comply with CPSC 16 CFR 1201 and other applicable safety requirements. Each piece of safety glazing shall be permanently labeled with appropriate marking.

1.5 PRODUCT HANDLING

A. Frame spreaders: Before shipment, install temporary spreaders at bottom of frames; do not remove until frames are in place.

B. Protection: During shipping and storage protect doors with cardboard or other resilient packaging. Immediately remove wrappings that become wet.

C. Storage: Store under cover in dry, vented, humidity free, protected space. Place units on blocking in upright position with 1/4 inch air circulation spaces between units.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products of the following manufacturers are acceptable and are listed in this Section to establish requirements for product type, characteristics, performance, and quality.

1. Amweld Building Products, Inc., Garrettsville, Ohio; ; www.amweld.com.

2. Ceco Door Products, Milan, Tennessee; 731-686-8345; www.cecodoor.com

3. Curries Company, Mason City, Iowa; 641-423-1334.

4. Republic Builders Products, McKenzie, Tennessee; 731-352-3383; www.republicdoor.com.

5. Steelcraft, Cincinnati, Ohio; 513-745-6400; www.steelcraft.com.

B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Section 01630 - Product Substitution Procedures.

2.2 MATERIALS

A. Cold-rolled steel sheet: Commercial quality, stretcher level for flatness complying with ASTM A366.

B. Galvanized steel sheet: Comply with ASTM A924 and coated by hot dip process in accordance with ASTM A653 to A60 or G60 coating.

C. Door core:

1. Honeycomb: Resin impregnated cardboard honeycomb with 1 inch maximum cells.

2. Polystyrene: Rigid, extruded, fire retardant, closed cell board complying with ASTM C578.

D. Galvanizing repair paint: Comply with SSPC - Paint 20.

E. Primers:

1. Galvanized steel: Zinc-dust, zinc-oxide, air-dried primer.

2. Cold rolled steel: Rust-inhibiting primer complying and compatible for field applied finish paint coats. Factory applied and either air-dried or thermoset.

F. Glazing: As specified in Section 08800 - Glazing.

G. Grout: Perlite gypsum type. Mix with only enough water for stiff workable mixture.

2.3 STEEL DOORS

A. Type: Hollow steel construction manufactured in compliance with ANSI A250.8.

B. Thickness: 1-3/4 inches.

C. Fabrication:

1. Edges: Smooth, seamless, unbroken edges with no visible seams along hinge, lock, and face surfaces. Interlocking joints shall be tack welded, filled, and ground smooth.

2. Exterior doors: Close top and bottom edges flush as integral part of door. Seal joints against water penetration.

3. Prepare doors to receive hardware in accordance with ANSI A250.6. Provide hardware reinforcement plates welded in place. Coordinate with hardware supplier to ensure proper preparation of doors for mounting hardware items.

4. Coordinate cut-outs for louvers to ensure integrity of fire rated doors.

5. Manufacturing tolerances: Comply with SDI 117.

6. Door numbers: Permanently stamp hinge side of door with reference number as designated on Drawings.

D. Exterior flush panel doors:

1. ANSI A250.8 Grade: Level III - Extra Heavy Duty, Model 2.

2. Face sheet: 16 gage minimum, galvanized steel sheet.

3. Core: Polystyrene rigid insulation.

4. Sound transmission class: STC 31, minimum.

E. Interior flush panel doors:

1. ANSI A250.8 Grade: Level II - Heavy Duty, Model 2.

2. Face sheet: 18 gage minimum, cold rolled steel sheet.

3. Core: Honeycomb.

4. Sound transmission class: STC 33, minimum.

F. Fire-rated doors: Provide fire-rated units as indicated in Door Schedule on Drawings. Other characteristics of fire-rated door shall be as stated on Door Schedule and specified above. Permanently attach fire-rating label to door edge.

2.4 DOOR GLAZING

A. Equip openings with glazing frames and moldings that are flush with door face. Frames for fire-rated doors shall be of size and type to maintain fire rating.

B. Glazing stops: Rectangular profile. Exterior stop to be non-removable. Interior stop to be removable snap-on type or attached with countersunk screws.

C. Glazing: Factory glaze doors with glazing as specified in Section 08800 - Glazing:

1. Fire rated interior doors: 5/16 inch thick , laminated, fire & impact resistive, clear glass.

2. Non-rated interior doors: 1/4 inch thick, clear, tempered, safety glass.

2.5 DOOR AND WINDOW FRAMES

A. Type: Hollow steel construction manufactured in compliance with ANSI A250.8.

B. Fabrication:

1. Fabricate frames as welded units. Welds shall be full length of joint and ground smooth.

2. Mortise, reinforce with plates, and drill frames to receive hardware in accordance with ANSI A250.6. Coordinate with hardware supplier to ensure proper preparation of frames for mounting hardware items.

3. Prepare door frames for 3 silencers if required.

C. Profile: Combination type with integral stop and trim of size and configuration shown on Drawings. Minor variations to accommodate manufacturer's standard fabrication are acceptable.

D. Exterior frames:

1. ANSI A250.8 Grade: Level III - Extra Heavy Duty.

2. Material: 16 gage minimum, galvanized steel sheet.

E. Interior frames:

1. ANSI A250.8 Grade: Level II - Heavy Duty.

2. Material: 16 gage minimum, cold rolled steel sheet.

F. Provide anchors for mechanical attachment of frames to adjacent structure. Provide 3 anchors minimum for each door jamb.

1. Masonry: T strap or strap and stirrup adjustable anchors for embedment in mortar joints.

2. Metal studs: Sheet metal Z screw attached to studs.

3. Floor anchors: 18 gage, adjustable base anchor for direct attachment to floor.

4. Anchors for galvanized frames shall have hot dip galvanized finish.

2.6 WINDOW GLAZING

A. Glazing stops: Provide sidelight, transom, and window frames with channel shaped glazing stops with mitered corners. Provide permanent frame stop on secure side of glazing. On opposite side, attach stops with countersunk screws.

B. Glass as specified in Section 08800 - Glazing:

2.7 FACTORY APPLIED FINISHES

A. Cold rolled steel doors and frames:

1. Preparation: In accordance with SSPC-SP 1, clean with non-petroleum solvent to remove oil, dirt, grease, and other contaminants. Remove mill scale and rust to comply with SSPC SP 5 or SSPC SP 8.

2. Pretreatment: Immediately after preparation, apply conversion coating compatible with primer.

3. Primer: Immediately after pretreatment, apply primer to prepare units for site applied paint finish.

B. Galvanized steel doors and frames:

1. Preparation: Clean with non-petroleum solvent to remove oil, dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint in accordance with ASTM A780.

2. Pretreatment: Apply conversion coating compatible with primer.

3. Pretreatment: Immediately after preparation, apply conversion coating compatible with primer.

4. Primer: Immediately after pretreatment, apply primer to prepare units for site applied paint finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with approved shop drawings, manufacturer's instructions, and ANSI A250.11.

B. Install fire-rated frames and door assemblies in accordance with NPPA 80 for class indicated in Door Schedule on Drawings.

C. Placing Frames:

1. Place frames before constructing enclosing walls and ceilings.
2. Center in opening, plumb, square and level.

3. Door jamb anchors: Install 3 minimum each jamb at hinge and strike locations.

4. Floor anchors: Install anchor directly to floor at each jamb.

D. Fully grout all hollow steel frames.

E. Seal joints around frames in accordance with Section 07900 - Joint Sealers.

F. Hardware: Install door hardware in accordance with Section 08710 - Door Hardware. Locate hardware as indicated on approved shop drawings or, if not indicated, in accordance with DHI Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.

G. Door installation: Fit steel doors accurately in frames in accordance with ANSI A250.8.

3.2 ADJUST AND CLEAN

A. Immediately after erection, sand smooth all rusted and damaged areas of prime coat. Touch-up with compatible, air-drying primer.

B. Check and readjust hardware items, leaving doors and frames in proper operating condition.

END OF SECTION

SECTION 081400 - WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Positive Pressure fire-rated and non-rated interior wood doors and vision lights.

B. Related sections:

1. Section 081100 - Steel Doors and Frames: Hollow steel frames for wood doors.

2. Section 087100 - Door Hardware: Finish hardware for wood doors.

3. Section 088000- Glazing: Glass for vision lights in wood doors.

1.2 REFERENCES AND REGULATORY REQUIREMENTS

A. ASTM E152 - Methods for Fire Tests of Door Assemblies.

B. AWI - Quality Standards for Architectural Woodwork Institute. Eighth Edition, 2003.

C. UBC 7-2, Part 1 and 2, 1997

D. UL 10 (c) - Fire Tests for Door Assemblies – Positive Pressure

E. NFPA-80, 1999 - Fire Doors and Windows

1.3 QUALITY ASSURANCE

A. Conform to requirements of AWI Quality Standard Section 1300.

B. Manufacturer: Company specializing in manufacture of wood doors with minimum 5 years experience building flush architectural grade doors.

C. Labeled Doors shall be listed, and conform to the requirements of, Intertek Testing Services-Warnock Hersey (ITS-WH).

1.4 SUBMITTALS

A. Provide in accordance with Section 01330 - Submittal Procedures:

1. Product data. Indicate door core materials, door thickness, construction, veneer species, cut color and matching, blocking options.

2. Shop drawings showing To/From locations, hand, elevation, sizes, dimensions, manufacturer’s door series reference, fabrication details, location of internal blocking for hardware, and glazing installation.

3. Samples of factory finishes, for selection by Architect.

4. Copy of warranty required by Paragraph 1.6 for review by Architect.

B. Manufacturer's installation instructions.

1.5 DELIVERY, STORAGE, HANDLING AND SITE CONDITIONS

A. Store flat on level surface in clean, dry, well ventilated area. Do not store in damp or wet areas, including areas where curing cement or wall finishes are present. HVAC systems should be operating and balanced prior to arrival of doors.

1. Avoid extreme heat.

2. Relative humidity: 30 percent minimum, 55 percent maximum.

B. Deliver Store, Protect and Handle doors under provisions of AWI, WDMA, WIC and manufacturers care and handling instructions.

C. Cover to keep clean, but permit air circulation.

D. Do not drag one door across another.

F. Protect doors from exposure to natural and artificial light after delivery.

1.6 WARRANTY

A. Submit in accordance with Section 01770 - Closeout Procedures:

1. Warranty against defects in manufacturing, warping, and delamination of facing for interior solid core flush doors, per AWI recommended tolerances, for life of initial installation.

1.7 COORDINATION

A. Coordinate door installation with door opening construction, door frame and door hardware installation with a pre-installation conference.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Algoma Hardwoods, Inc., Algoma, Wisconsin; 800-678-8910.

B. Eggers Industries, Neenah, Wisconsin; 920-722-6444.

C. Vancouver Architectural Doors. Puyallup, WA 800-999-3667

D. Marshfield Door Systems, Marshfield, Wisconsin; 800-869-3667.

E. Manufacturers of other products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

2.2 FLUSH DOORS

A. Type: Flush interior doors, 1-3/4 inches thick, solid core 5-ply construction, fire rated as indicated in Door Schedule on Drawings suitable for transparent finish.

B. Construction:

1. Comply with AWI Section 1300, PC-5 ME, Custom Grade, with A grade faces.

2. Fire-rated doors: Comply with AWI Section 1300, FD-5. Attach positive pressure fire rating label to door edge. Fire rating label shall include the “S” label, where required for smoke.

    a. Labeled doors shall be provided as “Category A”. All components required for label shall be provided as an integral part of the door construction. Smoke Seals, where required, shall be supplied in section 08710. Coordinate requirements of labeled door assembly with related door frame and hardware components provided in other sections, to assure complete compliance with tested assemblies.

3. Core: Particleboard, ANSI A208.1, 1-LD-1 Grade. Provide solid wood blocking for installation of locksets, closers, and exit devices where throughbolts are not scheduled to be used.

4. Stiles and rails sanded and bonded to core:

    a. Top and bottom rails: 1-1/8 inches minimum solid wood.

    b. Stiles: 1-1/2 inch minimum hardwood, same species as face veneer with no finger joints.

5. Face: Select red oak, plain sliced veneer suitable for transparent finish. Veneer leaves shall be, balanced, book matched.

2.3 FACTORY FINISH

A. Factory finish wood doors in accordance with AWI Quality Standard Section 1500, System TR-6, satin finish, Custom quality.

B. Wood grain shall be filled.

C. Color: As selected by Architect, from manufacturer's standard range.

D. Factory seal top and bottom door edge, and all cutouts, with 2 coats clear sealer.

2.4 VISION LIGHTS

A. Acceptable manufacturers:

1. Anemostat, Carson, California; 213-775-7441.

2. Manufacturers of other products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

B. Size: Refer to Drawings.

C. Type: Metal frame with countersunk mounting holes; FGS-75 as manufactured by Anemostat. Provide fire rated vision lights with UL listing for doors indicated on Door Schedule to be fire rated:

1. Material: 18 gage cold rolled steel.

2. Finish: Factory primed.

D. Glazing as specified in Section 08800 - Glazing:

1. Fire rated doors: 1/4 inch clear wire glass with square mesh.

2. Non-rated doors: 1/4 inch, clear, tempered safety glass.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify frames have been properly installed and prepared for hardware.

B. Allow doors to become acclimated to finished building heat and humidity before hanging.

C. Coordinate cut-outs for vision lights to ensure integrity of fire rated doors. Verify exact size required for vision lights to be provided.

3.2 INSTALLATION

A. Install fire rated and non-rated doors in accordance with NFPA80 and to ITS-WH requirements.

B. Consult door manufacturer for maximum allowable field modification of doors including, but not limited to – lock preps, undercut or trimming guidelines, for doors provided specifically for this project, to assure label and/or warranty is not voided.

C. Coordinate Installation of doors with installation of frames and hardware.

D. Drill pilot screw, and bolt, holes using templates provided by hardware manufacturer.

E. Adjust for smooth and balanced door movement.

F. Reseal or refinish any doors that require site alteration.

END OF SECTION

SECTION 083325 - ROLL UP COUNTER SHUTTERS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the roll up counter shutters as shown on the drawings and/or specified herein including, but not limited to, the following:

1. Roll up counter shutters, rated.
2. Manual operation.
3. Guides, anchors and hardware required for complete installation and operation.

1.3 RELATED SECTIONS

A. Painting - Section 099000.

1.4 QUALITY ASSURANCE

A. Fire Rated Assemblies: Furnish fire rated assemblies where scheduled on drawings which comply with NFPA No. 80 and have been fire tested, rated and labeled in accordance with ANSI/ASTM E152. Furnish each shutter with a metal UL label as evidence of rating, with label indicating rating in hours of duration of exposure t o fire and letter designation of location for which assembly is designed.

B. Automatic Closing: Provide automatic closing device and governor, operating when activated by temperature rise and melting of 160 deg. F. (71 deg. C.) fusible link and smoke detector. Construct governor unit to be inoperative during normal shutter operations. Design release mechanism for easy resetting.

1 . Fabricate unit to permit manual lifting of curtain for emergency use after automatic closing, with curtain returning to closed position when released.

1.5 SUBMITTALS

A . Product Data: Submit manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of roll up counter shutter. Include manufacturer's operating instructions and maintenance data.

B . Shop Drawings: Submit shop drawings indicating location and size of each unit, details for special components, surrounding conditions and installations which are not fully dimensioned or detailed in manufacturer's data.

C. Label Certification: Submit UL certification for fire rated shutters and frames.

1.6 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B . Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide pre-assembled roll up counter shutter units manufactured by;

1. Cornell Iron Works, Inc., Mountaintop, Pennsylvania; 800-233-8366.
2. The Cookson Company, Phoenix, Arizona; 602-272-4244.
3. Overhead Door Corp., Lewisville, Texas; 800-929-3667.
4. Raynor, Dixon, Illinois; 800-472-9667.
5. Manufacturers of other products submitted and approved in accordance with Section 016200 - Product Options.

2.2 MATERIAL DESCRIPTION

A. Fabricate roll up counter curtain of interlocking flat slats fabricated from 22 ga. steel. Each slat to be fitted with endlocks to hold curtain in alignment. Bottom of curtain to be finished with stainless steel angle and lift handle and a continuous neoprene bumper to prevent counter abrasion.

B. Furnish inserts and anchoring devices which must be secured to concrete or built into masonry or drywall assemblies for the installation of the units. Provide setting drawings, templates instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

2.3 CURTAIN ACCESSORIES

A. Locking Device: Curtain shall be locked at each end of bottom bar by a slide bolt, with padlock keeper, which shall engage a locking wedge in each guide.

B. Barrel and Counterbalance: Curtain to be coiled around a steel pipe fitted with involute shaped rings for ease of operation. Rings to be faced with suitable material to prevent curtain abrasion. Barrel to be of sufficient thickness and diameter to prevent deflection exceeding .03” per ft. Barrel to be supported by plate brackets. Helical, oil-tempered springs shall be installed inside the steel pipe, which shall rotate on self-lubricating bearings. Spring tension shall be adjusted in the field by means of an adjusting wheel.

C. 18 ga. steel hood shall be provided to enclose mechanism and end brackets. Barrel shall be mounted as part of the complete assembly within the hood. At fire rated units, furnish automatic drop baffle to guard against passage of smoke or flame.

D. Provide steel frame consisting of 16 ga. jambs and 14 ga. sill. Form grooves into sides of frames for retaining curtain.

E. Shutters shall be manually operated by push-up using lift handles.

F. All steel to have manufacturer’s standard shop primed finish.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where roll up counter shutters are to be installed and correct

any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install units complete with necessary hardware, in accordance with final shop drawings, manufacturer's instructions, and as specified herein.

B. Upon completion of installation, including work by other trades, test, lubricate and adjust shutters to operate easily, free from warp, twist or distortion.

C. Install fire rated units to comply with NFPA 80.

END OF SECTION

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum framed doors of the following types:
   1. Narrow stile aluminum framed doors (Series-200 Doors).
   2. Medium stile aluminum framed doors (Series-300 Doors).
   3. Wide stile aluminum framed doors (Series-500 Doors).
   4. Impact-resistant medium stile aluminum framed doors (Series-350 Resistor Impact Entrance Doors).
   5. Impact-resistant narrow stile aluminum framed doors (Series-256 Resistor Impact Entrance Doors).
   6. Impact-resistant medium stile aluminum framed doors (Series-356 Resistor Impact Entrance Doors).

B. Storefront systems of the following types:
   1. Storefront system for 1/4 inch (6 mm) glazing (Series CG450 Aluminum Storefront System).
   2. Storefront system for 1 inch (25 mm) glazing (Series CG451 Aluminum Storefront System).
   3. Storefront system thermally improved for 1 inch (25 mm) glazing (Series CT451 Thermal Aluminum Storefront System).
   4. Impact resistant storefront system for 9/16 inch (14 mm) laminated glass (Series CG500 Resistor Impact Aluminum Storefront System).
   5. Impact resistant storefront system for 1-5/16 inches (33 mm) laminated glass (Series CG501 Resistor Impact Aluminum Storefront System).
   6. Impact resistant storefront system for 9/16 inch (14 mm) laminated glass (Series 5000 Resistor Impact Aluminum Storefront System).
   7. Impact resistant storefront system for 9/16 inch (14 mm) laminated glass (Series 3000 Resistor Impact Aluminum Storefront System).
   8. Impact resistant storefront system for 9/16 inch (14 mm) laminated or 1-5/16 inch (33 mm) insulated-laminated glass (Series 3100 Resistor Impact Aluminum Storefront System).
   9. Impact resistant storefront system for 1-5/16 inch (33 mm) insulated-laminated glass (Series 3200 Resistor Impact Aluminum Storefront System).

1.2 RELATED SECTIONS

A. Section 07 91 26 - Joint Fillers.

B. Section 08 43 26 - All-Glass Storefronts.

C. Section 08 43 29 - Sliding Storefronts.

D. Section 08 43 29 - Sliding Storefronts.

E. Section 08 51 13 - Aluminum Windows.

F. Section 08 70 00 - Hardware.

G. Section 08 81 00 - Glass Glazing.

H. Section 08 44 23 - Structural Sealant Glazed Curtain Wall.

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 501 - Method of Test for Exterior Walls.
   2. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
   3. AAMA 503 - Voluntary Specifications for field testing of Storefront, Curtain Walls and Slope Glazing Systems
   4. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
   5. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
   6. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   7. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
   8. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   9. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site

B. ASTM International (ASTM):
   1. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   2. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   3. ASTM B 368 - Standard Method for Copper-Accelerated Acetic Acid-Salt Spray (Fog) Testing (CASS Test).
   4. ASTM C 236 - Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.
   5. ASTM C 864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
   6. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   7. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
   8. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
   9. ASTM E 783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
   10. ASTM E 1105 - 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.
   11. ASTM E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

C. Florida Building Code TAS 201, 202 and TAS 203.

D. SGCC - Safety Glazing Certification Council:
   1. ANSI Z97.1 - American National Standard for Safety Glazing Materials used in Buildings - Safety Performance Specifications and Methods of Test.
   2. 16 CFR 1201 - Consumer Product Safety Commission Safety Standard for Architectural Glazing Materials - codified at Title 16, Part 1201 of the Code of Federal Regulations.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

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. Installation methods.

C. Shop Drawings: Drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.

D. Test Reports: Submit certified test reports showing compliance with specified performance characteristics.

E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

G. Project Record Documents: Submit project record documents for installed materials in accordance with Division 1 sections.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

B. Installer Qualifications: Installer experienced (as determined by Contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to product manufacturer.

C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead- time requirements to avoid construction delays.

B. Packing, Shipping, Handling, and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle entrance doors and components to avoid damage. Protect entrance doors against damage from elements, construction activities, and other hazards before, during and after entrance installation.

1.7 PROJECT 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.

1.8 WARRANTY

A. Manufacturer's Product Warranty: Submit, for Owner's acceptance, manufacturer's warranty for entrance system as follows:
   1. Warranty Period: Two years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by Trulite Glass & Aluminum Solutions.
   2. Door corner construction shall be supported with a limited lifetime warranty for the life of the door under normal use.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Trulite Glass & Aluminum Solutions, which is located at: 403 Westpark Ct. Suite 201; Peachtree City, GA 30269; Toll Free Tel: 800-432-8132; Tel: 678-593-9200; Email:request info (info@trulite.com); Web:www.trulite.com

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 ENTRANCE DOORS

A. Design Requirements:
   1. Provide aluminum entrance doors from a single source.
   2. When aluminum entrances are part of a building enclosure system, including storefront framing, window wall systems, curtain wall system and related products, provide building enclosure system products from a single source manufacturer.
   3. Fabricate aluminum entrances in accordance with entrance manufacturer's prescribed tolerances.
   4. Material: ASTM B 221; 6063-T5 and T6 alloy and temper.
   5. Major portions of the door members to be 0.125 inch (3 mm) nominal in thickness and glazing molding to be 0.05 inch (1.3 mm) thick.
   6. Provide adjustable glass jack to center the glass in the door opening.
   7. Glazing gaskets shall be EPDM elastomeric extrusions.
   8. Fasteners: Where exposed, shall be aluminum, stainless steel or plated steel.
   9. Perimeter Anchors: Aluminum. When steel anchors are used, provide barrier between steel material and aluminum material to prevent galvanic action.

B. Performance Requirements:
   1. Air Infiltration: For single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 6.24 PSF for single doors and 1.567 PSF for pairs of doors. A single 3 feet by 7 feet (914 mm by 2134 mm) entrance door and frame shall not exceed 0.50 CFM per linear foot of perimeter crack. A pair of 6 feet by 7 feet (1829 mm by 2134 mm) entrance doors and frame shall not exceed 1.0 CFM per linear foot of perimeter crack.
   2. Door Corner Construction: Manufacturer shall provide a limited lifetime warranty for the life of the door under normal use.

C. Product: Narrow Stile Entrance Door, Series 200 Entrances by Trulite Glass & Aluminum

Solutions.

1. Dimension: Narrow stile, 2-1/8 inches (54 mm) vertical face dimension, 1-3/4 inches (44.5 mm) depth.
2. Provide ADA Bottom Rail: 10 inches (254 mm).

D. Product: Medium Stile Entrance Door, Series 300 Entrances by Trulite Glass & Aluminum Solutions.

1. Dimension: Medium stile, 3-3/4 inches (95 mm) vertical face dimension, 1-3/4 inches (44.5 mm) depth.
2. Provide ADA Bottom Rail: 10 inches (254 mm).

E. Product: Wide Stile Entrance Door, Series 500 Entrances by Trulite Glass & Aluminum Solutions..

1. Dimension: Wide stile 5 inches (127 mm) vertical face dimension, 1-3/4 inches (44.5 mm) depth.
2. Provide ADA Bottom Rail: 10 inches (254 mm).

F. Entrance Hardware:

1. The finish hardware supplier shall be responsible for furnishing physical hardware to the entrance manufacturer prior to fabrication, and for coordinating hardware delivery requirements with the hardware manufacturer, the Contractor and the entrance door manufacturer to insure the building project is not delayed.

G. Entrance Hardware:

1. Weather-stripping:
   a. Meeting stiles on pairs of doors shall be equipped with an adjustable astragal capable of in/out adjustment with a double row of wool pile weather-stripping. Gaps in weathering at lock location of meeting stile on door pair shall not be allowed.
   b. The door weathering on a single acting offset pivot or butt hung frame (single or pairs) shall have wool pile or EPDM bulb gasket (required to meet specified performance tests.)
2. Bottom Door Sweep: EPDM or Vinyl blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. (Note: Bottom Door Sweeps are required to meet specified performance for air infiltration)
3. Threshold: Extruded aluminum, one piece per door opening, with ribbed surface.
4. Center Pivots: [_____].
5. Offset Pivots: [_____].
6. Butt Hinge: [_____].
7. Continuous Gear Hinge: [_____].
8. Push/Pull: [_____] style.
9. Panic Device: [_____].
10. Closer: [_____].
11. Security Lock/Dead Lock: Active Leaf [_____]; Inactive Leaf [_____].
12. Latch Handle: [_____].
13. Cylinder(s)/Thumb-turn: [_____].
14. Electric Strike/Strike Keeper: [_____].

H. Entrance Door Fabrication:

1. Door corner construction shall consist of an interlocking rail and vertical stile using 3/8 inch (9.5 mm) diameter tie-rod construction at top and bottom. Glazing stops shall be snap fit type with EPDM glazing gaskets.
2. Accurately fit and secure joints and corners. Horizontal rails should nest into vertical stile, avoiding unsightly raw edges at corners.
3. Prepare components with internal reinforcement for door hardware.
4. Arrange fasteners and attachments to conceal from view.

I. Shop Finishing:
   1. Color Anodizing Conforming to AA-M12C22A44, AAMA 611, Color Anodic Coating (Color: # 80 Bronze). (Standard)
   2. Clear Anodizing Coating Conforming to AA-M12C22A31, AAMA 611, Clear Anodic Coating (Clear #04) (Standard)
   3. AAMA 2604, Polyester Powder Coating. (Color: _____)
   4. AAMA 2605, Fluoropolymer Powder Coating (Color: _____).
   5. Other: Manufacturer _____ Type _____ (Color_____).

J. Sealants: Refer to Section 07 91 26 - Joint Fillers.

2.3 IMPACT RESISTANT DOORS

A. Design Requirements:
   1. Provide aluminum entrance doors from a single source.
   2. When aluminum entrances are part of a building enclosure system, including storefront framing, window wall systems, curtain wall system and related products, provide building enclosure system products from a single source manufacturer.
   3. Fabricate aluminum entrances in accordance with entrance manufacturer's prescribed tolerances. Reference to tolerances for wall thickness and other cross-sectional dimensions of entrance members are nominal and in compliance with Aluminum Standards and Data, published by The Aluminum Association.
   4. Material: ASTM B 221; 6063-T5 or 6063-T6 alloy and temper.
   5. Major portions of the door members to be 0.125 inch (3 mm) nominal in thickness and glazing molding to be 0.055 inch (1.4 mm) thick.
   6. Provide adjustable glass jack to help center the glass in the door opening.
   7. Glazing gaskets shall be EPDM elastomeric extrusions.
   8. Fasteners: Only those fasteners shown within Trulite Glass & Aluminum Solutions Installation Instructions shall be used for assembly.
   9. Perimeter Anchors: Structural attachment of framing members to the various substrates shall be in compliance with the anchor charts contained within Trulite Glass & Aluminum Solutions Installation Instructions and be supported by structural calculations bearing a Florida P.E. seal.

B. Performance Requirements:
   1. Wind loads: Provide immediate door framing for swing doors, including anchorage capable of withstanding design pressures of (_____) PSF inward and (_____) outward. These design pressures are based upon (_____) Building Code: (_____) Edition.
   2. Air Infiltration: For a pair of single acting butt hung commercial entrances in the closed and locked position, the test specimen shall be tested in accordance with Florida Building Code TAS 202 and ASTM E 283 at a pressure differential of 1.57 PSF for a pair of doors The air infiltration shall not exceed 1.0 0.46 CFM/SF for door opening sizes of 6 feet by 7 feet (1829 mm by 2134 mm) (Series 256), 7 feet by 8 feet (2134 mm by 2438 mm) (Series 356) or 6 feet by 8 feet (1829 mm by 2438 mm) (Series 350).
   3. Uniform Load: A static air design load shall be applied in the positive and negative direction in accordance with Florida Building Code TAS 202 and ASTM E 330. The design load for a pair of doors shall be +/- 65 PSF for Series 256, +/-70 PSF for Series 356 and +/-85 for Series 350. At a structural test load equal to 1.5 times the specified design load, the measured permanent set deflection at midpoint of the meeting stiles shall not exceed 50% of the allowable and no glass breakage shall occur.
   4. Impact Resistance / Cyclic Load Test: Large Missile, tested in accordance with Florida Building Code TAS 201, TAS 203, SBCCI SSTD-12 and ASTM E1886/E1996 at a door opening sizes of 6 feet by 7 feet (1829 mm by 2134 mm) for Series 256 or 7 feet

by 8 feet (2134 mm by 2438 mm) for Series 356.

5. Forced Entry: Tested in accordance with AAMA 1304
   a. Product: Narrow Stile Impact Resistant Entrance Door, Series 256 Resistor Impact Entrance Doors by Trulite Glass & Aluminum Solutions.
      1) Dimension: Narrow stile, 2-1/8 inches (54 mm) vertical stile, 2-1/4 inches (57 mm) top rail, 4 inches (102 mm) bottom rail, 1-3/4 inches (44.5 mm) depth.
      2) Provide ADA Bottom Rail: 10 inches (254 mm).
   b. Product: Medium Stile Impact Resistant Entrance Door, Series 356 Resistor Impact Entrance Doors by Trulite Glass & Aluminum Solutions.
      1) Dimension: Medium stile, 3-3/4 inches (95 mm) vertical stile, 4 inches (102 mm) top rail, 7 inches (178 mm) bottom rail, 1-3/4 inches (44.5 mm) depth.
      2) Provide ADA Bottom Rail: 10 inches (254 mm).
      3) E.Product: Medium Stile Impact Resistant Entrance Door, Series 350 Resistor Impact Entrance Doors by Trulite Glass & Aluminum Solutions.
      4) Minimum Dimension: Medium stile, 3-1/2 inches (89 mm) vertical stile, 3-1/2 inches (89 mm) top rail, 5 inches (127 mm) bottom rail, 1-3/4 inches (44.5 mm) depth.
      5) Provide ADA Bottom Rail: 10 inches (254 mm).
   c. Entrance Hardware:
      1) The finish hardware supplier shall be responsible for furnishing physical hardware to the entrance manufacturer prior to fabrication, and for coordinating hardware delivery requirements with the hardware manufacturer, the Contractor and the entrance door manufacturer to insure the building project is not delayed.
   d. Entrance Hardware:
      1) Weather-stripping:
         a) Meeting stiles on pairs of doors shall be equipped with an adjustable astragal capable of in/out adjustment with a double row of wool pile weather-stripping. Gaps in weathering at lock location of meeting stile on door pair shall not be allowed.
         b) The door weathering at the immediate entrance frame shall have EPDM bulb gasket.
      2) Sill Sweep Strips: EPDM or Vinyl blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. Sill Sweep Strips are required to meet specified performance tests.)
      3) Threshold: Extruded aluminum, one piece per door opening, with ribbed surface.
      4) Butt Hinge: [_____].
      5) Continuous Gear Hinge: [_____].
      6) Push/Pull: [_____] style.
      7) Panic Device: [_____].
      8) Closer: [_____].
      9) Security Lock/Dead Lock: Active Leaf [_____]; Inactive Leaf [_____].
      10) Latch Handle: [_____].
      11) Cylinder(s)/Thumb-turn: [_____].
   e. Entrance Door Fabrication:
      1) Door corner construction shall consist of a tie-rod rigid connection, connecting vertical stile and horizontal rail at top and bottom of the door. Exterior glazing stops shall be snap-in type with EPDM glazing gaskets and interior glass stops shall be mechanically locked into position with stainless steel clips.
      2) Accurately fit and secure joints and corners. Horizontal rails should be

tucked-in nested at vertical stile for a clean corner connection.
3) Prepare components with internal reinforcement for door hardware.
4) Arrange fasteners and attachments to conceal from view.

f. Shop Finishing:
1) Color Anodizing Conforming to AA-M12C22A44, AAMA 6011, Color Anodic Coating (Color: # 80 Bronze). (Standard)
2) Clear Anodizing Coating Conforming to AA-M12C22A31, AAMA 611, Clear Anodic Coating (Clear #04) (Standard)
3) AAMA 2604, Polyester Powder Coating. (Color: _____).
4) AAMA 2605, Fluoropolymer Powder Coating (Color: _____).
5) Other: Manufacturer _____ Type _____ (Color _____).

g. Sealants: Refer to Section 07 91 26 - Joint Fillers

h. 2.4STOREFRONT FRAMING SYSTEM

i. Design Requirements:
1) Provide combination full height subsill flashing and sill section which eliminate blind seal conditions at fasteners penetrating subsill flashing. Subsill flashing to have full height end dams at each end.
2) Provide aluminum storefront specified herein from a single source.
3) When aluminum curtain wall are part of a building enclosure system, including entrances, entrance hardware, windows, curtain wall framing and related products, provide building enclosure system products from a single source manufacturer.
4) Material Standard: Extruded Aluminum, ASTM B 221, 6063-T5 or 6063-T6 alloy and temper.
5) Member Wall Thickness: Each framing member shall have a wall thickness sufficient to meet the specified structural requirements.
6) Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront framing members are nominal and in compliance with AA Aluminum Standards and Data.
7) Fasteners: Where exposed, shall be Stainless Steel.
8) Gaskets: Glazing gaskets shall comply with ASTM C 864 and be extruded of silicone compatible EPDM or neoprene rubber that provides for silicone adhesion.
9) Perimeter Anchors: When steel anchors or pressure treated wood are used, provide insulation between steel material and aluminum material to prevent galvanic action.

j. Performance Requirements:
1) Air Infiltration: The test specimen shall be tested in accordance with ASTM 283. Air infiltration rate shall not exceed 0.06 CFM/SF at a static air pressure differential of 6.24 PSF.
2) Water Resistance, Static: The test specimen shall be tested in accordance with ASTM 331. There shall be no leakage at a minimum static air pressure differential of 10 PSF as defined in AAMA 501.
3) Uniform Load: A static air design load shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

k. System: 1-3/4 inches by 4-1/2 inches (44.5 mm by 114 mm) outside or inside center glazed, as indicated or scheduled, storefront system for 1/4 inch (6 mm) glazing. Center glazed; screw spline fabrication. Stack setup available. System includes framing, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront framing.
1) Product: CG450 Architectural Aluminum Products by Trulite Glass & Aluminum Solutions.

l. System: 2 inches by 4-1/2 inches (51 mm by 114 mm) outside or inside center glazed, as indicated or scheduled, storefront system for 1 inch (25 mm) insulated glazing. Center glazed; screw spline fabrication. Stack setup available. System includes framing, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront framing.
    1) Product: CG451 Architectural Aluminum Products by Trulite Glass & Aluminum Solutions.

m. System: 2 inches by 4-1/2 inches (51 mm by 114 mm) outside or inside center glazed, as indicated or scheduled, thermally broken (pour and debridge) storefront system for 1 inch (25 mm) insulated glazing. Center glazed; screw spline fabrication. System includes framing, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront framing.
    1) Product: CT451 Architectural Aluminum Products by Trulite Glass & Aluminum Solutions.

n. Fabrication:
    1) Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
    2) Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.
    3) Arrange fasteners and attachments to conceal from view.

o. Shop Finishing:
    1) Color Anodizing Conforming to AA-M12C22A44, AAMA 6011, Color Anodic Coating (Color: # 80 Bronze). (Standard)
    2) Clear Anodizing Coating Conforming to AA-M12C22A31, AAMA 611, Clear Anodic Coating (Clear #04) (Standard)
    3) AAMA 2604, Polyester Powder Coating. (Color: _____).
    4) AAMA 2605, Fluoropolymer Powder Coating (Color: _____).
    5) Other: Manufacturer _____ Type _____ (Color _____).

p. Sealants: Refer to Section 07 91 26 - Joint Fillers.

q. 2.5IMPACT RESISTANT STOREFRONT FRAMING SYSTEM

r. Design Requirements:
    1) Provide combination full height subsill flashing and sill section which eliminate blind seal conditions at fasteners penetrating subsill flashing. Subsill flashing to have full height end dams at each end.
    2) Provide aluminum storefront specified herein from a single source.
    3) When aluminum curtain wall are part of a building enclosure system, including entrances, entrance hardware, windows, curtain wall framing and related products, provide building enclosure system products from a single source manufacturer.
    4) Material Standard: Extruded Aluminum, ASTM B 221, 6063-T5 or 6063-T6 alloy and temper.
    5) Member Wall Thickness: Each framing member shall have a wall thickness sufficient to meet the specified structural requirements.
    6) Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront framing members are nominal and in compliance with AA Aluminum Standards and Data.
    7) Fasteners: Where exposed, shall be Stainless Steel.
    8) Gaskets: Glazing gaskets shall comply with ASTM C 864 and be extruded of silicone compatible EPDM rubber that provides for silicone adhesion.
    9) Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
    10) Perimeter Anchors: Anchors shall be identical to the types used for product certification testing for wood, concrete or steel substrates.

s. Performance Requirements:
   1) Wind loads: Provide framing system; include anchorage, capable of withstanding wind load design pressures of (____) P.S.F. inward and (____) P.S.F. outward. The design pressures are based on the Florida Building Code; 2010 Edition.
   2) Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/sf at static air pressure differential of 6.24 P.S.F.
   3) Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 12 P.S.F. as defined in AAMA 501.
   4) Uniform Static Wind Load: Load shall be applied in the positive and negative direction in accordance with Florida Building Code TAS 202 and ASTM E 330.There shall be no deflection in excess of L/180 of the span of any framing member at a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.4% of their clear spans shall occur.
   5) Impact Resistance: Large Missile, tested in accordance with Florida Building Code TAS 201, TAS 203, SBCCI SSTD-12 and ASTM E 1886 / E 1996.
   6) Framing System shall provide direct structural attachment to substrate through perimeter framing sections eliminating blind seals or strap anchors.

t. System: 2-1/2 inches by 5 inches (64 mm by 127 mm); non-thermal; center glazed for 9/16 inch (14 mm) laminated glass for large missile impact-resistant glazing; Interior Structural Silicone Glazed (Wet Glazed) or Dry Glazed; Screw Spline Fabrication. System includes framing, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront framing.
   1) Product: Resistor Impact Aluminum Storefront System CG500 Architectural Aluminum Products by Trulite Glass & Aluminum Solutions.
   2) Design Load: A static air design load of +70/-80 P.S.F. with steel reinforcing 48 inches Spacing by 126 inches Span (1219 mm by 3200 mm). Maximum daylight glass size opening of 45-1/2 inches by 96 inches (1156 mm by 2438 mm) using Type A glass and wet or dry glazing.
   3) Design Load: A static air design load +65/-65 P.S.F. without steel reinforcing 48 inches Spacing by 120 inches Span (1219 mm by 3048 mm). Maximum daylight glass size opening of 45-1/2 inches by 84 inches (1156 mm by 2134 mm) using Type B glass and wet glazing.
   4) Glass Type A: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 DuPont SGP (NOA# 11-0624.02) 1/4 inch (6 mm) Heat Strengthened Glass.
   5) Glass Type B: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 Butacite (NOA# 11-0624.01) 1/4 inch (6 mm) Heat Strengthened Glass.

u. System: 2-1/2 inches by 5 inches (64 mm by 127 mm); non-thermal; center glazed for 1-5/16 inches (33 mm) laminated glass for large missile impact-resistant glazing; Interior Structural Silicone Glazed Wet or Dry Glazed; Screw Spline Fabrication. System includes framing, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront framing.
   1) Product: Resistor Impact Aluminum Storefront System CG501 Architectural Aluminum Products by Trulite Glass & Aluminum Solutions.
   2) Design Load: A static air design load of +70/-80 P.S.F. with steel reinforcing 48 inches Spacing by 126 inches Span (1219 mm by 3200 mm). Maximum daylight glass size opening of 45-1/2 inches by 96 inches (1156 mm by 2438 mm) using Type A glass and wet or dry

glazing.

3) Design Load: A static air design load +65/-65 P.S.F. without steel reinforcing 48 inches Spacing by 89 inches Span (1219 mm by 2261 mm). Maximum daylight glass size opening of 45-1/2 inches by 84 inches (1156 mm by 2134 mm) using Type B glass and wet glazing.
4) Glass Type A: 1-5/16 inches (33 mm) Insulated Laminated -1/4 inch (6 mm) Tempered -1/2 inch 13 mm) Air Space - 1/4 inch (6 mm) Heat Strengthened- 0.090 DuPont SGP (NOA# 11-0624.02) 1/4 inch (6 mm) Heat Strengthened.
5) Glass Type B: 1-5/16 inches (33 mm) Laminated - 1/4 inch (6 mm) Tempered-1/2 inch (13 mm) Air Space-1/4 inch (6 mm)Heat Strengthened Glass- 0.090 Butacite (NOA# 11-0624.01) 1/4 inch (6 mm) Heat Strengthened Glass.

v. System: 2-1/2 inches by 5 inches (64 mm by 127 mm); non-thermal; center glazed for 9/16 inch (14 mm) laminated glass for large missile impact-resistant glazing; Interior Structural Silicone Glazed (Wet Glazed) or Dry Glazed; Screw Spline Fabrication. System includes framing, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront framing.
1) Product: Series 5000 Resistor Impact Aluminum Storefront System Architectural Aluminum Products by Trulite Glass & Aluminum Solutions.
2) Design Load: A static air design load of +/-85 P.S.F. without steel reinforcing 60 inches Spacing by 120 inches Span (1524 mm by 3048 mm). Maximum daylight glass size opening of 58-3/4 inches by 115-3/4 inches (1492 mm by 2940 mm) using Type A, B & C glass, wet glazed.
3) Glass Type A: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 DuPont SGP (NOA# 11-0624.02) 1/4 inch (6 mm) Heat Strengthened Glass.
4) Glass Type B: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 Solutia Saflex Keepsafe Max (NOA# 09-0223.25) 1/4 inch (6 mm) Heat Strengthened Glass.
5) Glass Type C: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 Solutia Saflex HP (NOA# 08-0206.01) 1/4 inch (6 mm) Heat Strengthened Glass.

w. System: 1-1/4 inches by 4-1/2 inches (32 mm by 114 mm); non-thermal; center glazed for 9/16 inch (14 mm) laminated glass for large missile impact-resistant glazing; Exterior Structural Silicone Glazed (Wet Glazed); Shear Block Fabrication. System includes framing, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront framing.
1) Product: Series 3000 Aluminum Storefront System Architectural Aluminum Products by Trulite Glass & Aluminum Solutions.
2) Design Load: A static air design load of +100/-100 P.S.F. maximum, with or without steel reinforcing. Maximum allowable mullion spacing at 72 inches by maximum height of 120 inches span (1829 mm by 3048 mm). Use glass Type A, B or C.
3) Glass Type A: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 Solutia Saflex IIIG (NOA# 11-0325.05) 1/4 inch (6 mm) Heat Strengthened Glass.
4) Glass Type B: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 Solutia Saflex HP (NOA# 08-0206.01) 1/4 inch (6 mm) Heat Strengthened Glass.
5) Glass Type C: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 DuPont SGP (NOA# 11-0624.02) 1/4 inch (6 mm) Heat Strengthened Glass.

x. System: 2-3/4 inches by 4-1/2 inches (70 mm by 114 mm); non-thermal; front glazed for 9/16 (14 mm) laminated or 1-5/16 inch (33 mm) insulated-laminated glass for large missile impact-resistant glazing; Exterior Structural Silicone

Glazed (Wet Glazed); Shear Block Fabrication. System includes framing, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront framing.

1) Product: Series 3100 Aluminum Storefront System Architectural Aluminum Products by Trulite Glass & Aluminum Solutions.
2) Design Load: A static air design load of +100/-100 P.S.F. maximum, with or without steel reinforcing. Maximum allowable mullion spacing at 72 inches by maximum height of 120 inches span (1829 mm by 3048 mm). Use glass Type A, B or C.
3) Glass Type A: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass-- 0.090 Solutia Saflex IIIG (NOA# 11-0325.05) 1/4 inch (6 mm) Heat Strengthened Glass.
4) Glass Type B: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.100 Solutia Saflex HP (NOA# 08-0206.01)-1/4 inch (6 mm) Heat Strengthened Glass.
5) Glass Type C: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 DuPont SGP (NOA# 11-0624.02) - 1/4 inch (6 mm) Heat Strengthened Glass.
6) Glass Type A1: 1-5/16 inch (14 mm) Insulated-Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 Solutia Saflex IIIG (NOA# 11-0325.05)-1/4 inch (6 mm) Heat Strengthened Glass plus 1/2 inch air space plus 1/4 inch (6 mm) Heat Strengthened Glass inboard lite.
7) Glass Type B1: 1-5/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 Solutia Saflex HP (NOA# 08-0206.01) - 1/4 inch (6 mm) Heat Strengthened Glass plus 1/2 inch air space plus 1/4 inch (6 mm) Heat Strengthened Glass inboard lite.

y. System: 2-3/4 inches by 4-1/2 inches (70 mm by 114 mm); thermal; front glazed for 1-5/16 inch (33 mm) insulated-laminated glass for large missile impact-resistant glazing; Interior Structural Silicone Glazed (Wet Glazed); Shear Block Assembly. System includes framing, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront framing.

1) Product: Series 3200 Aluminum Storefront System Architectural Aluminum Products by Trulite Glass & Aluminum Solutions.
2) Design Load: A static air design load +65/-65 P.S.F. with or without steel reinforcing. Maximum allowable mullion spacing at 72 inches by maximum height of 120 inches span (1829 mm by 3048 mm). Use glass Type A, B or C.
3) Glass Type A1: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 Solutia Saflex IIIG (NOA# 11-0325.05) - 1/4 inch (6 mm) Heat Strengthened Glass.
4) Glass Type A2: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.100 Solutia Saflex HP (NOA# 08-0206.01) -1/4 inch (6 mm) Heat Strengthened Glass.
5) Glass Type A3: 9/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 DuPont SGP (NOA# 11-0624.02) - 1/4 inch (6 mm) Heat Strengthened Glass.
6) Glass Type B1: 1-5/16 inch (14 mm) Insulated-Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.100 Solutia Saflex HP (NOA# 08-0206.01) -1/4 inch (6 mm) Heat Strengthened Glass plus 1/2 inch air space plus 1/4 inch (6 mm) Heat Strengthened Glass inboard lite.
7) Glass Type B2: 1-5/16 inch (14 mm) Laminated - 1/4 inch (6 mm) Heat Strengthened Glass- 0.090 DuPont SGP (NOA# 11-0624.02) - 1/4 inch (6 mm) Heat Strengthened Glass plus 1/2 inch air space plus 1/4 inch (6 mm) Heat Strengthened Glass inboard lite.

z. Fabrication:

1) Fabricate components per manufacturer's installation instructions and

with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

2) Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.

3) Arrange fasteners and attachments to conceal from view.

4) Strap Anchors are not allowed for use with Hurricane Impact-Resistant Systems.

5) Structural perimeter fasteners shall be located per manufacturer's anchor charts bearing the seal of registered Professional Engineer.

aa. Shop Finishing:

1) Color Anodizing Conforming to AA-M12C22A44, AAMA 611, Color Anodic Coating (Color: # 80 Bronze). (Standard)

2) Clear Anodizing Coating Conforming to AA-M12C22A31, AAMA 611, Clear Anodic Coating (Clear #04) (Standard)

3) AAMA 2604, Polyester Powder Coating. (Color: _____).

4) AAMA 2605, Fluoropolymer Powder Coating (Color: _____).

5) Other: Manufacturer _____ Type _____ (Color _____).

bb. Sealants: Refer to Section 07 91 26 - Joint Fillers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which are specified to be installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive entrance system and sill is level in accordance with manufacturer's acceptable tolerances.

1. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the 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.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Entrance Doors: Install entrance system in accordance with manufacturer's instructions and AAMA storefront and entrance guide specifications manual.

1. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
2. Provide alignment attachments and shims to permanently fasten system to building structure.
3. Align assembly plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.

4. Set thresholds in bed of mastic and secure.
5. Adjusting: Adjust operating hardware for smooth operation.
6. Work of this section specified in other sections:
    a. Sealants (Perimeter): Refer to Section 07 91 26 - Joint Fillers Sealants.
    b. Glass: Refer to Section 08 81 00 - Glass Glazing Glass and Glazing. Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.

C. Impact Resistant Entrance Doors: Install entrance system in accordance with manufacturer's instructions for hurricane impact storefront and entrance doors. Comply with the Options and Limitation Charts for the Trulite Glass & Aluminum Solutions storefront system scheduled.
1. Attachment to structure shall be in compliance with Trulite Glass & Aluminum Solutions. Installation Instructions for storefront system shall remain within the scope shown on the Options and Limitation Charts for Storefront systems.
2. Provide alignment attachments and shims to permanently fasten system to building structure.
3. Align assembly plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.
4. Install thresholds and secure to structure with fasteners as shown in Trulite's Structural Anchor Charts.
5. Adjusting: Adjust operating hardware for smooth operation.
6. Work of this section specified in other sections:
    a. Sealants: Perimeter: Dow Corning 795 weather silicone sealant. Glass to metal adhesion: Dow Corning 995 Structural Silicone
    b. Framing Joint Treatment: Schnee-Moorehead SM5601 TackyTape Sealant. Comply with Trulite Glass & Aluminum Solutions Installation Instructions
    c. Glass: Comply with Trulite Glass & Aluminum Solutions Options and Limitation Charts for Storefront framing and impact entrance doors scheduled. Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual and GANA Laminated Glazing Reference.

D. Storefront Framing:
1. Install storefront systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions. Provide support and anchor in place.
2. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
3. Glazing: Glass shall be (outside) or (inside) glazed and held in place with extruded EPDM glazing gaskets on both sides of the glass.
4. Water Drainage: Water deflectors shall be installed at each end of intermediate horizontal allowing infiltrated water to drain down the vertical member's glazing pocket into a full height subsill flashing where it weeps to the exterior.
5. Work of this section specified in other sections:
    a. Sealants (Perimeter): Refer to Section 07 91 26 - Joint Fillers Sealants.
    b. Glass: Refer to Section 08 81 00 - Glass Glazing Glass and Glazing. Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.

E. Impact Resistant Storefront Framing:
1. Install framing system in accordance with manufacturer's instructions and AAMA storefront and entrance guide specifications manual.
2. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
3. Weather-tight Construction: Install storefront system and other members in accordance with manufacturer's installation instructions to ensure weather-tight construction. Coordinate installation with wall flashings and other components of construction.
4. Attach to structure to permit sufficient adjustment to accommodate construction

tolerances and other irregularities.

5. Provide alignment attachments and shims to permanently fasten system to building structure.
6. Align assembly plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.
7. Work of this section specified in other sections:
    a. Sealants (Perimeter): Refer to Section 07 91 26 - Joint Fillers Sealants.
    b. Glass: Refer to Section 08 81 00 - Glass Glazing Glass and Glazing. Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.
        1) Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.

3.4 FIELD QUALITY CONTROL

A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies must be corrected as part of the contract amount.

1. Testing: Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Division Testing Section for payment of testing and testing requirements.
    a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/sf, which, ever is greater.
    b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 PSF.

B. Manufacturer's Field Services: Provide manufacturer's field service consisting of product application recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Installed products must be cleaned in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

B. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum entrances from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants. Remove and replace damaged aluminum entrances at no extra cost.

C. Protect installed products until completion of project.

D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 085200 - ALUMINUM WINDOWS

PART 1 GENERAL

1.01 Work Included

A. Furnish and install aluminum architectural windows complete with hardware and related components as shown on drawings and specified in this section.

B. All windows shall be STERGIS WINDOW Series 800 SERIES Horizontal Double Sliding, OR approved equal. Other manufacturers requesting approval to bid their product as an equal must submit the following information fifteen days prior to close of bidding.
   1. A sample window (size and configuration) as per requirements of architect.
   2. Test reports documenting compliance with requirements of Section 1.05.

C. Glass and Glazing

   1. All units shall be 1” thick insulated glass, clear.

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D. Single Source Requirement

   1. All products listed in Section 1.02 shall be by the same manufacturer.

1.02 Testing and Performance Requirements

A. Test Units
   1. Air, water and structural test unit shall conform to requirements set forth in AAMA/NWWDA 101/I.S.2 - 97 for HC 50 grade.

B. Test Procedures and Performance
   1. Windows shall conform to all AAMA/NWWDA 101/I.S.2 - 97 for HC 50 grade requirements. In addition, the following specific performance requirements shall be met.
   2. Air Infiltration Test
      a. With window sash closed and locked, test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf.
      b. Air infiltration shall not exceed .10 cfm per square foot of unit.
   3. Water Resistance Test
      a. With window sash closed and locked, test unit in accordance with ASTM E 331 at a static air pressure difference of 8.00 psf.
      b. There shall be no uncontrolled water leakage.
   4. Uniform Load Structural Test
      a. With window sash closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 60.0 psf for HC grade, both positive and negative pressure.
      b. At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage which would cause the window to be inoperable.
   5. Uniform Load Deflection Test
      a. With ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 60 psf positive and negative pressure.
      b. No member shall deflect over L/175 of its span.
   6. Thermal Transmittance Test (Conductive U-Value)
      a. With window sash closed and locked, test unit in accordance with NFRC 102.
      b. Conductive thermal transmittance (U-Value) shall not be more than .41 BTU/hr/sf/degrees F.

1.03 Quality Assurance

A. Provide test reports from AAMA accredited laboratories certifying the performance as specified in 1.05.

B. Test reports shall be accompanied by the window manufacturer's letter of certification stating that the tested window meets or exceeds the referenced criteria for the appropriate AAMA/NWWDA 101/I.S.2 – 97 for HC 50 grade window type.

1.04 Submittals

A. Contractor shall submit shop drawings, finish samples, test reports, and warranties.
   1. Samples of materials as may be requested without cost to owner, i.e., metal, glass, fasteners, anchors, frame sections, mullion section, corner section, etc.

1.05 Warranties

A. Total Window System
   1. The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total window installation which includes that of the windows, hardware, glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc., as it relates to air, water and structural adequacy as called for in the specifications and approved shop drawings.
   2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at his expense during the warranty period.

PART 2 PRODUCTS

2.01 Materials

A. Aluminum
   1. Extruded aluminum shall be 6063-T5 or T6 alloy and tempered.

B. Hardware
   1. Plunger lock on the interior meeting rail with a flush mounted actuating handle.
   2. Sash shall ride on steel ball bearing rollers and on a raised track so that dirt will not interfere with normal operation.

C. Weather Strip
   1. All weather strip shall be Q-Lon® and Fin-Seal or equal.

D. Glass
   1. Insulated glass shall be 1" overall consisting of 1/8" Annealed glass exterior, ¾" Warm Edge air spacer, and 1/8" Annealed glass interior.

2.02 Fabrication

A. General
   1. All aluminum frame and sash extrusions shall have a minimum wall thickness of .062".
   2. Mechanical fasteners, welded components and hardware items shall not bridge thermal barriers. Thermal barriers shall align at all frame and sash corners.
   3. Depth of frame shall not be less than 3 1/4".

B. Frame
   1. Frame components shall be mechanically fastened.
   2. Frame and sash shall have a continuous interlock at the meeting rail.

C. Sash
   1. Sash vertical members shall be tubular for added strength and be mechanically fastened to the horizontal top and bottom rails. Both sash shall operate (double slide).

D. Screens
   1. Half screens only shall be permitted. The screen shall be flush with the exterior of the frame and not be surface mounted.
   2. Screen frames shall be extruded aluminum.
   3. Screen mesh shall be aluminum wire.

E. Glazing
   1. All lites of the horizontal sliding windows shall be inside glazed and weeped.
   2. All lites shall be glazed with a ½" wide Tremco butyl tape on the exterior glazing leg and Tremco Poly-weg on the interior glazing bead.

F. Finish

See separate finish specification for more details.

   1. Anodic
      a. Finish all exposed areas of aluminum windows and components with electrolytically deposited color in accordance with Aluminum Association Designation AA-M10-C22-A41. Color shall be clear.

PART 3 EXECUTION

3.01 Inspection

A. Job Conditions
   1. Verify that openings are dimensionally within allowable tolerances, plumb, level, clean, provide a solid anchoring surface and are in accordance with approved shop drawings.

3.02 Installation

A. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications.
B. Plumb and align window faces in a single plane for each wall plane and erect windows and materials square and true. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.
C. Adjust windows for proper operation after installation.
D. Furnish and apply sealants to provide a weather tight installation at all joints and intersections and at opening perimeters. Wipe off excess material and leave all exposed surfaces and joints clean and smooth.

3.03 Adjusting and Cleaning

A. After completion of window installation, windows shall be inspected, adjusted, put into working order and left clean, free of labels, dirt, etc. Protection from this point shall be the responsibility of the general contractor.

SECTION 087100 - FINISH HARDWARE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Related Work:

1. Cabinet Hardware: Architectural Woodwork and Manufactured Cabinets and Casework.
2. Threshold Caulking: Joint Sealants.
3. Connecting Electrical Hardware: Electrical
   All wire, pulling of wire, and connections electric hardware are to be supplied by the Electrical Contractor. Wiring diagrams (point to point termination diagrams) and riser diagrams to be furnished by the Finish Hardware Supplier.

1.02 QUALITY ASSURANCE

A. SUPPLIER QUALIFICATIONS: The hardware supplier must have in his/her employment an Architectural Hardware Consultant (AHC), as recognized by the Door And Hardware Institute, with a minimum of 10 years of Architectural Hardware experience or an equivalent person with 15 years of Architectural Hardware experience, who shall be responsible for the detailing , scheduling, and ordering of the finish hardware for this Contract.

B. DESIGN CRITERIA: Provide Underwriter's Laboratory listed hardware for fire or accident hazard where scheduled or required to maintain rating of openings. Comply with requirements of door and door frame labels. Comply with NFPA No. 80 and local codes that are in effect in the area of the project.

1.03 SUBMITTALS

A. Hardware Schedule: Within 10 days after receipt of a contract for the finish hardware, prepare a complete schedule and submit 8 copies of the hardware schedule with 3 copies of catalogue cuts, highlighted to show each different hardware item to the Architect for review.

B. Do not order hardware until an approved copy of the schedule is returned to the supplier bearing the approval of the Architect.

This schedule shall indicate the following details:

- Door numbers
- Location
- Size and thickness of door
- Door material
- Frame materials
- Hand of door
- Degree of opening
- Type of attachment
- Door Number / Hardware Heading Index

C. Templates: After receipt of the approved corrected hardware schedule, upon request the hardware supplier shall send 4 sets of templates and corrected hardware schedule to the general contractor for distribution to the wood door, metal door, and frame manufacturers/suppliers.

D. Maintenance Manuals: Furnish 1 copy of maintenance manual covering the finish hardware for this project. The manual shall consist of printed sheets from the hardware manufacturer bound in a three-ring binder and properly indexed.

Include the following information in the maintenance manuals:

1. Address and telephone number of the hardware supplier.
2. Address and telephone number of each hardware manufacturer.
3. Maintenance instructions and parts list for each type of operating hardware including:

   a. Locks
   b. Exit Devices

c. Closers

4. Warranty for closers and all other hardware.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver hardware to the jobsite only after proper provision for storage has been made.

NO DIRECT SHIPMENTS WILL BE ALLOWED.

B. Properly package and clearly identify each item relative to the hardware schedule.

C. The hardware supplier shall authorize his representative to be present when all finish hardware is delivered to the jobsite and shall check-in each item and turn over to the General Trades Contractor for storage in a secure place under lock and key.

1.05 WARRANTY

A. Furnish 3 copies of the following written warranty to be included in the Maintenance Manual:

1. Warranty against mechanical failure of exit devices for a 10 year period.
2. Warranty against mechanical failure of locksets for a 10 year period.
3. Warranty against mechanical failure of door closers for a 10 year period.
4. Warranty against failure of parts of all hardware except exit devices, locksets, and door closers for a 1 year period.
5. Starting date for all warranty periods to be the date of substantial completion of building by Architect.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A.	Butts:	Ives, Bommer, Hager, Stanley	IVE
B.	Exit Devices:	Falcon, Von Duprin, Precision	FAL
C.	Door Closers:	Falcon, LCN, Norton	FAL
D.	Locksets:	Falcon, Schlage, Sargent, Best	FAL
E.	Thresholds & Weatherstrip:	National Guard, Reese, Zero, Pemko	NGP
F.	Stops & Door Trim:	Ives, Trimco, Rockwood	IVE
G.	O/H Stops:	Glynn Johnson, ABH, Rixson	GLY
H.	Access Control Locks	Schlage Electronics	SCE

OTHER MANUFACTURERS BY PRIOR APPROVAL OF THE ARCHITECT AND LISTED IN AN ADDENDUM.

2.02 SCHEDULED HARDWARE

A. Requirements for design: grade, function, finish, size, and other distinctive qualities of each type of Builders Hardware is indicated in the Hardware Schedule at the end of this section. Products are identified by using manufacturers hardware product numbers.

B. Manufacturer's Product Designation: One or more manufacturers are listed for each hardware type required. The initial after the manufacturer's name indicates whose product designation is used in the Hardware Schedule for purposes of establishing minimum requirements. Provide either the product designated or where more than one manufacturer is listed, the comparable product of one of the other manufacturers which comply with requirements including those specified elsewhere in the section

2.03 MATERIALS AND FABRICATION

A. Hand of Door: The drawings show the direction of slide, swing, or hand of each door leaf. furnish

each item of hardware for proper installation and operation of the door movement as shown.

B. Base Metals: Produce hardware units of the basic metal and forming method indicated using the manufacturer's standard metal alloy, composition, temper, and hardness. Do not Furnish "optional" materials or forming methods for those indicated except as otherwise specified.

C. Fasteners: Manufacture hardware to conform to published templates generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping screws except as specifically indicated.

1. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match the hardware finish or if exposed in surfaces of other work to match the finish of such other work as closely as possible including "prepared for paint" in surfaces to receive painted finish.

a. Sex Bolts: Install door closer, door holders, and exit devices on ALL doors by means of thru bolts and sex nuts.

2. Provide concealed fasteners for hardware units which are exposed when the door is closed except to the extent no standard units of the type specified are available with concealed fasteners. Do not use thru bolts for installation where the bolt head or the nut on the opposite face is exposed in other work except where it is not feasible to adequately reinforce the work.

2.04 BUTTS, HINGES, AND PIVOTS

A. Templates: Provide only template produced units.

B. Screws: Furnish Phillips flat-head all purpose or machine screws for installation of units except furnish Phillips flat-head all purpose wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.

C. Hinge Pins: Except as otherwise indicated provide hinge pins as follows:

1.	Steel Hinges:	Steel pins
2.	Non-ferrous Hinges:	Stainless steel pins
3.	Exterior Doors:	Non-removable pins (NRP)
4.	Interior doors:	Non-rising pins
5.	Tips.	Flat button and matching plug finished to match leaves

D. Number of hinges: Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90" or less in height and 1 additional hinge for each 30" of additional height.

E. Size of hinge leaves: 4.5" high, except 5" for doors over 3'6" wide.

F. Width of hinges: Shall be sufficient to clear trim projection when door swings 180 degrees.

G. Fire Rated doors over 8'0" shall have heavy weight hinges.

H. All hinges SHALL be made of steel and have steel ball bearings where specified.

2.05 KEYING

A. The hardware supplier shall make available to the Architect and/or Owner a representative for the purpose of consulting and reviewing the project's keying requirements and make a written proposal of the complete key system.

B. Proposed key plan shall include expansion potential for the Owner's future requirements.

C. All locksets and cylinders SHALL be keyed to a Grand, or Simple Masterkey system and to the instructions as provided by the Architect/Owner. All locksets and cylinders shall be construction masterkeyed or have construction cores/cylinders.

D. Deliver all permanent key blanks and other security keys direct to Owner's representative from the

factory by secure courier, return receipt requested.

E. Keys Required: Furnish quantity of keys as follows:

1. Five (5) Master Keys
2. Two (2) keys per lock or cylinder.
3. Fifteen (15) construction keys.

I. All keys shall be made of nickel silver.

2.06 CYLINDRICAL TYPE LOCKSETS

A. Heavy Duty Cylindrical Locks and Latches: Falcon "T" Series. Fastened with through-bolts.

B. Chassis: Cylindrical design, corrosion - resistant plated cold-rolled steel.

C. Latch Retractors: Forged steel. Balance of inner parts: Corrosion-resistant plated steel, or stainless steel.

D. Lever Trim: Accessible design, independent operation, spring-cage supported, minimum 2" clearance from lever mid-point to door face.

E. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.

F. Rosettes: Minimum 3-7/16" diameter for coverage of ANSI/DHI A115.18, 1994 door preparation, through-bolt lugs on both spring cages to fully engage this pattern.

G. Springs: Full compression type.

H. Strikes: 16 gage curved steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.

2.07 DEADLOCKS

A. Deadlocks shall be cylindrical type with interior parts made of steel or bronze.

B. All steel parts shall be bronze plated or coated with zinc-dichromate to resist rusting and corrosion.

2.08 CLOSER AND DOOR CONTROL DEVICES

A. Surface type door closers shall be fully hydraulic, full rack and pinion action with a one piece forged steel piston, and have a cast iron or cast aluminum case with a ten year warranty. Closers at fire rated doors shall be in compliance with UL 10 C and UBC 702 (1997) certified for positive pressure. Barrier-free at all interior doors.

B. Separate adjusting valves shall be provided for closing speed, latching speed and backcheck.

C. Adjusting valves shall be of a metal material, concealed, adjustable only with special wrench, and shall be seated with “O” type rings.

D. All outswinging doors to be supplied with parallel arm.

E. Closers shall NOT be supplied with “Pressure Relief Valves”.

2.09 EXIT DEVICES

A. Provide all exit devices with roller strikes and ¾” throw deadlocking stainless steel latchbolts.

B. All exit devices shall be able to have the function changed without any additional parts other than outside trim being purchased.

C. All Exit Devices shall be non-handed or field reversible.

D. All mounting fasteners to be concealed.

E. Touch pad to be stainless steel.

2.10 MISCELLANEOUS DOOR TRIM UNITS

A. Material shall be brass, bronze or stainless steel as appropriate for required finish. Brass bronze material to be 0.050" minimum thickness and stainless steel to be 0.050" minimum thickness. Edges of plates to be beveled and polished except lower edge can be square.

B. Width of plates shall be 2" less than door width.

C. Push Plates: Plate shall be 4" x 16".

D. Pull Plates: Plate shall be 4" x 16". Grip shall be extruded or cast bronze or stainless steel located on center of plate.

E. Smoke Seal shall be a self-adhesive SILICONE material measuring 3/8" x 1/4".

2.11 TOOLS FOR MAINTENANCE

A. Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance and removal or replacement of finish hardware.

2.12 Electronic bored type locksets and exit device trim: UL Listed - UL294

A. Bored type locksets will be non-handed, heavy-duty cylindrical type, with 2 3/4" backset or greater, as specified, with ½ inch throw latchbolt with ¾ inch throw available. Chassis will accommodate standard 161 cylindrical lock prep for 1 3/4" doors standard. Backset will be 2 3/4" standard.

B. Locksets and exit device trim to meet or exceed ANSI Standard A156.25 and A156.2 Series 4000, Grade 1 strength and operational requirements.\

C. Locksets and exit device trim to meet UL10C, FCC Part15, ADA compliant, NFPA 101, NFPA 80, IBC 2006.

D. Locksets and exit device trim to be manufactured with open architecture characteristics capable of handling new and existing access control software and credential reading technology.

E. Locksets and exit device trim to be modular in design, to have the ability to change credential reader without being removed from door.

F. Locking escutcheon, security lever trim and to be non-handed, operate independently of non-locking levers for extended life cycles. Handing to be field reversible.

G. Exterior lever to be designed with ability to rotate freely while door remains securely locked, preventing damage to internal lock components from vandalism by excessive force.

H. Lockset and Exit Device Trim to have the following standard status switches: Lock/Unlock Status (Clutch Position), Request-to-Exit Switch, Request to Enter Switch, Door Position Switch, Interior Cover Tamper Guard.

I. Lockset to communicate Battery Status and Communication Status.

J. Furnish locks with following functions:
   1. Classroom / Storeroom 70.
   2. Office 50.

K. Power supply required 12 V DC or 24V DC power supply.(by others - Section 28 13 00)

L. Connection cabling to be: .(by others - Section 28 13 00)
   1. Data: 24AWG, 4 conductor shielded (Belden 9843, 9841 or equivalent).

2. DC Power: 18 AWG, 2 conductor, Belden 8760 or equivalent)
3. Other wiring options may be available based on application, environment, and length of cabling required.

M. Should power be lost to device, Lockset to have the ability to be field configured to manage access control in one of the three field configurable methods below:
1. Fail locked (secured)
2. Fail unlocked (unsecured)
3. Fail As-Is

N. Should communication be lost between device and network, Lockset to have ability to manage access control offline in one of four field configurable methods below:
1. Fail locked (secured)
2. Fail unlocked (unsecured)
3. Fail As-Is

O. Fail to Degraded/cache mode utilizing cache memory with following selectable options:
1. Grant access up to the last 1,000 unique previously accepted User IDs
2. Grant access up to the last 1,000 unique previously accepted Facility/Site codes

P. Lockset and Exit Trim system interface to be:
1. Wiegand or Clock & Data via PIB300 (Panel Interface Board).
2. Directly via RS485.

Q. Lever style: Rhodes

R. Locksets and exit device trim to have real-time communication with access control system, such that all events at Lockset are communicated real-time to network control software.

S. Lockset and Exit Device Trim utilized with Bright Blue, SMS Premier/Enterprise software or 3rd Party software to have capability to be remotely locked down real-time, within 10 seconds or less, without user interface at the device.

T Lockset and Exit Device Trim utilized with SMS Premier/Enterprise software or 3rd Party software to have capability to be remotely unlocked real-time without user interface at the device.

U. Locksets and exit device trim to have visual tri-colored LED to indicate operational systems status, system error conditions and low power conditions.

V. Locksets and exit device trim to have audible feedback that can be enabled or disabled.

W. Credential reader capabilities for SMS Select/Premier/Enterprise Software.

X. Multi-Technology readers that read both 13.56 MHz Smart Cards + 125 kHz Prox cards.

Y. The lock and exit device trim will have the ability to utilize multiple manufacturer's key systems in the lever.

Z. Manufacturers: Schlage Electronics Model: AD-300-CY Series

2.13 ELECTRICAL POWER TRANSFERS

A. Electrical Power Transfer (EPT) units shall be fully concealed when the door is closed.

B. EPT shall contain either 2 each 18 gauge stranded or 10 each 24 gauge stranded wires as determined in the hardware sets.

C. The transfer tube shall be made of stainless steel. "Spring Tubes" are NOT acceptable.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: All finish hardware shall be installed by the General Contractor.

B. Furnish all items of hardware with attachment screws, bolts, nuts, etc., as required to attach hardware to type of material involved and with finish to match hardware with which they are to be used. Make all attachments to metal by template machine screws.

C. Provide sex nuts and bolts for door closers, forearm shoes of closers, and holding devices.

D. Attach hardware to masonry or concrete with expansion bolts or similar drilled anchors to develop full strength of attached device.

E. Run weatherstripping or soundstripping full height of both jambs and full width of head. Run thresholds full width of opening. Run door bottoms full width of doors. Set expansion anchors in solid masonry, not mortar joints. Set thresholds in caulking by sealant contractor.

3.02 PROTECTION

A. Do not install door silencers, kickplates, pushplates, door bottoms, and wall stops until after painting is complete. Loosen locksets and panic hardware prior to painting and re-tighten after painting is complete. Mask all hardware or otherwise protect during painting operation.

3.03 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

C. Instruct Owner’s personnel in proper adjustment and maintenance of hardware and hardware finishes during the final adjustment of hardware.

D. Adjust all closers to meet ADA Requirements for sweep time and opening force. Set the closer’s backcheck valve to slow the doors opening from 85 degrees on.

3.04 HARDWARE SCHEDULE

A. It is intended the following schedule include all item of finish hardware necessary to complete the work; if a discrepancy is found in the schedule, such as a missing item, improper hardware for frame, door, or fire codes, the Preamble will be the deciding document.

B. All items shall be of proper type for attaching securely to type of material on which they occur.

C. The schedule of materials is as follows:

HW SET: 01
DOOR NUMBERS: 01 04

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC DEVICE	25-R-L-511L	26D	FAL
1	EA	IC CORE ONLY, KEYED	C607	626	FAL
1	EA	MORTISE CYLINDER	C987 X C607CCA	626	FAL
1	EA	SURFACE CLOSER	SC71 SS X TB	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	THRESHOLD	425E X D.W.	AL	NGP
1	EA	DOOR SWEEP	200NA X D.W.	AL	NGP
1	SET	SEALS	160S X D.S.	AL	NGP
1	EA	DRIP CAP	16A X D.W. +4"	AL	NGP

HW SET: 02 NOTE! THESE ARE ALUMINUM FRAMES – COORDINATE WITH DOOR & FRAME MFG.
DOOR NUMBERS: 02 03

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC DEVICE	25-R-L-511L	26D	FAL
1	EA	IC CORE ONLY, KEYED	C607	626	FAL
1	EA	MORTISE CYLINDER	C987 X C607CCA	626	FAL
1	EA	SURFACE CLOSER	SC71 SS X TB	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	THRESHOLD	425E X D.W.	AL	NGP
1	EA	DOOR SWEEP	200NA X D.W.	AL	NGP
1	SET	SEALS	160S X D.S.	AL	NGP
1	EA	DRIP CAP	16A X D.W. +4"	AL	NGP

HW SET: 03
DOOR NUMBER: 05

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	T561H7D D	626	FAL
1	EA	IC CORE ONLY, KEYED	C607	626	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	THRESHOLD	425E X D.W.	AL	NGP
1	EA	DOOR SWEEP	200NA X D.W.	AL	NGP
1	SET	SEALS	160S X D.S.	AL	NGP
1	EA	DRIP CAP	16A X D.W. +4"	AL	NGP

HW SET: 04
DOOR NUMBERS: 06 11 13 16

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	T581H7D D	626	FAL
1	EA	IC CORE ONLY, KEYED	C607	626	FAL
1	EA	WALL STOP	WS407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 05 (NOTE, DOORS ARE ROLL UP RATED SHUTTERS)
DOOR NUMBERS: 07 08

EACH TO HAVE:

2	EA	MFG. STANDARD HAND PULL, 1 EACH SIDE			
1	EA	CYLINDER LOCKING DEVICE PER MFG. STANDARD			

HW SET: 06
DOOR NUMBERS: 09 10

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY SET	T301S D	626	FAL
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 07
DOOR NUMBER: 12

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	T561H7D D	626	FAL
1	EA	IC CORE ONLY, KEYED	C607	626	FAL
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 08
DOOR NUMBER: 14

EACH TO HAVE:

1	SET	BIFOLD HARDWARE	2700 SERIES		STA
2	EA	DOOR PULL	8102-6	630	IVE

HW SET: 09
DOOR NUMBER: 15

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	T561H7D D	626	FAL
1	EA	IC CORE ONLY, KEYED	C607	626	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOOR SWEEP	200NA X D.W.	AL	NGP
1	SET	SEALS	160S X D.S.	AL	NGP

IT IS THE RESPONSIBILITY OF THE HARDWARE SUPPLIER TO FIELD VERIFY EXISTING CONDITIONS ON HINGE AND STRIKE PREPS AND SUPPLY HINGES AND STRIKES TO FIT INTO THESE PREPS.

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes monolithic, insulating, clear, tinted, annealed, fully tempered, and mirror glass and accessories for:

1. Hollow metal, glazed interior and exterior doors.
2. Hollow metal exterior and interior sidelight, transoms, and windows.
3. Aluminum window framing.
4. Vision lights in wood doors.
5. Large, wall mounted mirrors in Toilets.

B. Related sections:

1. Section 081100 - Steel Doors and Frames: Hollow metal factory glazed doors and hollow metal sidelight, transom, and window frames to be field glazed.
2. Section 081400 - Wood Doors: Factory glazed vision lights.
3. Section 08513 - Aluminum Window Framing: Aluminum framed windows to be field glazed.
4. Section 102813 – Commercial toilet Accessories: Metal framed mirrors factory glazed.

1.2 REFERENCES

A. ASCE 7 - American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures.

B. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.

C. ASTM C1036 - Flat Glass.

D. ASTM C1048 - Heat Treated Float Glass, Kind HS, Kind FT Coated and Uncoated.

E. ASTM C1172 - Laminated Architectural Flat Glass.

F. ASTM E546 - Frost Point of Sealed Insulating Glass Units.

G. ASTM E576 - Frost Point of Sealed Insulating Glass Units in Vertical Position.

H. ASTM E773 - Accelerated Weathering for Sealed Insulating Glass Units.

I. ASTM E774 - Classification of the Durability of Sealed Insulating Glass Units.

J. ASTM E1300 - Practice for Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load.

K. CPSC 16 CFR 1201 - Consumer Product Safety Commission Safety Standard for Architectural Glazing Materials.

L. FGMA - Glazing Manual, Flat Glass Marketing Association.

M. IBC - International Conference of Building Officials.

1.3 PERFORMANCE REQUIREMENTS

A. Provide and install glass to withstand thermal movement and wind and impact loads without breakage, loss, and other failure in accordance ASTM E1300 loads determined by ASCE 7.

B. Provide and install gaskets and seals to resist water and air penetration.

1.4 QUALITY ASSURANCE

A. Glass manufacturer: Company specializing in manufacture of clear and tinted glass products with 10 years minimum successful experience.

B. Glass fabricator: Company specialized in fabricating insulating, heat strengthened, tempered, laminated, glass units with 5 years minimum successful experience.

C. Comply with safety requirements of following standards. Where discrepancies exist, more stringent requirement shall govern.

1. Consumer Product Safety Commission 16 CFR 1201.

2. IBC - 2006

D. Comply with FGMA - Glazing Manual.

E. Each piece of safety glazing shall be permanently labeled with appropriate marking.

1.5 SUBMITTALS

A. Provide in accordance with Section 013300 - Submittal Procedures:

1. List of proposed products and product data.

2. Samples of tinted glass. Wired Glass, Tempered Glass and Laminated Glass.

3. Fabricators's certificates: Certify that safety glass units and sealed insulating glass units meet or exceed specified requirements.

1.6 WARRANTY

A. Provide under provisions of Section 017700 - Closeout Procedures:

1. 10 years fabricator's warranty for sealed glass units to cover replacement in event of seal failure and interpane dusting and misting.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. PPG Industries, Inc. Pittsburgh, Pennsylvania; 800-377-5267.

B. Guardian Industries Corp. Auburn Hills, MI: 248-340-1800.

C. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

2.2 GLASS

A. Clear float glass: Clear, annealed, float glass 1/4 inch thick, conforming to ASTM C1036, Type I, Class 1, Quality q3.

1. Visible light transmittance: 89 percent.

2. Ultra violet transmittance: 65 percent.

3. Winter nighttime U-value: 1.09.

4. Summer daytime U-value: 1.03.

5. Shading coefficient: 0.94.

6. Solar heat gain coefficient: 0.81.

7. Light to solar gain: 1.10.

B. Green tinted glass, in tempered and annealed: 1/4 inch thick, conforming to ASTM C1036, Type I, Class 2, Quality q3, by AFDG or approved equal.

1. Visible light transmittance: 68 percent.

2. Ultra violet transmittance: 16 percent.

3. U-Factor: .48.

4. Shading coefficient: 0.56.

5. Solar heat gain coefficient: 0.49.

6. Relative heat gain: 121.

C. Fire and impact resistive glass: Clear 5/16 inch thick, conforming to ANSI Z97.1 and CPSC 16CFR1201 for Category II impact resistant, “FireLite Plus” as manufactured by Technical Glass Products @ 1 (800) 426-0279 or Territorial Rep. @ 1 (800) 426-0279 (ext. 2660).

2.3 FABRICATED GLASS UNITS

A. Fabricate the following glazing units using glass products specified in Paragraphs 2.2. Refer to Drawings for required sizes and locations.

B. Thickness: Indicated glass thickness are minimums. Provide glass units with thickness as required for glass type, size, and to accommodate performance requirements specified in Paragraph 1.3.

C. Laminated glass: Fabricate by bonding two or more glass panes with transparent, flexible interlayment material in accordance with ASTM C1172. Laminated glass shall meet requirements of ANSI Z97.1 and CPSC 16 CFR to qualify as safety glass.

D. Heat treatment: Provide heat strengthened or fully tempered glass units where indicated or as required to accommodate performance requirements specified in Paragraph 1.3.

1. Heat strengthened glass: Annealed glass heat treated in accordance with ASTM C1048, Kind HS.

2. Fully tempered glass: Annealed glass heat treated in accordance with ASTM C1048, Kind FT to meet requirements of ANSI Z97.1 and CPSC 16 CFR to qualify as safety glass.

E. Insulating glass units: Fabricate insulating glass units with two panes separated by air space. Seal edge and purge interpane space with dry hermetic air. Comply with ASTM E546, ASTM E576, ASTM E773, and ASTM E774.

F. Clean cut glass units to accommodate opening sizes and edge and bite conditions.

2.4 GLASS TYPES

A. Type G1: 1/4 inch thick, clear, annealed glass.
B. Type G2: 1/4 inch thick clear, tempered glass.
C. Type G3: 1 inch thick, insulated, annealed, emerald green glass.

D. Type G4: 1 inch thick, insulated, tempered, emerald green glass
E. Type G5: 1 inch thick, insulated, annealed, clear glass.
F. Type G6: 5/16 inch thick, laminated, fire & impact resistive, clear glass.
G. Type G7: 3/8 inch thick, frosted or opaque, tempered glass.
H. Type G8: 1/4 inch thick, emerald green, tempered glass.
I. Type G9: 3/8 inch thick, clear, tempered glass.

2.5 ACCESSORIES

A. Provide glazing accessories as recommended by manufacturer and required for complete installation.

B. Setting blocks: Neoprene or EPDM, Shore A durometer hardness between 70 to 90.

C. Spacer shims: Neoprene, 50 Shore A durometer hardness.

D. Glazing tape: Preformed butyl compound, 10 to 15 Shore A durometer hardness, coiled on release paper, black.

E. Sealants: Compatible with materials and conditions as recommended by glass manufacturer.

PART 3 - EXECUTION

3.1 SCHEDULE

A. Provide Type G1 - 1/4 inch clear, annealed glass.

1. Hollow steel, interior, non-rated, vision lites where impact resistance is not required.

B. Provide Type G2 - 1/4 inch clear, tempered, safety glass.

1. Vision lights in non-rated, interior, wood doors.

2. Hollow steel, interior, non-rated, glazed doors.

3. Hollow steel frames for interior, non-rated, sidelights and windows where required by code or indicated on Drawings to be safety or impact resistive glass.

C. Provide Type G3 - 1 inch thick, insulating glass with clear, annealed interior pane and annealed, green exterior pane.

1. Aluminum and hollow metal framed exterior windows where not required by code nor indicated on Drawings to be safety or impact resistive glass.

D. Provide Type G4 - 1 inch thick, insulating glass with clear, tempered interior pane and tempered, green exterior pane.

1. Hollow metal framed exterior windows where required by code or indicated on Drawings to be non-rated safety or impact resistive glass.

E. Provide Type G5 - 1 inch thick, insulating glass with clear, annealed interior pane and clear annealed exterior pane.

1. High hollow metal framed exterior clerestory windows.

F. Provide Type G6 - 5/16 inch thick, laminated, fire & impact resistive, clear glass.

1. All fire-rated interior doors where required by code or indicated on Drawings to be rated, safety or impact resistive glass.

2. All hollow metal framed fire-rated corridor windows and door side lites where required by code or indicated on Drawings to be rated, safety or impact resistive glass.

G. Provide Type G7 – 3/8 inch thick, frosted or opaque tempered glass. This occurs only in the high Gymnasium/Multi-Purpose Room windows.

H. Provide Type G8 – 1/4 inch thick, tempered, green glass. This occurs mainly in hollow metal framed glass doors.

I. Provide Type G9 – 3/8 inch thick, clear tempered glass. This typically occurs in reception windows.

3.2 PREPARATION

A. Verify glass framing is accurately sized, structurally sound, square, and without bow.

B. Verify surfaces of glazing channels and recesses are clean, free of obstructions, and ready to receive glazing.

C. Inspect edges of glass. Install only glass with clean cut edges. Do not bump, drag, or brush edges against sash or hard objects. Avoid scratching.

D. Clean contact surfaces with solvent and wipe dry.

E. Prime surfaces as required for adhesion of sealants.

3.3 INSTALLATION

A. Comply with FGMA - Glazing Manual.

B. Install setting blocks and spacers as recommended by referenced glazing standards and glass manufacturer's recommendations.

C. Provide edge blocking as required to prevent sideway movement of glass in glazing channel.

D. Tape glazing:

1. Cut glazing tape to length and set against permanent stops, projecting slightly above sightline.

2. Rest glass on setting blocks and push against tape for full contact at perimeter of pane.

3. Place spacers below sightline and install removable glazing stop against spacers.

4. Fill gap between pane and removable glazing stop with sealant to uniform line level with bite of frame.

5. Knife trim protruding edge of glazing tape.

E. Gasket glazing:

1. Fabricate two piece compression gaskets to exactly fit openings.

2. Install soft compression gasket against permanent stops. Miter cut and bond together corners.

3. Rest glass on setting blocks. Insert dense compression gasket to press glass against soft gasket and lock in place against removable stop.

4. Apply sealant to gasket joints.

F. Wet sealant glazing:

1. Install spacers and sealant backing between glass and stops. Position to control depth and width of sealant.

2. Apply sealant to glazing channels without voids. Ensure complete bond of sealant to glass and channel surfaces.

3. Tool exposed sealant surfaces to provide wash away from glass.

3.4 CLEANING

A. Clean glass immediately following installation. Remove sealants and other glazing materials from adjacent finished surfaces.

B. Remove labels.

C. Prior to final inspection, clean all glass.

END OF SECTION

SECTION 092100 – GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Metal stud interior partition framing.
2. Metal Z furring channels for CMU walls.
3. Metal channel ceiling framing.
4. Gypsum wall board.
5. Gypsum sheathing.
6. Gypsum roof board.
7. Cement backer board at Showers.
8. Shaft wall system for elevator shaft.

B. Related sections:

1. Section 061000 - Rough Carpentry: Wood blocking for metal studs.
2. Sections 072100 – Thermal Insulation: Batt insulation for exterior stud walls, acoustical insulation for interior partitions.
3. Section 099100 - Painting: Finishing of gypsum board surfaces.

1.2 REFERENCES

A. ASTM C36 - Gypsum Wallboard.

B. ASTM C79 - Gypsum Sheathing Board.

C. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.

D. ASTM C630 - Water Resistant Gypsum Backing Board.

E. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.

F. ASTM C754 - Installation of Steel Framing Members to Receive Screw Attached Gypsum Board.

G. ASTM C1278 - Fiber Reinforced Gypsum Panels.

H. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

I. GA-201 - Gypsum Board for Walls and Ceilings.

J. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.

1.3 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittal Procedures:

1. List of proposed products and product data.

2. Sample of gypsum board textured finish:

a. Minimum size: 2 by 4 feet.

b. Apply specified texture to complete sample. On one half of sample, apply paint finish over texture as specified in Section 09900 - Painting.

c. Provide additional samples as requested by Architect.

d. Accepted sample shall be used as basis of acceptance for field applied texture.

3. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. American Gypsum, Albuquerque, New Mexico; 505-823-2022.

B. Domtar Gypsum, Ann Arbor, Michigan; 800-366-8274.

C. Georgia Pacific Gypsum Corporation, Atlanta, Georgia; 800-284-5347.

D. Gold Bond Building Products, National Gypsum Company, Charlotte, North Carolina; 704-365-7300.

E. Louisiana-Pacific, Portland, Oregon; 800-547-6331.

F. United States Gypsum Company, Chicago, Illinois; 312-606-5756.

G. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Options and Substitutions.

2.2 FRAMING MATERIALS

A. Studs and tracks: ASTM C645, rolled formed, channel type, galvanized sheet steel, 20 and 25 gage, 4 and 6 inches wide.

B. Z furring channels: ASTM C645, rolled formed, galvanized sheet steel, 1-1/2 inches deep.

C. Ceiling suspension members: ASTM C645 rolled formed galvanized sheet steel:

1. Main carrying channels: 1-1/2 inches deep, 16 gage.

2. Furring channels: Hat shaped, 20 gage, 7/8 inch deep.

D. Shaft wall studs and accessories: 25 gage C-H studs and J runner track, 4 inches deep, as manufactured by United States Gypsum Company.

E. Fasteners: ASTM C514.

2.3 GYPSUM BOARD MATERIALS

A. Regular gypsum board: ASTM C36, 5/8 inch thick, 4 feet wide, maximum permissible length, ends square cut, and tapered and beveled edges.

B. Fire rated gypsum board: ASTM C36, Type X fire resistive type, UL rated, 5/8 inch thick, 4 feet wide, maximum permissible length, ends square cut, and tapered and beveled edges.

C. High Impact or Abuse-Resistant gypsum board: Fire code Type X fire resistive type, UL rated, 5/8 inch thick, fiber reinforced.

D. Water resistant gypsum board, regular and Type X fire resistive: ASTM C630, 5/8 inch thick, 4 feet wide, maximum permissible length, ends square cut, tapered and beveled edges.

E. Gypsum sheathing board: ASTM C79, moisture resistant type, 5/8 inch thick, maximum permissible length, ends square cut, square edges, water repellent paper faces.

F. Gypsum liner panels: Fire resistive type, UL listed, beveled edges, 1 inch thick, 2 feet wide, maximum permissible length; Sheetrock Gypsum Liner Panels as manufactured by United States Gypsum Company.

G. Gypsum roof cover board: Glass mat faced, non-asphaltic coating, noncombustible, water-resistant gypsum core panel, 1/4, 1/2, and 5/8 inch thick, 48 by 96 inches, and 0 flame spread and 0 smoke development tested in accordance with ASTM E84; Dens Deck Prime as manufactured by Georgia Pacific Gypsum Corporation.

2.4 CEMENT BACKER BOARD

A. 1/4”, 1/2" & 5/8” thick Durock® Brand Cement Board (or approved equal): per ANSI A 118.9-1992.

2.5 ACCESSORIES

A. Corner beads: Galvanized steel with 1-1/4 inches knurled flanges.

B. Casing beads: Galvanized steel, L shaped with 1 inch knurled flange and height to match thickness of gypsum board.

C. Joint materials: ASTM C475, reinforcing tape, joint compound, adhesive, water, and fasteners.

D. Textured finish materials: Latex based texturing material.

PART 3 – EXECUTION:

3.1 METAL STUD INSTALLATION

A. Install studs in accordance with ASTM C754 and manufacturer's instructions.
B. Install studs of the following gages:

1. Partitions less than 15 feet high: 25 gage.

2. Partitions 15 feet or more high: 20 gage.

3. Double jambs at door and other openings: 20 Gage.

4. Partition corners: 20 gage.

5. End of free standing partition: 20 gage.

C. Maximum stud spacing: 16 inches on center.

D. Install double studs at door frame jambs and at other openings.

E. Extend studs to roof deck for fire rated partitions, sound control partitions with acoustical insulation, and elsewhere as shown on Drawings.

F. At roof deck, form a slip joint with double track to allow for building movement. Stop gypsum board short of deck and seal with backer rod and sealant.

G. Install a runner section between door jamb studs and adjacent stud at door head height.

H. Shaft wall framing: Install J runner track and C-H studs at 24 inches on center in accordance with UL approved design and manufacturer's instructions.

I. Blocking: Screw wood blocking to studs for support of plumbing fixtures, toilet accessories, cabinets, and hardware in accordance with Section 061000 - Rough Carpentry.

3.2 FURRING CMU WALLS

A. Erect metal studs and Z furring channels directly on exterior CMU walls. Locate on interior side of walls designated on Drawings.

B. Erect vertically.

C. Space at 16 inches maximum on center and not more than 3 inches from external corners and 12 inches from internal corners.

D. Secure flanges of Z furring channels at 24 inches maximum.

3.3 CEILING FRAMING INSTALLATION

A. Install system of main runner channels and hat furring channels for suspended gypsum board ceilings and as fire rated secondary ceilings below structural joists. Install at locations indicated on Drawings in accordance with ASTM C745 and manufacturer's instructions.

B. Coordinate location of hangers with other work.

C. Install ceiling framing independent of walls and above ceiling work.

D. Brace entire suspension system for seismic and other lateral loads.

3.4 ACOUSTICAL ACCESSORIES INSTALLATION

A. Install acoustical insulation specified in Section 07210 - Building Insulation in partitions and above ceilings where indicated on Drawings.

B. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

C. Install acoustical sealant specified in Section 07900 - Joint Sealers within partitions and around penetrations in accordance with manufacturer's instructions.

D. Place acoustical insulation above ceiling after gypsum board is applied. Extend to roof deck. Fit tight between studs.

3.5 GYPSUM BOARD INSTALLATION – NOTE: ALL INTERIOR GYPSUM BOARD WALLS EXPOSED TO PUBLIC VIEW SHALL BE FINISHED TO LEVEL 5, AS DEFINED BY THE GYPSUM ASSOCIATION.

A. Installation schedule:

1. Type X fire rated gypsum board in fire rated partitions and ceilings as indicated on Drawings.

2. Water resistant gypsum board in Toilets, Locker Rooms, Kitchens, Mechanical Rooms, and other wet areas as indicated on Drawings.

3. High Impact or Abuse-Resistant Type-X fire rated gypsum board in all corridors, vestibules, lobbies, and as indicated on Drawings, up to 8'-0" in height.

4. Regular gypsum board in all other partitions and ceilings.

B. Install gypsum board in accordance with GA 201 and GA 216 and manufacturer's instructions.

C. Erect gypsum board in most economical direction with ends and edges occurring over firm bearing.

D. Use screws to fasten gypsum board to metal framing.

E. Treat cut edges and holes in water resistant gypsum board with sealant.

F. Place corner beads at external corners, at edges of decorative ceiling and wall reveals, and other locations as detailed. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

3.6 SHAFT WALL

A. Install in accordance with GA 600, UL approved design requirements, and manufacturer's instructions.

B. Install 1 inch liner panels between C-H studs and screw attach 2 layers of 1/2 in thick fire rated gypsum board vertically on opposite side.

3.7 CEMENT BACKER BOARD

A. Install around shower areas as indicated on drawings and in accordance with manufacturer instructions.

3.8 GYPSUM SHEATHING

A. Install gypsum sheathing on exterior walls under provision of Section 09220 - Portland Cement Plaster

3.9 GYPSUM ROOF BOARD

A. Install one layer of 1/4-inch gypsum roof board as substrate for roofing systems and for achieving fire rating as part of:

1. Section 076113 - Standing Seam Metal Roof System.

2. Section 075400 – Thermoplastic membrane roofing.

3.10 JOINT TREATMENT

A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

B. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.

C. All surfaces shall be dry mopped or cleaned with clean rags after sanding and prior to the application of the primer.

3.11 PRIMING OF ALL GYPSUM BOARD INTERIOR WALLS PRIOR TO TEXTURING

A. All gypsum board interior walls shall have spray-applied primer as recommended by the gypsum board manufacturer (i.e. Sheetrock First Coat manufactured by USG, or approved equal), and backrolled.

3.12 TEXTURE FINISH

A. Spray apply texture coating in accordance with manufacturer's instructions.

B. Texture: Orange peel.

3.13 TOLERANCES

A. Maximum variation from true flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 093013 - CERAMIC TILE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A . Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1. 2 SUMMARY

A. Section includes: Ceramic tile for floors, base, walls, wainscot, and showers using thinset and mortar bed methods. Includes adhesives, mortar, grout, and waterproofing sheet membrane for showers.

B. Related sections:

1. Section 092100 - Gypsum Board Assemblies: Cement backer board for tile substrate for Shower walls.

1.3 REFERENCES

A. ANSI A118.1 - Dry-Set Portland Cement Mortar.

B. ANSI A118.3 - Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive.

C. ANSI A118.4 - Latex-Portland Cement Mortar.

D. ANSI A118.6 - Ceramic Tile Grouts.

E. ANSI A137.1 - Standard Specification for Ceramic Tile.

F. ASTM C206 - Finishing Hydrated Lime.

G. ASTM C150 - Portland Cement.

H. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.4 SUBMITTALS

A. Provide in accordance with Section 013300 - Submittal Procedures:

1. List of proposed products and product data.

2. Samples:

a. Tile, including Manufacturer’s full range of colors for selection by Architect.

b. Grout, including Manufacturer’s full range of colors for selection by Architect.

3. Manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with ANSI A137.1.

B. Conform to TCA Handbook for Ceramic Tile Installation.

C. Installer: Company specializing in installing tile with 5 years minimum experience.

1.6 FIELD SAMPLE

A. In accordance with Section 01400 - Quality Requirements, apply ceramic tile to one floor area and one wall area each 4 SF minimum. Grout tile joints and clean.

B. Accepted sample may remain as part of work and will be used as basis for acceptance of remaining tile installation. Unacceptable samples shall be removed.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

B. Do not install adhesives in closed, unventilated rooms.

C. Maintain 50 degrees F during installation of mortar materials.

1.5 EXTRA MATERIALS

A. Provide in accordance with Section 01770 - Closeout Procedures:

1. One box for each 50 boxes or fraction thereof for each type, color, pattern, and size installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Tile: Dal-Tile Corporation, Dallas, Texas; 800-933-8453.

B. Sealer: Miracle Sealants Company, Irwindale, California; 800-350-1901.

C. Anti-Fracture Membrane: Laticrete International, Inc. 800-243-4788

D. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Substitution Procedures. Architect reserves right to reject proposed substitutions on basis of color and pattern compatibility even though fabrication and materials are equivalent.

2.2 MOSAIC FLOOR TILE

A. Type: Ceramic mosaic, porcelain tile, ANSI 137.1; Keystones as manufactured by Dal Tile Corporation.

B. Size: 2 by 2 inches.

C. Surface finish: Unglazed.

D. Edge: Cushioned.

E. Colors (Field Color): As selected by Architect from manufacturer's standard range. (Price group 1 and 2)

F. Colors (Accent Colors) As selected by Architect from manufacturer's full range. Allow for color accent tile including all price groups.

G.. Moisture absorption: Less than 0.5 percent in accordance with ASTM C373.

H. Minimum breaking strength: 300 pounds in accordance with ASTM C648.

I. Chemical resistant in accordance with ASTM C650.

J. Resistant to freeze thaw conditions in accordance with ASTM C1026.

K. Slip resistant, minimum coefficient of friction in accordance with ASTM C1028: 0.6 dry; 0.8 wet.

2.3 PAVER FLOOR AND WALL TILE

A. Type: Glazed Porcelain with outstanding technology, Colour Scheme as manufactured by Dal Tile Corporation.

B. Size: 6” by 12/18” or 6” by 6” or12” by 12” or 18” by 18” inches (as indicated on Drawings)

C. Surface finish: Glazed.

D. Edge: Cushioned.

E. Colors: As selected by Architect from manufacturer's full range.

F. Moisture absorption: Less than .5 percent in accordance with ASTM C373.

G. Minimum breaking strength: 300 pounds in accordance with ASTM C648.

H. Chemical resistant in accordance with ASTM C650.

I. Slip resistant, minimum coefficient of friction in accordance with ASTM C1028: ≥0.65 dry; ≥0.6 wet.

2.4 WALL TILE

A. Type: Glazed wall tile; model ‘Semi-Gloss’ as manufacturered by Dal Tile Corporation.

B. Size: 4 ¼ by 4 ¼ inches.

C. Surface finish: Semi-Gloss

D. Edge: Cushioned, provide bullnosed where exposed.

E. Color: As selected by Architect from manufacturer's full range. Allow for color accent tile including all price groups.

F. Moisture absorption: Less than 3 percent in accordance with ASTM C373.

G. Minimum breaking strength: 250 pounds in accordance with ASTM C648.

H. Chemical resistant in accordance with ASTM C650.

I. Resistant to freeze thaw conditions in accordance with ASTM C1026.

2.5 QUARRY FLOOR TILE

A. Type: Ceramic paver quarry tile, ANSI 137.1; Quarry Tile as manufactured by Dal Tile Corporation.

B. Size: 6 by 6 inches.

C. Surface finish: Unglazed.

1. Dishwashing area: Include Suretread for added slip resistance.

2. All other rooms to receive quarry tile: Smooth.

D. Edge: Cushioned.

E. Colors: As selected by Architect from manufacturer's full range.

F. Moisture absorption: Less than 3 percent in accordance with ASTM C373.

G. Minimum breaking strength: 350 pounds in accordance with ASTM C648.

H. Chemical resistant in accordance with ASTM C650.

I. Resistant to freeze thaw conditions in accordance with ASTM C1026.

J. Slip resistant, minimum coefficient of friction in accordance with ASTM C1028:

1. Textured surface: 0.8 dry; 0.7 wet.

2. Smooth surface: 0.8 dry; 0.6 wet.

K. Provide and install required sealer for quarry tile in section 2.10 Accessories.

2.6 BASE AND TRIM

A. Types: Ceramic cove base tile, ANSI 137.1.

1. Rooms with glazed wall tile: 6 by 12 inches to match wall tile.

2. Rooms with floor or wall paver tile: 6 by 8 inches with flattop.

3. Rooms with quarry floor tile: 5 by 8 inch base to match floor tile.

B. Trim: Match color and pattern of floor and wall tile as shown on Drawings. Provide shapes as required by project conditions for finished work (inlcuding bull nose, bullnose corners, outside corners, etc.).

2.7 MORTAR BED

A. Materials:

1. Cement: ASTM C150, Type I.

2. Lime: ANSI/ASTM C206, Type S.

3. Aggregate: Natural sand within the following gradations:

a. No. 4 sieve: 0 percent.

b. No. 8 sieve: 0 to 10 percent.

c. No. 16 sieve: 10 to 40 percent.

d. No. 30 sieve: 30 to 65 percent.

e. No. 50 sieve: 70 to 90 percent.

f. No. 100 sieve: 95 to 100 percent.

4. Water: Clean, fresh, potable, and free from minerals and impurities which can affect mortar.

B. Mortar bed mix for floors:

1. 1 part Portland cement.

2. 5 parts sand.

2.8 THINSET MATERIALS

A. Thinset mortar: Latex-Portland cement mortar conforming to ANSI A118.4.

B. Epoxy mortar bond coat: Chemical resistant type conforming to ANSI A118.3.

2.9 GROUT

A. Latex Portland cement grout: Cementitious, dry cure type with latex additives and resistant to shrinking and staining, ANSI A118.4.

B. Epoxy grout: (Required at kitchen and dishwashing area): Chemical resistant type conforming to ANSI A118.3.

C. Colors: As selected by Architect from manufacturer's full range.

2.10 ANTI-FRACTURE MEMBRANE

A. Two-Part anti-fracture system: Blue 92 Anti-Fracture by Laticrete International, Inc. or Equal.

B. Anti-fracture membrane shall be used to cover all control and expansion joints in concrete floor slab.

C. Anti-fracture membrane shall be used to cover all hairline cracking within the concrete substrate.

D. Install per manufacturers recommendations.

2.11 ACCESSORIES

A. Waterproofing sheet membrane for shower pan: 40 mil thick elastomeric chlorinated polyethylene waterproofing and crack isolation sheet membrane.

B. Underlayment: No. 15 asphalt saturated felt.

C. Reinforcing mesh: 2 by 2 inches size weave of 16/16 wire size; welded fabric, galvanized.

D. Metal lath: 3.4 pounds per SY, self furring lath without ribs, galvanized finish.

E. Sealer (required at all Quarry Tile installation): Polymerized silicone penetrating sealer that will not change surface of material being treated; 511 Impregnator as manufactured by Miracle Sealants Company. Install per manufactures instructions.

G. Metal Tile Edge (where indicated on drawings): Provide and Install brushed nickel anodized aluminum edge protection, style “JOLLY”, Product number “ANIGB 80” (5/16 inch thick), by Schluter Systems (Tel: 1-800-472-4588 Ext. 136) (www.schluter.com) or approved equal. Install per manufactures recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate recessing floor areas to receive ceramic tile with work of Section 033000 - Cast-in-Place Concrete.

1. Showers: Slope to drain, waterproofing material and tile to allow flush transition to adjacent floor finishes.

B. Coordinate placement of concrete slab control joints with provision of ceramic tile expansion joints. Locate concrete control joints to minimize or eliminate requirement for expansion joints in ceramic tile floor finish.

C. Floors to be tiled shall fall within maximum variation of 1/4 inch in 10 feet.

D. Shower subfloors shall slope 1/4 inch per foot to drains.

E. Report unacceptable surfaces. Do not tile until surfaces are corrected.

F. Vacuum clean existing surfaces.

G. Seal substrate surface cracks with filler.

3.2 INSTALLATION

A. Install in accordance with appropriate installation method of TCA Handbook.

1. Use TCA Method No. F112 for cast-in-place concrete subfloors:

a. Where indicated on Drawings, verify slope to floor drains.

b. Thinset tile to concrete subfloor with latex Portland cement mortar bond coat.

3. Use TCA Method No. B414 for cast-in-place concrete Shower subfloors:

a. Coordinate with installation of floor drains.

b. Cover shower floor with waterproof sheet membrane. Turn membrane up walls 6 inches minimum.

c. Surround drain with broken pieces of tile or crushed stone to prevent mortar from blocking weep holes.

d. Apply 1-1/2 inches thick mortar bed over membrane. Reinforce with wire mesh.

e. Allow mortar bed to cure. Thinset tile to cured mortar bed with latex Portland cement mortar.

f. Grout tile joints with latex Portland cement grout.

4. Use TCA Method No. W243 for Toilet Room walls with gypsum board and metal stud interior walls:

a. Thinset tile using latex Portland cement mortar.

b. Grout tile joints with latex Portland cement grout.

5. Use TCA Method No. 244 for Shower walls with metal studs and cement backer board:

a. Install underlayment beneath cement backer board.

b. Thinset tile with latex Portland cement mortar.

c. Grout tile joints with latex Portland cement grout.

B. Tile expansion joints: Provide and locate expansion joints in ceramic tile floor finish at locations over all control joints in concrete floor slabs. Construct in accordance with TCA Method No. EJ171:

1. Minimum width: Width of concrete control joint.

2. Install joint in mortar bed directly over concrete control joint.

3. Keep joint clean of grout, mortar, and other debris.

4. Install compressible backer rod and urethane sealant as specified in Section 07900 - Joint Sealers.

C. Layout work so as to minimize cuts. Locate cuts so as to be least conspicuous.

D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor and base joints.

E. Make tile joints uniform in width.

F. Sound tile after setting. Replace hollow sounding units.

G. Allow tile to set for a minimum of 48 hours prior to grouting.

H. Sealer: Apply sealer to quarry floor tile prior to grouting joints in accordance with manufacturer's instructions and recommended rates. After grouting, remove grout residue from tile surfaces and allow grout to cure. Apply sealer to grout joints with thin paint brush. Wipe excess sealer from tile surfaces.

I. Grout tile joints. Make joints watertight, without voids, cracks, or excess grout.

J. Seal all grout joints with sealer applied in accordance with manufacturer's instructions.

3.3 CLEANING AND PROTECTION

A. Thoroughly clean and polish tile surfaces.

B. Limit foot and wheel traffic over finished floor surface.

END OF SECTION

SECTION 095100- ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes non-rated standard and humidity resistant:

1. Suspended metal grid ceiling system.

2. Acoustical ceiling panels.

3. Washable vinyl faced lay-in panels.

B. Related sections:

1. Section 092100 - Gypsum Board Assemblies: Suspended gypsum board ceilings.

1.2 REFERENCES

A. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

C. ASTM E580 - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

D. ASTM E1264 - Classification of Acoustical Ceiling Products,

1.3 SUBMITTALS

A. Submit in accordance with Section 013300 - Submittal Procedures:

1. Product data.

2. Samples:

a. 4 by 4 inches minimum of panels.

b. 2 inches long sections of suspension system main runner, cross, runner, and edge trim.

3. Manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. Suspension grid components and installation shall comply with requirements for Seismic Zone 2B.

B. Ceiling panel and suspension grid for Kitchen shall be USDA approved for sanitary food processing plants.

1.5 EXTRA MATERIALS

A. Provide in accordance with Section 017700 - Closeout Procedures:

1. Three (3) boxes of each type of ceiling panel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Armstrong World Industries, Inc., Lancaster, Pennsylvania; 800-233-3823.

B. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

2.2 SUSPENSION SYSTEM

A. Type: ASTM C635 non-rated, intermediate duty, exposed tee grid fabricated from cold rolled steel with hot dipped galvanized coating;

1. General use: Prelude XL as manufactured by Armstrong World Industries.

2. Kitchen, Dishwashing Room, and Locker Room use *[REVISE AS APPLICABLE]*: Corrosion resistant grid conforming to ASTM C635 for Severe Environmental Performance and USDA approved for food processing use; Prelude Plus XL as manufactured by Armstrong World Industries.

B. Sizes: 1-1/2 inch main tees and 1-1/2 inch cross tees with 15/16 inch exposed grid face.

C. Finish: Baked polyester paint.

D. Colors: As selected by Architect from manufacturer's full range.

E. Accessories: Hold down clips, splices, and angle type wall molding to match grid.

F. Hanger wire: 12 gage minimum.

G. Maximum deflection of installed system: 1/360 of span.

2.3 ACOUSTICAL PANELS

A. Type A: ASTM E1264, Type III, Form 2, Pattern CD, non-directional textured panel; Cortega Tegular as manufactured by Armstrong World Industries.

1. Sizes: 24 by 24 inches.

2. Thickness: 5/8 inch.

3. Edge: Angled tegular.

4. Composition: Mineral fiberboard.

5. Minimum light reflectance: 80 percent.

6. NRC rating: 0.60.

7. CAC rating: 40.

8. Flame spread: Class A.

9. Surface finish: Factory applied vinyl latex paint.

10. Color: As selected by Architect from manufacturer's full range.

B. Type B: ASTM E1264, Type III, Form 2, Pattern CD, non-directional fissured panel; Fissured Square Lay-In as manufactured by Armstrong World Industries.

1. Size: 24 by 48 inches.

2. Thickness: 5/8 inch.

3. Edge: Square.

4. Composition: Mineral fiberboard.

5. Minimum light reflectance: 80 percent.
6. NRC rating: 0.55.

7. CAC rating: 30.

8. Flame spread: Class A.

9. Surface finish: Factory applied vinyl latex paint.

10. Color: As selected by Architect from manufacturer's full range.

2.4 HUMIDITY RESISTANT WASHABLE CEILING PANELS

A. Type: ASTM E 1264, Type IV, form 2, Pattern E, humidity and sag resistant, washable, non-perforated, vinyl faced panel; Clean Room VL as manufactured by Armstrong World Industries.

B. Size: 24 by 48 inches.

C. Thickness: 3/4 inch.

D. Edge: Square.

E. Composition: Mineral fiber.

F. Minimum light reflectance: 83 percent.

G. NRC rating: 0.10.

H. CAC rating: 40.

I. Flame spread: Class A.

J. Surface finish: Vinyl-faced membrane.

K. Color: White.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not install acoustical ceilings until building is enclosed, minimum temperature is 60 degrees F, dust generating activities have terminated, and overhead work is completed, tested and approved.

B. Verify that layout of hangers will not interfere with other work.

3.2 SUSPENSION SYSTEM INSTALLATION

A. Install grid systems in accordance with ASTM C636 and ASTM E580.

B. Install corrosion resistant grid in Kitchens, Dishwashing Room, Locker Rooms, *[REVISE AS APPLICABLE]* and other humidity conditions as indicated on Finish Schedules on Drawings. Install standard grid in all other locations.

C. Coordinate location of hangers with other work.

D. Hang system independent of walls, columns, ducts, pipes, and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Locate system on room axis according to Reflected Ceiling Plan.

F. Where ducts or other equipment prevent regular spacing of hangers, reinforce the nearest affected hangers and related grid members.

G. Loading:

1. Do not support other building components on main runners and cross tees if weight causes total dead load to exceed deflection capability.

2. Support light fixture loads by supplementary hangers.

3. Do not eccentrically load system. or produce rotation of runners.

H. Edge molding: Install at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

3.3 PANEL INSTALLATION

A. Install humidity resistant, washable panels in Kitchen, Dishwashing Room, Locker Rooms, and other humidity conditions as indicated on Finish Schedules on Drawings. Install Type A or Type B acoustical ceiling panels in all other locations as indicated on Reflecting Ceiling Plan in Drawings.

B. Fit acoustical panels in place, free from damaged edges or other defects. Install level, in uniform plane, and free from twist, warp, and dents.

C. Lay directional patterned units with fissures running in one direction.

D. Cut panels to fit irregular grid and perimeter edge trim.

E. Install hold-down clips to retain panels tight to grid system within 20 feet of exterior doors.

3.4 TOLERANCES

A. Variation from flat and level surface: 1/8 inch in 10 feet.

3.5 CLEANING

A. Vacuum or brush grid and panels to remove dust and loose dirt.

B. Clean grid and panels of all marks, smudges, and clinging dirt with moist cloth and mild soap.

C. Replace scratched sections of grid and heavily soiled or stained panels.

D. Remove cut sections of grid, panel scraps, wire clippings, and all other debris from space above ceiling.

END OF SECTION

SECTION 096500 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Vinyl composition tile, homogeneous linoleum floor tile, rubber base, combination rubber stair tread and riser, rubber stair stringers, and vinyl edge strips.

B. Related sections:

1. Section 096813 – Tile Carpeting.

1.2 REFERENCES

A. ASTM E84 - Surface Burning Characteristics of Building Materials.

B. ASTM F1066 - Vinyl Composition Floor Tile.

C. FS L-F-475 - Floor Covering, Vinyl Surface (Tile and Roll), with Backing.

D. FS SS-W-40 - Wall Base: Rubber and Vinyl Plastic.

E. ASTM F2195 - Standard Specification for Linoleum Floor Tile

1.3 ENVIRONMENTAL REQUIREMENTS

A. Ventilation: Do not install flooring in enclosed building spaces without adequate ventilation. Provide ventilation to remove volatile organic compound (VOC) outgasses emitting from sheet flooring and adhesive during storage, installation, and after installation as required to minimize contamination of building interior spaces.

1.4 QUALITY ASSURANCE

A. Provide flooring, adhesive, and other products with low or zero volatile organic compound (VOC) content and containing no hazardous or carcinogenic ingredients.

B. Regulatory requirements: Comply with current applicable regulation of the Environmental Protection Agency (EPA) as related to volatile organic compound content of products.

C. Conform to applicable code for flame, fuel, and smoke rating requirements of resilient flooring in accordance with ASTM E84.

1.5 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittal Procedures:

0. List of proposed products and product data.

1. Samples.

2. Manufacturer's installation and maintenance instructions.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain space to receive flooring at 65 degrees F minimum for 48 hours prior to, during, and 48 hours after installation.

B. Store materials for 48 hours prior to installation in area of installation to achieve temperature stability.

1.7 EXTRA MATERIALS

A. Provide in accordance with Section 017700 - Closeout: Procedures:

1. 1 box of Field color and 10 square feet of each accent color and pattern of floor tile used. Package each type separately, distinctly marked, and adequately protected against deterioration.

2. 20 linear feet of each type and color of rubber base.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Vinyl composition tile (VCT):

1. Armstrong World Industries, Inc., Lancaster, Pennsylvania; 800-233-3823.

2. Azrock Industries, Inc., Florence, Alabama; 205-766-0234.

3. Mannington Commercial, Calhoun, Georgia; 800-241-2262.

4. Tarket, Inc. Whitehall, Pennsylvania; 610-266-5500.

B. Linoleum tile (LT):

1. “Forbo, Hazleton, PA; 1-800-842-7839

C. Rubber wall base:

1. Johnsonite, Chagrin Falls, Ohio; 800-899-8916.

2. Mondo USA, Inc., Grapevine, Texas; 888-966-6369.

3. Roppe Corporation, Fostoria, Ohio; 800-537-9527.

D. Rubber stair tread, riser, and stringer: Johnsonite, Chagrin Falls, Ohio; 800-899-8916.

E. Vinyl edge strips: Johnsonite, Chagrin Falls, Ohio; 800-899-8916.

F. Manufacturers of other products submitted and approved in accordance with Section 01600 - Product Requirements. Architect reserves right to reject proposed substitutions on basis of color and pattern compatibility even though fabrication and materials are equivalent.

2.2 VINYL COMPOSITION FLOOR TILE (VCT)

A. Type: Vinyl composition tile, ASTM F1066.

B. Size: 12 by 12 inches, 1/8 inch thick.

C. Colors: As selected by Architect from manufacturer's full range. Allow adequate percentages for field and accent colors.

2.3 LINOLEUM FLOOR TILE (LT)

A. Marmoleum® Composition Tile / Certified sustainable tile.

B. Description: Homogeneous tile of primarily natural materials consisting of linseed oil, wood flour, and rosin binders, mixed and calendered onto a polyester backing. Pattern and color shall extend throughout total thickness of tile material.

B. Size: 13 by 13 inches, 1/10 inch thick.

C. Backing: Polyester backing.

C. Colors: As selected by Architect from manufacturer's **full range**.

2.4 WALL BASE

A. Type: Extruded rubber, vulcanized.

B. Toe: Coved.

C. Height: 4 inches.

D. Thickness: 1/8 inch.

E. Color: As selected by Architect from manufacturer's full range.

F. Provide in coils in order to minimize joints in field.

2. 5 STAIR TREADS, RISERS AND STRINGER

A. Type: Combination, rubber riser, nosing, and tread unit as manufactured by Johnsonite.

B. Thickness: .153” to .210”.

C. Size (Field cut to dimensions shown on Drawings):

1. Tread: width to accommodate stair tread.

2. Riser: height to accommodate stair riser.

3. Stringer: provide 10” width to accommodate stair.

D. Tread surface: Raised disk pattern at leading edge of tread with smooth riser.

E. Color: As selected by Architect from manufacturer's full range.

F. Provide in lengths to minimize splicing to the fullest extent possible. Provide stringers, in continuous length for entire run of stair.

2. 6 ADAPTERS AND TRANSITION STRIPS

A. Material: Vinyl

B. Color: As selected by Architect from manufacturer’s full range.

C. Type as manufactured by Johnsonite for the following conditions:

1. Linoleum to Carpet.

2. Linoleum to Ceramic Tile.

3. Linoleum to Athletic Flooring.

4. Concrete to adjacent raised flooring surface.

2. 7 EDGE STRIPS

A. Material: Vinyl.

B. Color: As selected by Architect from manufacturer's full range.

C. Type: Edge guard for 1/8 inch vinyl composition tile: Flange to overlap tile with transition reducer, approximately 1-1/2 inches wide; SSR-XX-B as manufactured by Johnsonite.

2. 8 ACCESSORIES

A. Subfloor filler: White premix latex type as recommended by flooring material manufacturer.

B. Primers: As recommended by floor material manufacturer.

C. Adhesive: Waterproof types as recommended by floor material manufacturer.

D. Sealer and wax: Type as recommended by flooring material manufacturer.

PART 3 – EXECUTION:

3.1 PREPARATION

A. Verify that substrate surfaces are smooth, flat, and free from irregularities. Fill low spots, cracks, joints, holes, and other defects, with floor filler.

B. Apply, trowel, and float filler to leave smooth, flat, hard surface. Prohibit traffic until cured.

C. Vacuum floor surfaces.

3.2 GENERAL FLOORING INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate transitions to other floor coverings at doorways such that joint is concealed when door is closed.

C. Scribe flooring to walls, columns, cabinets, and other appurtenances to produce tight joints.

D. Spread only enough adhesive to permit installation of flooring materials before initial set.

E. Set flooring in place; press with heavy roller to attain full adhesion.

F. Install edge strips at unprotected or exposed edges and at intersections with other floor finishes. Use maximum possible lengths.

3.3 VINYL COMPOSITION and LINOLEUM TILE

A. Mix tile from cartons to ensure shade variations are consistent.

B. Install tile with pattern grain alternating with adjacent unit to produce basket weave pattern.

C. Layout tile pattern from center of room such that tiles at perimeter are wider than 6 inches, or as indicated on Drawings.

D. Install tile in patterns using different colors as shown on Drawings.

D. Install per manufactures recommendations.

3.4 BASE INSTALLATION

A. Install straight and continuous in maximum possible lengths. Fit joints tight and vertical.

B. Scribe to fit doors and frames and other interruptions.

C. Corners:

1. Internal: Miter.

2. External:

a. Preformed cove base: Install factory fabricated outside corner pieces.

b. Install base on solid backing. Bond tight to wall.

3.5 STAIR TREAD, RISER, STRINGER INSTALLATION

A. Accurately cut stair tread and riser to fit stair width and profile. Install in continuous lengths to the fullest extent possible, extending full width of stair.

B. Accurately cut stair stringer material with straight edge to profile of stairs and adjoining base. Install as one piece covering full length of stair run.

C. Adhere over entire contact surface. Fit accurately and securely.

3.6 EDGE STRIPS

A. Coordinate installation of vinyl edge transition strips with installation of adjacent materials.

B. Install vinyl edge transition strips with manufacturer's recommended contact bond adhesive.

C. Roll with hand roller to ensure proper bonding.

3.7 ADAPTERS AND TRANSITION STRIPS

A. Coordinate installation of rubber adapters and transition strips with installation of adjacent materials.

B. Install rubber adapters and transition strips with manufacturer's recommended contact bond adhesive.

C. Roll with hand roller to ensure proper bonding.

3.8 CLEANING AND PROTECTION

A. Prohibit traffic on floor for 48 hours after installation.

B. Remove excess adhesive from floor, base, and wall.

C. After floors have set sufficiently to properly bond, wash with neutral cleaner, wax, and buff thoroughly.

D. Provide non-staining paper pathway taped to resilient flooring as protection from construction traffic.

END OF SECTION

SECTION 099000 - PAINTING AND COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.

2. Exposed surfaces of steel lintels and ledge angles.

3. Mechanical and Electrical:

a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.

b. On the roof and outdoors, paint all piping that is exposed to weather or to view, including that which is factory-finished.

c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

d. Paint dampers exposed behind louvers, grilles, to match face panels.

C. Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically so 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, and operating parts of equipment.

5. Marble, granite, slate, and other natural stones.

5. Floors, unless specifically so indicated.

6. Ceramic and other tiles.

7. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.

8. Exterior insulation and finish system (EIFS).

9. Glass.

10. Acoustical materials, unless specifically so indicated.

12. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 055000 – Miscellaneous Metals: Shop-primed items.

1.02 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

1.03 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 D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2007.

C. ASTM D 4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 1992 (Reapproved 2003).

D. GreenSeal GS-11 - Paints; 1993.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: Provide data on all finishing products, including VOC content.

C. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 4 x 8 inch in size.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

2. Extra Paint and Coatings: 1 gallon of each color; store where directed.

3. Label each container with color and paint color formula in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

1.06 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 and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 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 exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Paints and Coatings:

1. Base Manufacturer: Sherwin Williams.

2. Dunn Edwards Paints: www.dunnedwards.com.

3. Kwal Paint: www.kwalpaint.com.

4. Sherwin Williams: www.sherwin-williams.com.

C. Substitutions: See Section 01 6200 - Product Options.

2.02 PAINTS AND COATINGS – GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

1. Provide paints and coatings 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 coating material in quantity required to complete entire project's work from a single production run.

3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Chemical Content: The following compounds are prohibited:

1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

D. Colors: As indicated on drawings

1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint WE-OP-3L - Wood, Opaque, Latex, 3 Coat:

1. One coat of latex primer sealer.

2. Flat: Two coats of latex enamel; 100 % Acrylic A-100 series

3. Satin: Two coats of latex enamel; 100 % Acrylic A-100 series.

B. Paint CBE-OP-3L - Cement Board, Opaque, Latex, 3 Coat:

1. Loxon Conditioner Guide Coat White A24W100.

2. Flat: Two coats of latex enamel; 100 % Acrylic A-100 series.

C. Ferrous Metals, Primed, Latex, 2 Coat:

1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.

2. Gloss: Two coats of latex enamel; SuperPaint Exterior High Gloss A85 series.

D. Galvanized Metals, Latex, 3 Coat:

1. One coat Pro-Cryl Universal Metal Primer B66-310 series , if unprimed. If primed, touch up as required.

2. Gloss: Two coats of latex enamel; SuperPaint Exterior High Gloss A85 series.

2.04 PAINT SYSTEMS – INTERIOR

A. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:

1. One coat of latex primer sealer.

2. Semi-gloss: Two coats of latex enamel; Pro Green 200.

B. Paint WI-TR-V - Wood, Transparent, Varnish, No Stain:

1. One coat sealer.

C. Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:

1. One coat of stain; WoodClassics Wood Stain A49 Series.

2. Satin: Two coats of varnish; WoodClassics Waterborne Polyurethane Varnish.

D. Concrete/Masonry, Opaque, Latex, 3 Coat:

1. One coat of block filler.

2. Egg Shell: Two coats of latex enamel; Harmony Interior Latex Eg-shel B9W900 series.

E. Ferrous Metals, Primed, Latex, 2 Coat:

1. Touch-up with latex primer.

2. Semi-gloss: Two coats of latex enamel; Pro Green 200.

F. Galvanized Metals, Latex, 3 Coat:

1. One coat Pro-Cryl Universal Metal Primer B66-310 Series .

2. Semi-gloss: Two coats of latex enamel; Pro Green 200.

G. Gypsum Board/Plaster, Latex, 2 Coat:

1. Primer: By Section 09 2116.

2. Eggshell: Two coats of latex enamel; Harmony Interior Latex Eggshel B9W900 series.

H. Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:

1. One coat of Harmony Interior Primer B11W900 primer sealer.

2. Semi-gloss: Two coats of latex-acrylic enamel; Bath Paint Semi-gloss A59 series.

I. Exposed Overhead Metal, , Latex-Acrylic, 3 Coat:

1. One coat of Pro-Cryl Metal Primer B66-310 primer sealer.

2. Eggshell: One coat of latex-acrylic enamel; Waterborne Acrylic Eg-shel Dryfall B42W2.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared.

1. Including but not limited to primer and texture required for gypsum wall surfaces specified in Section 09 2116.

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 are below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3. Interior Wood: 15 percent, measured in accordance with ASTM D 4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D 4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating 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. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

I. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

K. Shop-Primed Steel Surfaces to be Finish Painted: 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.

L. Interior 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. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 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 instructions.

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.

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.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finished coatings until completion of project.

END OF SECTION

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Plastic room signs.

2. Cast aluminum letters for exterior of building.

B. Related sections:

1. Section 061000 - Rough Carpentry: Blocking in stud walls for installation on dedication plaques.

1.2 REFERENCES

A. ANSI A117.7 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.

1.3 QUALITY ASSURANCE

A. Signs shall be designed and installed for use by handicapped persons in accordance with ANSI A117.7 and ADA 101-336 Sections 4.30 through 4.30-5.

1.4 SUBMITTALS

A. Provide in accordance with 013300 - Submittal Procedures:

1. List of proposed products and product data.

2. Shop drawings listing identifying devices, text, lettering style, dimensions, and methods and details of attachment.

3. Samples illustrating available types and colors for selection by Architect.

4. Copy of warranty required by Paragraph 1.5 for review by Architect.

1.5 WARRANTY

A. Provide under provisions of Section 017700 - Closeout Procedures:

1. Life of building warranty for plastic room signs against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Century Sign Builders, Albuquerque, NM; 505-888-2901. Website: www.csbsigns.com

B. A.R.K. Ramos, Oklahoma City, OK: 800-725-7266. Website: www.arkramos.com

C. Best Sign Systems, Montrose, Colorado; 800-235-2378. Website: www.bestsigns.com

D. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

2.2 ROOM SIGN FABRICATION

A. Signs shall have the following characteristics:

1. Tactile characters/symbols shall be raised 1/32" from sign plate face.

2. Text shall be accompanied by Grade 2 braille on signs requiring braille.
3. All letters, numbers and/or symbols shall have a 70% contrast to the plaque color of the sign as required by ADA regulations.
4. Signs shall have a 3/8” wide raised (1/32”) boarder around the perimeter of plaque.
5. Sign plaques, lettering, and symbols shall have a matte or eggshell finish
6. Sign plaques, letters, and symbols must be constructed with materials having embedded coloration that is the final approved color for the signs. Products with painted or otherwise applied coloration method are not acceptable.

B. Sign plaque, letters and symbols shall be constructed using 0.125” single ply non-glare acrylic multipolymer material with either continuous embedded pigment or a micro-surfaced color layer. (depending on color selection)

C. Tactile lettering and symbols shall be formed using rotary engraving method and bonded to sign plaque using 3M Scotch 467HP adhesive or approved equal.

D. Lettering and symbols must have 1/32” return cut. Lettering and symbols must conform to material standards in section 2.02 B (above) of this specification guide.

E. Lettering style and size will be in accordance with design format in Century Sign Builders product line CS or approved equal.

F. Signs requiring Braille must be constructed using the Edgerton Grade 2 Braille System.

2.3 ROOM SIGN DESIGN

A. Room Identification Type: Model CB88P (rounded corners) as manufactured by Century Sign Builders or approved equal.

1. Size: 7.75 inches by 7.75 inches

B. Restroom and ADA Core: Model CB88R (rounded corners) as manufactured by Century Sign Builders or approved equal.

1. Size: 7.75 inches by 7.75 inches

C. Text: Refer to Sign Schedule in Drawings for actual text of signs.

D. Lettering: ADA Approved San Serif font, 1/32 inch raised tactile characters. Style selected by Architect from manufacturer's standard. Height of lettering shall be 5/8”.

E. Symbols: 1/32 inch raised graphics:

1. Restrooms: International gender and handicapped symbols.

F. Accompanying braille indications: Grade 2.

G. Borders: 3/8 inch wide around perimeter of sign with 1/8 inch inside radiused corners.

H. Colors: Selected by Architect from manufacturer's full range and providing 70 percent contrast between text/graphics and background.

2.4 EXTERIOR LETTERS

A. Exterior lettering as manufactured by A.R.K. Ramos or approved equal:

1. Type: Precision cut aluminum.

2. Finish: F-3 Painted Face and Edge.

3. Color: Custom color as selected by Architect.

4. Mounting: PM-1 (Projected mount with collars and threaded studs set in adhesive).

5. FRONT ENTRY

a. Height: 12 inches.

b. Thickness: 2 inches (solid)

c. Style: Helvetica medium.

d. Text: “HONDO SENIOR CENTER”.

PART 3 – EXECUTION

3.1 PREPARATION

A. Coordinate requirements for blocking. Provide sizes locations, and heights needed for mounting dedication plaque.

3.2 INSTALLATION

A. Install identifying devices after walls and doors are finished.

B. Do not permanently mark finished surfaces with chalk lines or other reference marks.

C. Mount signs according to approved shop drawings and manufacturer's instructions.

3.3 ROOM SIGNS

A. Signs shall be mounted using double vinyl foam tape (1/16” thickness) and silicon adhesive (when necessary).

B. All signs shall be mounted 60" from the floor to the center of the sign on the latch side of the door. The distance between the door frame and edge of the sign should be 2".

C. If condition 3.3 B cannot be met, approval may be given to install in alternate location.

B. For signs mounted on glass panels, mount blank panel on opposite glass surface and directly behind room sign to conceal mounting adhesive.

C. After installation is complete, clean and polish identifying devices.

3.4 BUILDING DEDICATION PLAQUES

A. Flush mounted with stainless steel threaded studs on rear of plaque of size required for anchoring to substrate.

END OF SECTION

SECTION 102813 - COMMERCIAL TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Toilet accessories and attachment hardware and plumbing pipe safety covers.

B. Related sections:

1. Section 061000 - Rough Carpentry and Section 092100 - Gypsum Board Assemblies: Blocking in partitions for toilet accessories.

1.2 REFERENCES

A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.

B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

D. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

E. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

F. Recommendations for Accessibility to Serve Physically Handicapped Children in Elementary Schools.

1.3 SUBMITTALS

A. Submit in accordance with Section 013300- Submittal Procedures:

1. List of proposed products and product data.

2. Manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. Provide and install accessories to comply with ANSI A117.1 for adult usage and Recommendations for Accessibility to Serve Physically Handicapped Children in Elementary Schools for elementary student usage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Toilet accessories:

1. AJ Washroom Accessories, New Windsor, New York; 914-562-3332.

2. American Specialties Incorporated, Yonkers, New York; 914-476-9000.

3. Bobrick Washroom Equipment, Inc, North Hollywood, California; 800-553-1600.

4. Bradley Corporation, Menomonee Falls, Wisconsin; 414-354-0100.

5. Health Craft Products, Inc. Ottawa, Ontario, Canada: 888-619-9992

B. Plumbing pipe safety covers: Plumberex Specialty Products, Inc., Palm Springs, California; 800-475-8629.

C. Manufacturers of equivalent products submitted and approved in accordance with Section 01600 - Product Requirements.

2.2 MATERIAL

A. Toilet accessories are to be constructed of stainless steel sheet, ASTM A167, and tubing, ASTM A269, unless noted otherwise.

B. Provide with anchor plates, adapters, fasteners, and other anchoring devices required for secure installation.

C. Fasteners, screws, and bolts: Galvanized or stainless steel, tamperproof, and size appropriate for finish surface where items are mounted.

2.3 FABRICATION

A. Form exposed surfaces from single sheet of material, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches and dents.

B. Weld and grind smooth joints of fabricated components.

C. Shop assemble accessories and package complete with anchors and fittings.

2.4 TOILET ACCESSORIES

A. Grab bars: 18 gage stainless steel with peened non-slip gripping surface, 1-1/4 inches diameter, 1-1/2 inches clearance from wall, mounting flange welded to bar with fasteners concealed with escutcheon plate:

   a. Horizontal: 36 inches long; Bobrick B5806 x 36.

   b. Horizontal: 42 inches long; Bobrick B5806 x 42.

   c. Vertical: 18 inches long; Bobrick B5806 x 18.

   d. Horizontal, two wall configuration for shower stall: 24 by 36 inches; Bobrick B5637.

   e. 90 degrees horizontal and vertical bars for shower stall: 12 by 36 inches; Bobrick B5856.

B. Surface mounted paper towel dispenser equipped with piano hinge and tumbler lock; Bobrick B262:

   1. Capacity:

      a. 400 C-fold and 525 multi-fold towels.

   2. Nominal size: 10-3/4 inches wide, 14 inches high, 4 inches deep.

C. Toilet tissue dispenser: Surface mounted cast aluminum toilet tissue dispenser holding two rolls, theft-resistant and without controlled delivery; Bobrick B2740:

   1. Type: Holds two rolls, theft-resistant, and without controlled delivery.

   2. Nominal size: 12-1/2 inches wide by 4-7/8 inches deep.

D. Mirrors: Surface mounted in stainless frame with mitered corners and No. 1 Quality 1/4 inch electrolytically plated tempered mirror glass.

   1. Tilt mirror: Fixed angle tilt mirror in stainless steel frame tapering from 4 inches at top to 1 inch at bottom; Bobrick B293.

      a. Nominal size: 24 inches wide by 36 inches high. (Above Sinks).

E. Mop and broom holder; Bobrick B223:

   1. Type: Surface mounted stainless steel mop and broom holder with 4 spring cam holders.

2. Size: 36 inches long by 5 inches high by 4-1/4 inches deep.

F. Diaper changing station: Surface mounted, fold down, polyethylene unit with concave changing bed, safety straps, hooks for bags, pneumatic cylinder for opening and closing, and full length steel hinge rod; Bobrick B2200.

1. Nominal size: 32 inches wide by 20 inches high and projecting 4 inches when closed. When open, bed projects 19 inches from wall.
2. Weight capacity: 250 pounds.

2.5 KEYING

A. Provide 2 keys for each accessory requiring secure access to filling or maintenance in accordance with Section 01770 - Closeout Procedures.

B. Master key accessories.

2.6 FINISHES

A. Stainless steel: No. 4 satin luster finish.

B. Chrome/nickel plating: ASTM B456, Type SC 2 satin finish.

C. Enamel: Pretreat to clean condition, apply one coat primer and 2 coats minimum baked enamel.

D. Galvanizing: Galvanize ferrous metal and fastening devices; ASTM A123 to 1.25 ounces per SY minimum.

E. Galvanizing: Galvanize ferrous metal and fastening devices; ASTM A123 to 1.25 ounces per SY minimum.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate requirements for blocking and deliver inserts and rough-in frames to site at appropriate time for building-in.

B. Provide templates and rough-in measurements as required.

C. Verify with Architect exact locations of accessories.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mounting heights: Refer to Drawings and references listed in Paragraph 1.4.

C. In toilets install plumbing pipe safety covers on all exposed piping underneath lavatories and vanities.

END OF SECTION

SECTION 104400- FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Fire extinguishers.
2. Fire extinguisher cabinets.
3. Accessories.

B. Related sections:

1. Section 061000 - Rough Carpentry and Section 092100 - Gypsum Board Assemblies: Blocking for cabinets.

1.2 REFERENCES

A. NFPA 10 - Standard for Portable Fire Extinguishers; National Fire Protection Association; 2007.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.3 QUALITY ASSURANCE

A. Extinguisher, cabinets, and accessories shall be products of a single manufacturer.

B. Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

C. Fire rated cabinets shall meet the requirements of ASTM E814 and be certified and labeled for use in one and two hour wall systems.

1.4 SUBMITTALS

A. Provide in accordance with Section 01330 - Submittal Procedures:

1. Product data including dimensions, operational features, anchorage details, rough-in measurements, and locations.

2. Maintenance data describing test, refill and recharge schedules, and re-certification requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. J. L. Industries, Inc., Los Angeles, California, website: www.jlindustries.com.

B. Larsen's Manufacturing Company, Minneapolis, Minnesota, website: www.larsensmfg.com.

C. Potter-Roemer, Los Angeles, California, website: www.potterroemer.com.

D. Manufacturers of other products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

2.2 FIRE EXTINGUISHERS (FE)

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

1. Provide extinguishers labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

B. Dry Chemical Type Fire Extinguishers: Cast steel tank, with pressure gage.

1. Class 4A-60B:C.

2. Size 10.

3. Finish: Baked enamel, red color.

C. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.

1. Class 2A:1B:C:K for use in Kitchens.

2. Size 6L.

2. Finish: Polished.

2.3 FIRE EXTINGUISHER CABINETS (FEC)

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type, equivalent Larsen Cameo CS2409-6R.
1. Sized to accommodate accessories.

C. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.

D. Door Glazing: Plastic, clear, 1/8 inch thick acrylic. Set in resilient channel gasket glazing.

E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

F. Weld, fill, and grind components smooth.

G. Provide rated cabinets for installation in rated assemblies.

H. Finish of Cabinet Exterior Trim and Door: Primed for field paint finish.

I. Finish of Cabinet Interior: White enamel.

2.4 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets in metal stud and gypsum board partitions and CMU walls and other locations indicated on Drawings.

1. Kitchen: wet chemical extinguisher.

2. All other locations: Semi-recessed cabinet and multi-purpose, dry chemical extinguisher.

B. Verify rough openings for cabinets are correctly sized and located and blocking has been provided.

C. Install in accordance with manufacturer's instructions.

D. Install cabinets plumb and level in wall openings, 42 inches from finished floor to top of cabinet

interior.

E. Secure rigidly in place in accordance with manufacturer's instructions.

F. Place extinguishers in cabinets.

END OF SECTION

SECTION 122100 – WINDOW BLINDS

PART 1 -GENERAL

1.1 SUMMARY

A. This Section includes: Horizontal louver blinds, mounting brackets, and operating hardware.

1.2 REFERENCES

A. FS AA-V-00200- Venetian Blinds.

1.3 SUBMITTALS

A. Provide in accordance with Section 01330 – Submittal Procedures:

1. Product Data

2. Shop drawings indicating opening sizes, tolerance required, and attachment method.

3. 2-inch long sample of each finish and color being provided.

4. Installation and maintenance instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hunter Douglas, Inc., Upper Saddle River, New Jersey; 800-727-8953

B. Levelor Corporation, Garden Grove, California; 800-221-8021

C. Manufacturers of other products submitted and approved in accordance with section 01630 – Product Substitution Procedures.

2.2 LOUVER BLINDS (PROVIDE ON ALL EXTERIOR WINDOWS)

A. Type: Horizontal louver blinds complying with FS AA – V – 00200, with manual control of raising and lowering and blade angle adjustment by control wand; Riviera DustGuard as manufacturing Levelor Corporation.

B. Fabricate blind units to completely fill openings form head to sill and jamb-to-jamb. See drawings for locations and sizes.

C. Quantity: All exterior windows (unless specifically noted not to receive) – excluding rooms specified in 2.3 Vertical Blinds. Interior windows as indicated on drawings – excluding rooms specified in 2.3 Vertical Blinds.

D. Materials:

1. Louver slats: 1 inch wide, 0.008 minimum inch thick spring tempered prefinished aluminum horizontal slats with radiused corners.

2. Slat support: Braided polyester yarn, ladder configuration.

3. Hard rail housing: Formed steel box, prefinished to match slats, internally fitted with hardware, pulleys, and bearings for blind operation.

4. Cord: Braided polyester yarn.

5. Control wand: Extruded clear tubular plastic 7/16-inch diameter. Length shall not exceed height of window opening.

6. Bottom rail: Tubular shape formed from 0.018 inch thick steel sheet prefinished to match slats.
7. Provide hold down brackets for bottom rail.

8. Provide hold down pins and brackets to secure bottom rail jamb or sill.

9. Provide with brackets and all other required hardware.

E. Finish:

1. Louver slats, head rail housing, and bottom rail: Baked- on paint finish.

2. Color: As selected by Architect form manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install blinds on all exterior sliding windows and interior windows as indicated on drawings.

B. Do not commence fabrication until field measurements are confirmed.

C. Position units level, plumb, secure, and at proper height relative to adjacent construction.

D. Secure in place with fasteners recommended by manufacturer.

E. Operate each blind through complete cycle of lowering, tilting, and raising a minimum of three times to ensure proper operation.

F. Clean blinds.

END OF SECTION

SECTION 131200
PRE-ENGINEERED METAL BUILDING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal Building System:
1. Structural steel framing system.
2. Secondary structural framing members.
3. Metal roof systems.
4. Metal wall systems.
5. Flashings, closures and trims.
6. Eave gutters and downspouts.
7. Roof and wall materials.
8. Roof and wall coating systems.
9. Light transmitting panels.
10. Fasteners.
11. Roof and wall insulation systems.
12. Roof curbs.

1.2 REFERENCE STANDARDS

A. American Institute of Steel Construction (AISC):
1. AISC S326 - Specifications for the Design, Fabrication and Erection of Structural Steel Buildings. (Allowable Stress Design)

B. International Accreditation service (IAS):
1. AC472 - Accreditation Criteria for Inspection Programs for Manufacturer of Metal Building Systems, latest edition.

C. American Welding Society (AWS):

1.	AWS D1.1	Structural Welding Code-Steel (Latest Edition Unless Noted)

D. ASTM International (ASTM):

1.	ASTM A36/A572/A992	Structural Steel Shapes
2.	ASTM A653	Steel Sheet, Zinc-Coated (G-90 Galvanized) by Hot-Dip Process, Structural (Physical) Quality.
3.	ASTM A475	Extra High Strength Grade Cable.
4.	ASTM A529	High-Strength Structural Steel Flat Bars
5.	ASTM A1011 SS/HSLAS	Cold-Formed Structural Shapes
6.	ASTM A792 SS	Steel Sheet (For Cladding Panels), Aluminum-Zinc Alloy Coated by Hot-Dip Process
7.	ASTM A53/A500, Gr B	Hollow Structural Shapes
8.	ASTM A307	Common Bolts
9.	ASTM A325/A490	High Strength Bolts

10. ASTM B117 Salt Spray (Fog) Testing
11. ASTM C1371 Measuring Thermal Emittance of Exterior Coatings
12. ASTM C1549 Measuring Solar Reflectance of Exterior Coatings.
13. ASTM D523 Specular Gloss
14. ASTM D659 Measuring Degree of Fade of Exterior Coatings.
15. ASTM D4214 Evaporating Degree of Chalking of Exterior Paints
16. ASTM D968 Abrasion Resistance of Organic Coatings by Falling Abrasive
17. ASTM D2244 Calculation of Color Differences from Instrumentally Measured Color Coordinates
18. ASTM D2247 Testing Water Resistance of Coatings in 100% Relative Humidity.
19. ASTM D2794 Testing Impact resistance of Coating with Direct Impact.

E. Metal Building Manufacturers Association (MBMA)
1. MBMA-01 Metal Buildings System Manual, 2012 edition.

F. Underwriters Laboratories, Inc. (UL)
1. UL 580 Test for Uplift Resistance of Roof Assemblies
2. UL 790 Standard Test Methods for Fire Tests Of Roof Coverings.
3. UL 2218 Impact Resistance of Prepared Roof Covering Materials.

G. Federal Specifications (FS)
1. FS TT-P-664 Protective Coatings for Fabricated Structural Members.

H. Steel Structures Painting Council (SSPC)
1. SP-2 Hand Tool Cleaning

I. FM Global:
1. FM 4471 Approval Standard For Class 1 Panel Roofs.

J. Cool Roof Rating Council (CRRC):
1. CRRC-1 Product Rating Program Manual, November 2013

1.3 SUBMITTALS

A. Product Data: Submit metal building system manufacturer's product information, specifications, and installation instructions for building components and accessories.

B. Erection Drawings: Submit metal building system manufacturer's erection drawings, including plans, elevations, sections, and details, indicating roof framing, transverse cross-sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components.

C. Certification: Submit written "Letter of Certification" prepared and signed by a Professional Engineer, registered to practice in (PROJECT STATE) verifying that the metal building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
1. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads,

end-use categories, governing code bodies, including year, and load applications.

D. Submit certification verifying that the metal roof system has been tested and approved by Underwriter's Laboratory as UL 580 Class 90 or;

E. Submit certification verifying that the metal roof system has been tested and approved by Factory Mutual as Class (1-90, 1-120, 1-135, 1-150, or 1-165).

F. LEED Submittals: Provide documentation for the following:
   1. Credit SS 7.2 Heat Island Effect: product data indicating compliance with solar reflectance index requirement.
   2. Credit MR 4 Recycled Content: product data indicating the following:
      a. Material costs for each product having recycled content
      b. Percentages by weight of pre and post-consumer recycled content.
      c. Total weight of products provided.

G. Warranty Documentation: Submit manufacturer's standard warranties.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer regularly engaged, for a minimum of 20 years, in the manufacture of metal building systems of similar type and scope of that specified.
   2. Accredited based on IAS Accreditation Criteria AC472 and requirements in International Building Code (IBC), Chapter 17.

B. Installer's Qualifications:
   1. Installer regularly engaged, for a minimum of 5 years, in installation of metal building systems of similar type and scope of that specified.
   2. Employ persons trained by the manufacturer for installation of metal building systems.

C. Certificate of design and manufacturing conformance:
   1. Refer to Submittals article of this specification section.

D. Material Test Reports:
   1. In addition to material certifications of structural steel, metal building system manufacturer shall provide, upon request at time of order, evidence of compliance with specifications through testing.
   2. This quality assurance testing shall include testing of structural bolts, nuts, screw fasteners, mastics, and metal coatings (primers, metallic coated products, and painted coil products).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
3. Do not store materials directly on ground.
4. Store materials on flat, level surface, raised above ground, with adequate support to prevent sagging.
5. Protect materials and finish during storage, handling, and installation to prevent damage.

1.6 WARRANTY

A. Standard Weather-tightness Warranty (Available only on Standing Seam Roof Systems)

1. Manufacturer's standard 5, 10, 15 or 20 year limited liability weather-tightness warranty which covers the roof panels, clips and related accessories. It is prorated and does not include flashings. Additional exclusions apply. The warranty includes one (1) inspection visit.
2. Liability, as combined to the manufacturer, is limited to 1 times the original cost of the metal roofing system (square foot of roofing, not building footprint).

B. One Year Workmanship Warranty

1. This warranty provides additional reassurance that Alliance stands behind our products warranting the workmanship of the materials manufactured by Alliance for a period of one year from date of substantial completion.
2. This warranty is supplied at no cost to our customer.

C. Finish Warranties

1. Bare Acrylic-Coated Galvalume™:
    a. Warrant that products will not rupture, fail structurally or perforate within 25 years due to normal atmospheric corrosion.

2. WeatherXL Modified silicone-Polyester Two-Coat System (SMP):
    a. 2,000 hours salt spray resistance per ASTM B117.
    b. Thermal emittance per ASTM C1371 (varies by color).
    c. Solar reflectance per ASTM C1544 (varies by color).
    d. SRI values calculated per ASTM 1980 for LEED cool roof credits.
    e. Specular gloss of 20 to 80 at 60-degree viewing per ASTM D523.
    f. 35 liters abrasion resistance per ASTM D968.
    g. Color fading in excess of five (5) Hunter units per ASTM D2244, for vertical applications for 30 years.
    h. 2,000 hours humidity resistance per ASTM D2247.
    i. Reverse impact resistance of 1.5X per ASTM D2794.
    j. Chalking in excess of a No. 8 rating per ASTM D4214, for vertical applications for 30 years.
    k. Failure of adhesion, peeling, checking or cracking for 40 years.

3. Fluoropolymer Two-Coat System (PVDF/Kynar-500):
    a. 3,000 hours salt spray resistance per ASTM B117.
    b. Thermal emittance per ASTM C1371 (varies by color).
    c. Solar reflectance per ASTM C1544 (varies by color).

d. SRI values calculated per ASTM 1980 for LEED cool roof credits.
e. Specular gloss of 20 to 35 at 60-degree viewing per ASTM D523.
f. 65 liters abrasion resistance per ASTM D968.
g. Color fading in excess of five (5) Hunter units per ASTM D2244, for vertical applications for 20 years.
h. 3,000 hours humidity resistance per ASTM D2247.
i. Reverse impact resistance of 1.5X per ASTM D2794.
j. Chalking in excess of a No. 8 rating per ASTM D4214, for vertical applications for 20 years.
k. Failure of adhesion, peeling, checking or cracking for 35 years.

1.7 BUILDING DESCRIPTION

A. Building Dimensions: Indicated on the Drawings.
1. Horizontal Dimensions: Measure to inside face of wall sheets.
2. Eave Height: Measure from top of finished floor to intersection of insides of roof and sidewall sheets.
3. Clear Height Between Finished Floor and Bottom of Roof Steel: Indicated on the Drawings.

B. Primary Structural Members:
1. Primary Framing System: Alliance Steel, Inc. framing system as specified in this specification section.
2. Frames: Welded-up plate section or structural wide flange columns and roof beams, complete with necessary splice plates for bolted field assembly as specified in this specification section.
3. Bolts for Field Assembly of Primary Steel: High-strength A-325 plain (black) bolts as indicated on erection drawings of metal building system manufacturer.
4. Beam and Post Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
5. Exterior Columns: Welded-up “H” sections or cold-formed “CEE” sections.
6. Interior Columns: “H” sections, pipe or tube columns.
7. Connection of Primary Structural Members: ASTM A-325 plain (black) bolts through factory-punched holes.
8. Primary Structural Members: Factory painted with metal building system manufacturer’s standard red oxide primer with surface preparation as specified in this specification section. Optional Galvanized primary framing is available at an additional cost.

C. Secondary Structural Members:
1. Secondary Framing System: Alliance Steel, Inc. framing system as specified in this section.
2. CEE / ZEE Purlins and Girts: Factory painted with metal building system manufacturer’s standard red oxide primer with surface preparation as specified in this specification section. Optional G90 Galvanized secondary framing is available at an additional cost.

D. Metal Roof System: as specified in this section.

E. Metal Wall System: as specified in this section.

F. Where metal panels must be painted, use coating system as specified in this section.

1.8 DESIGN LOADS

A. Governing Design Code:
   1. Structural design for the building structural system shall be provided by the metal building system manufacturer for the following design criteria:
      a. Governing Building Code: Refer to Drawing Cover Sheet for Code information.
      b. Year/Version: Refer to Drawing Cover Sheet for Code information.
      c. Occupancy Category: Refer to Drawing Cover Sheet for Code information.

B. Roof Live Load:
   1. Roof live loads are loads produced during the life of the structure by moveable objects.
   2. Wind, snow, seismic, or dead loads are not live loads.
   3. Roof live loads are applied based on the Tributary Area.

C. Roof Snow Load:
   1. Roof snow load used for designing the structure shall not be reduced and shall be the product of applicable local building codes.
   2. Design snow load shall include the effects of minimum flat roof load limits, rain on snow, drifting snow, and unbalanced snow load as defined in the governing building code specified above.

D. Wind Load:
   1. Wind load used for designing the structure shall be the product of applicable local building codes.
   2. Wind Pressure Coefficients and the design pressures shall be applied in accordance with applicable local building codes.

E. Seismic Load:
   1. Seismic load used for designing the structure shall be based on applicable local building codes:

F. Dead Load: Dead load shall consist of the weight of building system construction, such as roof, framing, and covering members.

G. Collateral Load:
   1. Collateral load in pounds per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, hung partitions, and ceilings.
   2. This allowance does not include the weight of hung equipment weighing 50 pounds or more.
   3. Equipment loads of 50 pounds or more shall be indicated on the Drawings and the structure shall be strengthened as required.
   4. Architect will provide the metal building system manufacturer with the magnitude and approximate location of concentrated loads greater than 50 pounds before design of the building starts.

H. Auxiliary Loads: Auxiliary loads shall include dynamic loads, such as cranes and material handling systems, and will be defined in the Contract Documents.

I. Crane Loads:
   1. Crane loads shall be a function of the Service Class as defined by the governing code and Crane Manufacturers Association of America (CMAA) and the rated tonnage (A- Standby or Infrequent service, B- Light service, C- Moderate service, D- Heavy Service, E- Severe Service, F- Continuous Severe Service).

2. Cranes in Service Class E or F shall be in accordance with AISE 13.
3. Crane loads will be obtained from the crane manufacturer and supplied by the Architect to the metal building system manufacturer at the time of bid.
4. Building structure shall be designed for the crane loads in accordance with the governing code.
5. Multiple cranes in the same bay or aisle shall be designed in accordance with the governing code.
6. If the governing code does not address multiple crane design practices, MBMA Metal Building Systems Manual shall be used.

J. Load Combinations: Load combinations used to design primary and secondary structural members shall be in accordance with the governing code.

1.9 DEFLECTIONS

A. Structural Members:
1. Maximum deflection of main framing members shall not exceed those limits established by local building codes.
2. Maximum deflection due to snow load in roof panels and purlins shall not exceed those limits established by local building codes.
3. Maximum deflection due to wind load in wall panels and girts shall not exceed those limits established by local building codes.

B. Lateral deflections, or drift, at the roof level of the structure in relation to the floor or slab on grade, caused by deflection of horizontal force resisting elements, shall not exceed those limits established by local building codes.

C. Calculations for deflections shall be done using only the bare frame method.
1. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed.
2. Drift shall be in accordance with AISC Serviceability Design Considerations for Low-Rise Buildings.
3. Use of composite stiffness for deflection calculations is permitted only when actual calculations for the stiffness are included with the design for the specific project.
4. When maximum deflections are specified, calculations shall be included in the design data.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL FRAMING SYSTEM

A. General:
1. Design of Structural System: Clear or multi-span rigid frame with tapered or straight columns and roof beams, with gable or single-slope roof.
2. Actual Building Length:
   a. Structural line to structural line.
   b. Same as nominal; i.e., number of bays times the length of the bays.
   c. Structural Line: Defined as inside face of wall sheets.
3. Actual Building Width:

a. Structural line to structural line.
b. Nominal building width.

4. Minimum Roof Slope: 2 inches in 12 inches.
5. Maximum Roof Slope: 2 inches in 12 inches.
6. Components and Parts of Structural System:
   a. Indicated on the Drawings or the Specifications.
   b. Clearly marked.
   c. Erection Drawings: Supply for identification and assembly of parts.
   d. Drawings: Carry stamp of a registered professional engineer.
7. Foundations:
   a. Foundations, Including Anchor Bolt Embedment Length: Properly designed by qualified engineer, retained by other than metal building system manufacturer, in accordance with specific soil conditions for building site.
   b. Reactions for Proper Design of Foundations: Supplied by metal building system manufacturer.
   c. Anchor Bolts:
      1) Anchor Bolt Diameter: Indicated on anchor bolt layout drawings furnished by metal building system manufacturer.
      2) Anchor Bolts: Supplied by Contractor, not metal building system manufacturer.
      3) Anchor Bolts on Moment-Resisting Column Bases: Nuts above and below base plates.

B. Structural Steel Design:
   1. Structural Mill Sections or Welded-up Plate Sections: Design in accordance with AISC Specification for Structural Steel Buildings.
   2. Cold-Formed Steel Structural Members: Design in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
   3. Structural System: Design in accordance with specified building code (Refer to Design Loads and Building Codes).

C. Primary Framing:
   1. Rigid Frames:
      a. Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly.
         1) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes factory fabricated.
         2) Columns and Roof Beams: Fabricated complete with holes in webs and flanges for attachment of secondary structural members and bracing, except for fieldwork as noted on erection drawings furnished by metal building system manufacturer.
      b. Bolts for Field Assembly of Frame Members: ASTM A-325 high-strength bolts as indicated on erection drawings furnished by metal building system manufacturer.
   2. Endwall Structural Members: Cold-formed channel members designed in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members or welded-up plate sections designed in accordance with AISC Specification for Structural Steel Buildings.
      a. Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
         1) Splice Plates and Base Clips: Shop fabricated complete with bolt connection holes.
         2) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes shop fabricated.

3) Beams and Posts: Factory fabricated complete with holes for attachment of secondary structural members, except for field work as noted on erection drawings furnished by metal building system manufacturer.

b. Intermediate Frames: Substituted for end-wall roof beams, when specified.

1) Factory fabricate necessary endwall posts and holes for connection to intermediate frame used in endwall.

D. Secondary Structural Framing Members:

1. Purlins, Girts and Eave Members: ASTM A 1011 Grade 55 (380), or ASTM A 653 Grade 55 (380).
2. Recycled Content: post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
3. Finish: red oxide primed (G-90 galvanized available at extra cost).
4. Thickness
   a. 16 gauge: 0.056 inch (1.421 mm) minimum uncoated thickness.
   b. 14 gauge: 0.067 inch (1.689 mm) minimum uncoated thickness.
   c. 13 gauge: 0.081 inch (2.051 mm) minimum uncoated thickness.
   d. 12 gauge: 0.100 inch (2.534 mm) minimum uncoated thickness.
5. Purlins:
   a. Purlins:
      1) "ZEE"-shaped, precision-roll-formed, in different gauges to meet specified loading conditions.
      2) 8-inch, 10-inch, or 12-inch-deep "ZEE" sections.
   b. Brace purlins at intervals indicated on erection drawings furnished by metal building system manufacturer.
   c. Concentrated Loads: Hung at purlin panel points.
6. Eave Members:
   a. Eave Struts: Factory punched, 8-inch, 10-inch, or 12-inch-deep "CEE" sections, precision-roll-formed, in different gauges to meet specified loading conditions.
7. Girts:
   a. "ZEE" or "CEE"-shaped, precision-roll-formed, in different gauges to meet specified loading conditions.
   b. 8-inch, 10-inch, or 12-inch-deep "ZEE" or "CEE" sections.
8. Bracing:
   a. Locate bracing as indicated on the Drawings.
   b. Diagonal Bracing:
      1) Cable Bracing conforming to ASTM A475-78 for extra high strength grade or
      2) Structural Angle Bracing or
      3) Hot-rolled rods of sizes indicated on the Drawings.
      4) Attach to columns and roof beams as indicated on the Drawings.
   c. Optional fixed-base wind posts or pinned-base portal frames may be substituted as required.
   d. Flange Braces and Purlin Braces: Cold formed and installed as indicated on the Drawings.

E. Welding:

1. Welding Procedures, Operator Qualifications, and Welding Quality Standards: AWS D1.1 - Structural Welding Code – Steel and AWS D1.3 - Structural Welding Code – Sheet Steel.
2. Welding inspection, other than visual inspection as defined by AWS D1.1, paragraph 6.9, shall be

identified and negotiated before bidding.

3. Certification of Welder Qualification: Supply when requested.

F. Priming of Structural Steel Framing System:

1. General:
   a. Structural Steel: Prime paint as temporary protection against ordinary atmospheric conditions.
   b. Perform subsequent finish painting, if required, in field as specified in the painting section.
   c. Before priming, clean steel of loose rust, loose mill scale, dirt, and other foreign materials.
   d. Steel Fabricator: Not required to sand blast, flame clean, or pickle steel before painting, unless otherwise specified.
2. Primary Frames:
   a. Clean steel in accordance with SSPC-SP2.
   b. Factory cover steel with 1 coat of Alliance Steel's standard Red oxide primer formulated to equal or exceed Federal Specification TTP-664
   c. Minimum Dry Film Thickness: 1.0 mil.
3. Secondary Structural Framing Members – Roll-Formed:
   a. Pre-coated cold form material, red oxide primed, by commercial coater using a preparation process equal to SSPC-SP10.
   b. Minimum Dry Film Thickness: 0.5 mil.
   c. G-90 Galvanized available for extra cost.

2.2 METAL ROOF SYSTEMS

A. Roof covering shall consist of the roof panels, their attachments, trim and sealants for use on the exterior of the roof:

1. Shall be a system of exposed fastener roof panels providing a 36" wide net coverage having 1 ¼" high major ribs at 12" centers and two minor ribs between the major ribs. Sidelaps shall be one full major rib and shall utilize the bearing edge of the underlying major rib for support. Panels shall be continuous from ridge to eave until panel length exceeds 40' and/or the panel becomes prohibitive of handling, in which case endlaps are provided. Endlaps shall be 6" and occur over a supporting member. Roof panels shall be UL 580 Class 90 uplift and UL 2218 Class 4 impact resistant rated.

2. Shall be a system of exposed fastener roof panels providing a 36" wide net coverage having ¾" high major ribs at 6" centers. Sidelaps shall be one full major rib and shall utilize the bearing edge of the underlying major rib for support. Panels shall be continuous from ridge to eave until panel length exceeds 40' and/or the panel becomes prohibitive of handling, in which case endlaps are provided. Endlaps shall be 6" and occur over a supporting member. Roof panels shall be UL 580 Class 90 uplift and UL 2218 Class 4 impact resistant rated.

3. Shall be a system of exposed fastener roof panels providing a 36" wide net coverage having 1-1/2" high major ribs at 7.2" centers. Sidelaps shall be one full major rib. Panels shall be continuous from ridge to eave until panel length exceeds 40' and/or the panel becomes prohibitive of handling, in which case endlaps are provided. Endlaps shall be 6" and occur over a supporting member. Roof panels shall be UL 580 Class 90 uplift and UL 2218 Class 4 impact resistant rated.

4. Shall be a system of standing seam roof panels with either a fixed clip system for rigid

construction or a floating clip system to provide for thermal movement of the panel and have a roof slope of ¼:12 or greater. The 24" wide net coverage has 3" high major ribs at 24" centers, and three minor ribs between the major ribs. The AS-24 roof system shall be installed utilizing concealed steel clips, snap- locked at the side joints and weatherproofed by factory applied sealant and is field seamed with either a TripleLok or QuadLok seam. AS-24 panels shall be continuous from ridge to eave until the panel length exceeds 40' and/or the panels become prohibitive for handling, in which case endlaps are provided. Endlaps shall be 3" and occur 7" above a supporting member, utilizing 16 gage back-up plates. The AS-24 standing seam roof system shall be available for 3 different insulation conditions. The "UTILITY" system (fixed condition only) shall be for buildings without insulation up to 2" of blanket insulation and does not provide for clearance over the purlins. The "LOW" system shall be for buildings with no more than 4" of blanket insulation, but not requiring thermal blocks and will provide 3/8" of clearance over the purlins. The "HIGH" system shall be for buildings with more than 4" of blanket insulation that require thermal blocks and will provide 1 3/8" of clearance over the purlins. Roof panels shall be UL 580 Class 90 uplift and UL 2218 Class 4 impact resistant rated.

5. Shall be a system of standing seam roof panels with either a fixed clip system for rigid construction or a floating clip system to provide for thermal movement of the panel and have a roof slope of ½:12 or greater. The 16" wide net coverage has 2" vertical legs at 16" centers. The ALok-16 roof system shall be installed utilizing concealed steel clips, weatherproofed by factory applied sealant and is field seamed with either a TripleLok or QuadLok seam. ALok-16 panels shall be continuous from ridge to eave until the panel length exceeds 40'and/or the panels become prohibitive for handling, in which case endlaps are provided. Endlaps shall be 3" and occur 7" above a supporting member, utilizing 16 gage back-up plates. The ALok-16 standing seam roof system shall be available for 3 different insulation conditions. The "UTILITY" system (fixed condition only) shall be for buildings without insulation and does not provide for clearance over the purlins. The "LOW" system shall be for buildings with no more than 4" of blanket insulation, but not requiring thermal blocks and will provide 3/8" of clearance over the purlins. The "HIGH" system shall be for buildings with more than 4" of blanket insulation that require thermal blocks and will provide 1" of clearance over the purlins. Roof panels shall be UL 580 Class 90 uplift and UL 2218 Class 4 impact resistant rated.

6. Shall be a system of standing seam roof panels with a fixed clip system for rigid construction over a solid substrate and have a roof slope of 3:12 or greater. The 16" wide net coverage has 1-3/4" vertical legs at 16" centers and striated flat pans. The NFS-16" roof system shall be installed utilizing concealed steel clips, weatherproofed by factory applied sealant and a male/female snaplock rib connection. Field seaming is not required. NFS-16 panels shall be continuous from ridge to eave until the panel length exceeds 40'and/or the panels become prohibitive for handling, in which case endlaps are provided. Endlaps shall be 6" and utilize 16 gage back-up plates. The NFS-16 standing seam roof system shall be available for use over rigid insulation with a bearing plate under the panel clips. Roof panels shall be UL 580 Class 90 uplift and UL 2218 Class 4 impact resistant rated.

7. Shall be a roof covering systems (except for NFS-16) are designed for 6" maximum blanket insulation thickness over the purlin.

2.3 METAL WALL SYSTEMS

A. Wall covering shall consist of the wall panels, their attachments, trim and sealants for use on the exterior of the walls or as interior liner walls as follows:

1. Shall be a system of exposed fastener wall panels providing a 36” wide net coverage having 1 ¼” high major ribs at 12” centers and two minor ribs between the major ribs. Sidelaps shall be one full major rib and shall utilize the bearing edge of the underlying major rib for support. Panels shall be continuous from eave to sill until panel length exceeds 35’ and/or the panel becomes prohibitive of handling, in which case endlaps are provided. Endlaps shall be 4” and occur over a supporting member.

2. Shall be a system of exposed fastener wall panels providing a 36” wide net coverage having ¾” high major ribs at 6” centers. Sidelaps shall be one full major rib and shall utilize the bearing edge of the underlying major rib for support. Panels shall be continuous from eave to sill until panel length exceeds 35’ and/or the panel becomes prohibitive of handling, in which case endlaps are provided. Endlaps shall be 4” and occur over a supporting member.

3. Shall be a system of exposed fastener wall panels providing a 36” wide net coverage having 1 ¼” deep major ribs at 12” centers and one sculptured valley shape between major ribs. Sidelaps shall be one major rib and shall utilize the bearing edge of the underlying major rib for support. Alliance “PBA” panels shall be continuous from eave to sill until the panel length exceeds 35’ and/or the panel becomes prohibitive of handling in which case endlaps are provided. Endlaps shall be 4” and occur over a supporting member.

4. Shall be a system of exposed fastener wall panels providing a 36” wide net coverage having 1-1/2” high major ribs at 7.2” centers. Sidelaps shall be one full major rib. Panels shall be continuous from eave to sill until panel length exceeds 35’ and/or the panel becomes prohibitive of handling, in which case endlaps are provided. Endlaps shall be 6” and occur over a supporting member. This profile can alternatively be installed in a horizontal application.

5. Shall be a system of exposed fastener wall panels providing a 36” wide net coverage having 7/8” high symmetrically corrugated sine wave ribs at 2.67” on center. Sidelaps shall be one and one-half ribs. Panels shall be continuous from eave to sill until panel length exceeds 35’ and/or the panel becomes prohibitive of handling, in which case endlaps are provided. Endlaps shall be 6” and occur over a supporting member.

6. Shall be a system of concealed fastener wall panels providing 16” wide net coverage and 3” deep ribs with a 5-1/2” wide x 1-1/2” deep center reveal. Panel ribs are connected to the framework with a concealed clip system. Panels shall be continuous from eave to sill until panel length exceeds 35’ and/or the panel becomes prohibitive of handling, in which case endlaps are provided. Endlaps shall be 6” and occur over a supporting member.

7. Shall be a system of concealed fastener soffit panels providing 12” wide net coverage and 1” deep ribs. Panel ribs are positively connected to the framework with concealed self-drilling screws spaced 24” on center. Panels shall be continuous from wall out to eave or gable.

2.4 FLASHINGS, CLOSURES AND SEALANTS:

A. Flashings

1. Flashing and/or trim shall be furnished at the rake, corners, eaves, framed openings and wherever necessary to provide weather-tightness and a finished appearance.
2. A die-formed ridge-cap panel, matching the adjoining roof panels, shall be provided along the building for roof slopes up through 6:12.
3. Colors of flashings/trims are to match the adjoining panel unless noted otherwise.

4. Eave gutters shall be sized and provided to remove the volume of water emanating from the roof. The face of the gutter will match the profile of the rake trim. All gutter sections will be securely fastened and contain sealed endlaps and terminations.
5. Downspouts shall be sized and spaced to remove the volume of water emanating from the roof. The color of the downspouts will match the adjoining panels unless otherwise noted. Downspouts shall be securely attached to the building. Water kick outs shall be provided at the bottom of each downspout.

B. Profiled panel closures: closures shall be an interlocking closed cell foam material of a gray or neutral color, and shall be die cut to the profile shape. Profile panel closures shall have a minimum service temperature of -100 to +180-degrees Fahrenheit.

C. Field-applied roof panel sealants shall normally be pre-formed roll-tape mastic sealants, tube sealants, and closures as required for weather-tightness of the roof.

D. Mastic tape sealants for exposed fastener side lapped panels shall be of preformed butyl rubber base, and shall normally be supplied as a 3/32" x 1/2" extruded shape. 3/32" x 3/4" and 3/16" x 1" sizes are also available. The sealant shall be non-shrinking, non-drying, non-toxic and non-curing. The sealant shall adhere to roof surfaces from -40 to +200-degrees Fahrenheit.

E. Field- applied gunnable sealants shall be TiteBond clear polymer sealant for non-exposed (non-curing) applications and Sonneborne NP-1 Urethane sealant for exposed (curing) applications.

2.5 ROOF AND WALL PANEL MATERIALS:

A. Panel Materials: ASTM A 792.

B. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

C. Thickness and Yield strength:
   a. 26 gauge: 0.0172 inch (0.437 mm) minimum uncoated thickness, 80 ksi (550 MPa) yield strength.
   b. 24 gauge: 0.212 inch (0.538 mm) minimum uncoated thickness, 50 ksi (340 MPa) yield strength.
   c. 22 gauge: 0.0272 inch (0.690 mm) minimum uncoated thickness, 50 ksi (340 MPa) yield strength.

D. Panel profiles shall be provided in accordance with the specifications below:

1. Roof and wall panels: 26 or 24 gauge steel, AZ-55 bare Galvalume, WeatherXL (SMP) and Kynar-500 painted. 22 gauge steel is available for an additional cost.

2. LT 3.3 roof and wall panels: 26 or 24 gauge steel, AZ-55 bare Galvalume, WeatherXL (SMP) and Kynar-500 painted. 22 gauge steel available for an additional cost.

3. Wall panels: 24 gauge steel, AZ-55 bare Galvalume, WeatherXL (SMP) and Kynar-500 painted. 22 gauge steel is available for an additional cost.

4. Wall panels: 26 or 24 gauge steel, AZ-55 bare Galvalume, WeatherXL (SMP) and Kynar-500 painted. 22 gauge steel is available for an additional cost.

5. AW-16 wall panels: 24 gauge steel, AZ-55 bare Galvalume, WeatherXL (SMP) and Kynar-500 painted.

6. ALok-16", and NFS-16"roof panels: 24 gauge steel, AZ-55 bare Galvalume, WeatherXL (SMP) and Kynar-500 painted. 22 gauge steel is available for an additional cost.

7. AS-24" Standing seam: 24 gauge steel, AZ-55 bare Galvalume, WeatherXL (SMP) and Kynar-500 painted. 22 gauge steel is available for an additional cost.

8. A-12 Soffit panels: 24 gauge steel, AZ-55 bare Galvalume, WeatherXL (SMP) and Kynar-500 painted. 22 gauge steel is available for an additional cost.

2.6 ROOF AND WALL COATING SYSTEMS

A. Galvalume™: Aluminum-Zinc Alloy Coating, 55% Aluminum, 50% Zinc coated steel per ASTM A 792 AZ55.

B. Galvalume-Plus™: Acrylic-Coated Aluminum-Zinc Alloy Coating, 55% Aluminum, 50% Zinc coated steel per ASTM A 792 AZ55 with acrylic finish.

C. Exterior Paint Finishes:

1. WeatherXL Modified Silicone-Polyester Two-Coat System (SMP): 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat.

2. Fluoropolymer Two-Coat System (PVDF/Kynar-500): 0.2 – 0.3 mil primer with 0.7 – 0.8 mil 70 percent PVDF fluoropolymer color coat.

3. Fluoropolymer Two-Coat Metallic System (PVDF/Kynar-500 Metallic): 0.2 – 0.3 mil primer with 0.7 – 0.8 mil 70 percent PVDF metallic fluoropolymer color coat.

4. Interior (backer side) paint: 0.5 mil total dry film thickness consisting of a primer coat and wash coat of manufacturer's standard light-colored acrylic or polyester backer finish.

D. Roof panels shall normally be unfinished Galvalume™ or Acrylic-coated Galvalume™ zinc-aluminum alloy coated steel or provided prefinished with an exterior paint finish over zinc-aluminum alloy coated steel.

E. Wall panels shall normally be provided prefinished with an exterior paint finish over zinc-aluminum alloy coated steel.

F. Flashings shall normally be of 26 or 24 gauge Grade D steel and shall be provided in the same exterior paint finish as the adjoining roof or wall panel profile unless noted otherwise.

2.7 LIGHT TRANSMITTING PANELS

A. Material: Provide UV-resistant, Woven fiber-reinforced acrylic light transmitting panels meeting the following requirements;

1. Self-Ignition Temperature: 650 degrees Fahrenheit (343 degrees Celsius) when tested in

accordance with ASTM D 1929.

2. Diffuse Light transmission: not less than 50% when tested to ASTM D 1494.
3. Burn Rate: Less than 2.5 inches per minute when tested in accordance with ASTM D 635.
4. Smoke Developed Index: Not greater than 450 when tested in accordance with ASTM E 84.
5. Haze Value: Not less than 90% in accordance with ASTM D 1003.

2.8 FASTENERS

A. Exposed fastener roof panels: fasteners shall be self-drilling and self-tapping long life ZAC alloy coated with integral molded washers, painted to match the material when necessary.

B. Exposed fastener wall panels: fasteners shall be self-drilling and self-tapping cadmium/zinc plated with integral molded washers, painted to match the wall panels when necessary.

C. Standing seam roof panels: fasteners shall be self-drilling and self-tapping long life ZAC alloy coated with integral molded washers, painted to match the material when necessary.

D. Ridge: self-drilling and self-tapping long life ZAC alloy coated with integral molded washers, painted to match the material when necessary.

E. Clips to purlin or bar joists: self-drilling and self-tapping cadmium/zinc plated with integral molded washers.

F. Rivets for connecting light gauge flashings shall be stainless steel, painted to match the material when necessary.

2.9 ROOF AND WALL INSULATION (Available on request)

A. Laminated fiberglass insulation shall have a density of 0.75 pounds per cubic foot and shall be available in thickness from 2” to 6”. Fiberglass facings shall be laminated on one side, solar reflective laminates are available. Fiberglass insulation shall have a flame spread rating of 25 or less when tested per ASTM E 84.

2.10 ROOF CURBS (Available on request)

A. Engineered and custom fabricated roof curbs shall be constructed from #3003 aluminum with continuously welded seams and integral water diverters. Minimum curb sidewall height is 12” and is insulated with foil-faced insulated sidewalls.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine area to receive metal building system.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 ERECTION – STRUCTURAL STEEL FRAMING SYSTEM

A. Erect structural steel framing system in accordance with the Drawings and metal building system manufacturer's erection drawings.

B. Field Modifications:
   1. Require approval of metal building system manufacturer.
   2. Responsibility of building erector.
   3. Field Modifications to Truss Purlins: Not allowed, unless indicated on erection drawings furnished by metal building system manufacturer.

C Fixed Column Bases: Grout flush with floor line after structural steel erection is complete.

3.3 INSTALLATION – METAL ROOF SYSTEM

A. Metal Roof System Installation:
   1. Install roof system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
   2. Install roof system weathertight.

3.4 INSTALLATION – METAL WALL SYSTEM

A. Metal Wall System Installation:
   1. Install wall system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
   2. Install wall system weathertight.
   3. Verify structural system is plumb before wall panels are attached.
   4. Align and attach wall panels in accordance with erection drawings furnished by metal building system manufacturer.
   5. Install side laps with minimum of 1 full corrugation.
   6. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

3.5 INSTALLATION – INSULATION

A. Insulation Installation: Install insulation in accordance with manufacturer's instructions at locations indicated on the Drawings.

3.6 PROTECTION

A. Protect installed metal building system to ensure that, except for normal weathering, metal building system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome plated finish and setscrew fastener.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
d. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

A. One-Piece, Bronze Ball Valves:

1. Apollo, FNW, NIBCO, Watts or approved equal.
2. Description:

    a. Standard: MSS SP-110.
    b. CWP Rating: 400 psig.
    c. Body Design: One piece.
    d. Body Material: Bronze.
    e. Ends: Threaded.
    f. Seats: PTFE.
    g. Stem: Bronze.
    h. Ball: Chrome-plated brass.
    i. Port: Reduced.
    j. Port: Regular.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.3 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. One piece, bronze ball valve with bronze trim.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psigminimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psigminimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inchesbeyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal 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 the building structure.

B. Metal 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 for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inchesthick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment support in first paragraph below requires calculating and detailing at each use.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

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 allowed by 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 incheslong 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 or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 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/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.4 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.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. 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.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Brady, LEM, Seton or approved equal.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch-thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. 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-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Brady, LEM, Seton or approved equal.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: White.

D. Background Color: Red.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. 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-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. Brady, LEM, Seton or approved equal

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include 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: Size letters according to ASME A13.1 for piping.

PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.2 PIPE LABEL INSTALLATION

A. Pipe Label Locations: 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 and on both sides of 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.

B. Pipe Label Color Schedule:

1. Low-Pressure Compressed Air Piping:

   a. Background: Safety blue.
   b. Letter Colors: White.

2. High-Pressure Compressed Air Piping:

   a. Background: Safety blue
   b. Letter Colors: White

3. Domestic Water Piping

   a. Background: Safety green
   b. Letter Colors: White

4. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Safety purple.
   b. Letter Color: White.

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Domestic recirculating hot-water piping.
3. Sanitary waste piping exposed to freezing conditions.
4. Storm-water piping exposed to freezing conditions.
5. Roof drains and rainwater leaders.
6. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.2 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

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.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Special-Shaped Insulation: ASTM C 552, Type III.
2. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
3. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. 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. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. 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. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. 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).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. 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. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. 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. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: Color-code jackets based on system. Color as selected by Architect.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Sheet and roll stock ready for shop or field sizing.
2. Finish and thickness are indicated in field-applied jacket schedules.
3. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
4. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
5. Factory-Fabricated Fitting Covers:

    a. Same material, finish, and thickness as jacket.
    b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    c. Tee covers.
    d. Flange and union covers.
    e. End caps.
    f. Beveled collars.
    g. Valve covers.
    h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, galvanized steel.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

      a. For below-ambient services, apply vapor-barrier mastic over staples.

   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

   1. Vibration-control devices.
   2. Testing agency labels and stamps.

3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 3/4 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
3. Polyolefin: 3/4 inch thick.

B. Stormwater and Overflow: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
3. Polyolefin: 1 inch thick.

C. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
3. Polyolefin: 1 inch thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:

1. Flexible Elastomeric: 1/2 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
3. Polyolefin: 1/2 inch thick.

E. Sanitary Waste Piping Where Heat Tracing Is Installed: Mineral-fiber, preformed pipe insulation, Type I, 1-1/2 inches thick.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping: Insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Flexible Elastomeric: 2 inches thick.

3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
4. Polyolefin: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Flexible Elastomeric: 2 inches thick.
3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
4. Polyolefin: 2 inches thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed: Insulation shall be[one of] the following:

1. Cellular Glass: 2 inches thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.15 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.16 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. PVC: 20 mils thick.
2. Aluminum, Corrugated: 0.016 inch thick.

D. Piping, Exposed:Retain one of four subparagraphs below.

1. PVC: 20 mils thick.
2. Aluminum, Corrugated: 0.016 inch thick.

3.17 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. PVC: 20 mils thick.
3. Aluminum, corrugated: 0.016 inch thick.

D. Piping, Exposed:

1. PVC: 20 mils thick.
2. Aluminum, corrugated: 0.016 inch.

3.18 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Copper Push-on-Joint Fittings:

1. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
2. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:

1. ASTM A 53/A 53M, Type E, Grade B Standard Weight.
2. Include ends matching joining method.

B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.

C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable-Iron Unions:

1. ASME B16.39, Class 150.
2. Hexagonal-stock body.
3. Ball-and-socket, metal-to-metal, bronze seating surface.

4. Threaded ends.

E. Flanges: ASME B16.1, Class 125, cast iron.

2.5 CPVC PIPING

A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40 and Schedule 80.

1. CPVC Socket Fittings: ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80.
2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.

B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.

C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.6 PEX TUBE AND FITTINGS

A. PEX Distribution System: ASTM F 877, SDR 9 tubing.

B. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.

C. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

2.7 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.

B. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

2.8 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.9 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Plastic-to-Metal Transition Fittings:

1. Description:

a. PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:

1. Description:

a. PVC four-part union.
b. Brass threaded end.
c. Solvent-cement-joint or threaded plastic end.
d. Rubber O-ring.
e. Union nut.

2.10 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 125 psig minimum at 180 deg F.

4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Nonconducting materials for field assembly of companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

G. Install domestic water piping level without pitch and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install PEX piping with loop at each change of direction of more than 90 degrees.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

U. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

I. Joints for PEX Piping: Join according to ASTM F 1807.

J. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unitions.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

J. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

K. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.

L. Install hangers for vertical PEX piping every 48 inches.

M. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8: 48 inches with 7/8-inch rod.

N. Install supports for vertical PVC piping every 48 inches.

O. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
3. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

F. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12, shall be the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

G. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

H. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L; copper push-on-joint fittings; and push-on joints.
4. PEX tube, NPS 1 and smaller; fittings for PEX tube; and crimped joints.

I. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be [one of] the following:

1. Hard copper tube, ASTM B 88, Type L; cast-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L; copper push-on-joint fittings; and push-on joints.

J. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:

1. CPVC, Schedule 80; socket fittings; and solvent-cemented joints.
2. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
3. PVC, Schedule 80; socket fittings; and solvent-cemented joints.

END OF SECTION

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Temperature-actuated, water mixing valves.
2. Hose bibbs.
3. Water-hammer arresters.
4. Trap-seal primer valves.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 22 11 16 "Domestic Water Piping" for water meters.
3. Section 22 47 16 "Pressure Water Coolers" for water filters for water coolers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 60 psig unless otherwise indicated or with engineering approval.

2.3 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices MXV-1:

1. Wilkins ZW1070XL
2. Standard: ASSE 1070.
3. Pressure Rating: 145 psig.
4. Type: Thermostatically controlled, water mixing valve.

5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 105 deg F.
9. Tempered-Water Design Flow Rate: .35 gpm.
10. Valve Finish: Rough bronze.

2.4 HOSE BIBBS

A. Hose Bibbs HB-1:

1. Zurn Z1341.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 threaded or solder-joint inlet.
5. Pressure Rating: 125 psig.
6. Vacuum Breaker: Integral, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
7. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
8. Finish for Service Areas: Rough bronze.
9. Operation for Service Areas: Wheel handle.

2.5 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters SA-1:

1. Zurn Z1700.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.6 TRAP-SEAL PRIMER DEVICE

A. Drainage-Type, Trap-Seal Primer Device:

1. Zurn Z1072.
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

B. Install water-hammer arresters in water piping according to PDI-WH 201.

C. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each device according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Section:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.3 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, 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. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, [Service] class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stops.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stops.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

D. Solvent Cement: ASTM D 2235.

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C 1173.
    b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
        2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C 1460.
    b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Install aboveground ABS piping according to ASTM D 2661.

O. Install aboveground PVC piping according to ASTM D 2665.

P. Install underground ABS and PVC piping according to ASTM D 2321.

Q. Plumbing Specialties:

1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.

2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

I. Install supports for vertical copper tubing every 10 feet.

J. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.

K. Install supports for vertical ABS and PVC piping every 48 inches.

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed [ABS] [and] [PVC] Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be [any of] the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be [any of] the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

G. Underground, soil and waste piping [NPS 5 and larger] <Insert pipe size range> shall be [any of] the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Floor drains.
3. Grease interceptors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Cast-Iron Floor Cleanouts GCO and FCO:

1. Zurn Z1402-HD and Z1400-BZ.
2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Threaded.
8. Closure: Cast-iron plug.
9. Top Loading Classification: Extra Heavy Duty.

B. Cast-Iron Wall Cleanouts WCO:

1. Zurn Z1446.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
8. Wall Access: Round wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains FD-1:

1. Z415-B
2. Standard: ASME A112.6.3 with backwater valve.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Outlet: Bottom.
6. Backwater Valve: Drain-outlet type.
7. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
8. Top or Strainer Material: Bronze.
9. Top of Body and Strainer Finish: Polished bronze.
10. Top Shape: Round.

2.3 GREASE INTERCEPTORS

A. Grease Interceptors GI-1:

1. Cast-Iron or Steel Grease Interceptors:

    a. ZURN GT2701-20.
2. Standard: ASME A112.14.3 and PDI-G101, for intercepting and retaining fats, oils, and greases from food-preparation.
3. Plumbing and Drainage Institute Seal: Required.
4. Body Material: Cast iron.
5. Interior Lining: Corrosion-resistant enamel.
6. Exterior Coating: Corrosion-resistant enamel.
7. Body Dimensions: 32-3/8 x 20-3/4 x 6-3/4 inch.
8. Flow Rate: 20 gpm
9. Grease Retention Capacity: 40 gal.
10. Inlet and Outlet Size: 3 inch.
11. End Connections: Hub.
12. Cleanout: Integral.
13. Mounting: Recessed, flush with floor.
14. Flow-Control Fitting: Required.
15. Operation: Manual cleaning.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install deep-seal traps on floor drains and other waste outlets, if indicated.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

H. Install vent caps on each vent pipe passing through roof.

I. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 33 00 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Commercial, light-duty, storage, electric, domestic-water heaters.
   2. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

B. Source quality-control reports.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex, "Drinking Water System Components - Health Effects."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

   1. Warranty Periods: From date of Substantial Completion.

      a. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: Three years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1. Bradford White LE150L3-3.
2. Storage-Tank Construction: Steel, vertical arrangement, low boy.

    a. Pressure Rating: 300 psig.
    b. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Insulation: Comply with ASHRAE/IESNA 90.1.
    c. Jacket: Steel with enameled finish.
    d. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    e. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation unless otherwise indicated. Limited to 12 kW total.
    f. Temperature Control: Adjustable thermostat.
    g. Safety Control: High-temperature-limit cutoff device or system.
    h. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

B. Capacity and Characteristics:

1. Capacity: 47 gal..
2. Recovery: 62 gph at 60 deg F temperature rise.
3. Temperature Setting: 125 deg F.
4. Power Demand: 9KW.
5. Heating Elements:

    a. Number of Elements: Two.
    b. Kilowatts Each Element: 4.5KW.
    c. Number of Stages: Two.

6. Electrical Characteristics:

    a. Volts: 208.
    b. Phases: Three.
    c. Hertz: 60.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. A.O. Smith PMC-5
2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.
b. Capacity Acceptable: 4.4 gallon minimum.
c. Air Precharge Pressure: 38 psig.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- maximum outlet pressure unless otherwise indicated.

F. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

G. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

I. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

J. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

K. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base.

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping,"

C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains

G. Install thermometers on outlet piping of electric, domestic-water heaters.

H. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig.

I. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

J. Fill electric, domestic-water heaters with water.

K. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 22 42 13.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water closets.
2. Toilet seats.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets WC-1 Floor mounted, bottom outlet.

1. Kohler K-3493
2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Style: Tank.
d. Height: Handicapped/elderly, complying with ICC/ANSI A117.1.
e. Rim Contour: Elongated.
f. Water Consumption: 1.6 gal. per flush.
g. Spud Size and Location: NPS 1-1/2; top.
h. Color: White.

TOILET SEATS

B. Toilet Seats

1. Kohler K-4652
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard).
5. Shape: Elongated rim, closed front.
6. Hinge: Check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Required.
9. Color: White.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.2 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.3 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.4 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 16.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory L-1: Oval, self rimming, vitreous china, counter mounted.

1. Kohler K-2196-4
2. Fixture:

    a. Standard: ASME A112.19.2/CSA B45.1.
    b. Type: Self-rimming for above-counter mounting.
    c. Nominal Size: Oval, 20-1/4 by 17 inches.
    d. Faucet-Hole Punching: Three holes, 4-inch centers.
    e. Faucet-Hole Location: Top.
    f. Color: White.
    g. Mounting Material: Sealant.

3. Faucet: Insert lavatory faucet designation from "Solid-Brass, Manually Operated Faucets" Article.

2.2 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Manual-type, two-handle mixing, commercial, solid-brass valve.

1. Kohler K-45102-4.
2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: Centerset.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 0.5 gpm.
8. Mounting Type: Deck, concealed.
9. Valve Handle(s): Wrist blade.
10. Spout: Rigid type.
11. Spout Outlet: Aerator.
12. Operation: Noncompression, manualW.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 1/2.
2. Chrome-plated, soft-copper flexible tube ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

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

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Indicate on Drawings those lavatories that are required to be accessible.

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 16.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Utility sinks.
2. Handwash sinks.
3. Faucets.
4. Supply fittings.
5. Waste fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 UTILITY SINKS

A. Utility Sinks MS-1: Stainless steel, counter mounted.

1. Universal BS1818-1
2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Ledge back.
c. Number of Compartments: One.
d. Overall Dimensions: 18 x 18 inch.
e. Metal Thickness: 0.050 inch.
f. Compartment:

1) Dimensions: 18 x 18 x 36.
2) Drain: Grid with NPS 2 tailpiece and twist drain.
3) Drain Location: Centered in compartment.

3. Faucet(s): Universal JSPS-33.

a. Number Required: One.
b. Mounting: On ledge.

4. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Wheel handle.
2) Risers: NPS 1/2, ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

5. Waste Fittings:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Trap(s):

1) Size: NPS 2.
2) Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall and chrome-plated brass or steel wall flange.
3) Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

c. Continuous Waste:

1) Size: NPS 2.
2) Material: Chrome-plated, 0.032-inch- thick brass tube.

6. Mounting: On counter with sealant.

2.2 HANDWASH SINKS

A. Handwash Sinks HS-1 Stainless steel, wall mounted.

1. Regency 600HS17
2. Fixture:

a. Standards: ASME A112.19.3/CSA B45.4 and NSF/ANSI 2.
b. Type: Basin with radius corners, back for faucet, and support brackets.
c. Nominal Size: 17 by 16 by 5 inches.
d. Faucet: Regency 8” gooseneck faucet.

3. Faucet: Insert sink-faucet designation from "Sink Faucets" Article>.
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.
6. Support: ASME A112.6.1M, Type II, sink carrier.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 1/2
2. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2.
2. Material: Chrome-plated, one-piece, cast-brass trap with swivel 0.029-inch- thick tubular brass wall bend; and chrome-plated brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

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

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 47 16 - PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pressure water coolers and related components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to 2% percent of quantity installed for each type and size indicated, but no fewer than 2 of each.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers EWC-1: Wall mounted, wheelchair accessible.

1. Hasley Taylor HACG8BLPV-WF
2. Cabinet: Bi-level with two attached cabinets.
3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
4. Control: Push bar.
5. Drain: Grid with NPS 1-1/4 tailpiece.
6. Supply: NPS 3/8 with shutoff valve.
7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
8. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

10. Capacities and Characteristics:

    a. Cooled Water: 8 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F.
    d. Cooled-Water Temperature: 50 deg F.

e. Cooled-Water Storage: <Insert value>.
f. Electrical Characteristics:

1) Volts: 120-V ac.
2) Phase: Single.
3) Hertz: 60.
4) Full-Load Amperes: 4.5.

11. Support: ASME A112.6.1M, Type I water-cooler carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set freestanding pressure water coolers on floor.

C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.15 "Gate Valves for Plumbing Piping."

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.15 "Gate Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch-thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch-thick, 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 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-quarters the size of principal lettering.

G. Fasteners: Stainless-steel 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.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include 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: Size letters according to ASME A13.1 for piping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulates.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Pipe Label Locations: 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 and on both sides of 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.

B. Pipe Label Color Schedule:

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.
b. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:

a. Constant-flow hydronic systems.
b. Variable-flow hydronic systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.3 ACTION SUBMITTALS

A. LEED Submittals:

1. Air-Balance Report for Prerequisite IEQ 1: Documentation indicating that work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
2. TAB Report for Prerequisite EA 2: Documentation indicating that work complies with ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.4 INFORMATIONAL SUBMITTALS

A. Strategies and Procedures Plan: Within 30 > days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC, NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

   a. Duct systems are complete with terminals installed.
   b. Volume, smoke, and fire dampers are open and functional.
   c. Clean filters are installed.
   d. Fans are operating, free of vibration, and rotating in correct direction.
   e. Variable-frequency controllers' startup is complete and safeties are verified.
   f. Automatic temperature-control systems are operational.
   g. Ceilings are installed.
   h. Windows and doors are installed.
   i. Suitable access to balancing devices and equipment is provided.

2. Hydronic:

   a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
   b. Piping is complete with terminals installed.
   c. Water treatment is complete.
   d. Systems are flushed, filled, and air purged.
   e. Strainers are pulled and cleaned.
   f. Control valves are functioning per the sequence of operation.
   g. Shutoff and balance valves have been verified to be 100 percent open.
   h. Pumps are started and proper rotation is verified.
   i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
   j. Variable-frequency controllers' startup is complete and safeties are verified.
   k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from commissioning authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:

a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
d. Adjust controls so that terminal is calling for minimum airflow.
e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.

5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

6. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
b. Verify that terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
9. Verify final system conditions as follows:

a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
b. Re-measure and confirm that total airflow is within design.
c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
d. Mark final settings.
e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
f. Verify tracking between supply and return fans.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:

1. Check liquid level in expansion tank.
2. Check highest vent for adequate pressure.
3. Check flow-control valves for proper position.
4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.

1. Measure total water flow.

a. Position valves for full flow through coils.
b. Measure flow by main flow meter, if installed.
c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

2. Measure pump TDH as follows:

a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
c. Convert pressure to head and correct for differences in gage heights.
d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow-measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow-measuring devices installed at terminals for each space to design water flows.

1. Measure flow at terminals.
2. Adjust each terminal to design flow.
3. Re-measure each terminal after it is adjusted.
4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after flows have been balanced.

D. For systems with pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.
2. Perform temperature tests after flows have been verified.

E. For systems without pressure-independent valves or flow-measuring devices at terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.
2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

G. Verify that memory stops have been set.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.

B. Adjust the variable-flow hydronic system as follows:

1. Verify that the differential-pressure sensor is located as indicated.
2. Determine whether there is diversity in the system.

C. For systems with no diversity:

1. Adjust pumps to deliver total design gpm.

a. Measure total water flow.

1) Position valves for full flow through coils.
2) Measure flow by main flow meter, if installed.
3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

b. Measure pump TDH as follows:

1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
3) Convert pressure to head and correct for differences in gage heights.
4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

2. Adjust flow-measuring devices installed in mains and branches to design water flows.

a. Measure flow in main and branch pipes.
b. Adjust main and branch balance valves for design flow.
c. Re-measure each main and branch after all have been adjusted.

3. Adjust flow-measuring devices installed at terminals for each space to design water flows.

a. Measure flow at terminals.
b. Adjust each terminal to design flow.
c. Re-measure each terminal after it is adjusted.
d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
e. Perform temperature tests after flows have been balanced.

4. For systems with pressure-independent valves at terminals:

a. Measure differential pressure and verify that it is within manufacturer's specified range.
b. Perform temperature tests after flows have been verified.

5. For systems without pressure-independent valves or flow-measuring devices at terminals:

a. Measure and balance coils by either coil pressure drop or temperature method.
b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

6. Prior to verifying final system conditions, determine the system differential-pressure set point.
7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
8. Mark final settings and verify that all memory stops have been set.
9. Verify final system conditions as follows:

    a. Re-measure and confirm that total water flow is within design.
    b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
    c. Mark final settings.

10. Verify that memory stops have been set.

D. For systems with diversity:

1. Determine diversity factor.
2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
3. Adjust pumps to deliver total design gpm.

    a. Measure total water flow.

        1) Position valves for full flow through coils.
        2) Measure flow by main flow meter, if installed.
        3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

    b. Measure pump TDH as follows:

        1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
        2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
        3) Convert pressure to head and correct for differences in gage heights.
        4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
        5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

    c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

4. Adjust flow-measuring devices installed in mains and branches to design water flows.

    a. Measure flow in main and branch pipes.
    b. Adjust main and branch balance valves for design flow.
    c. Re-measure each main and branch after all have been adjusted.

5. Adjust flow-measuring devices installed at terminals for each space to design water flows.

    a. Measure flow at terminals.
    b. Adjust each terminal to design flow.
    c. Re-measure each terminal after it is adjusted.
    d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
    e. Perform temperature tests after flows have been balanced.

6. For systems with pressure-independent valves at terminals:

    a. Measure differential pressure, and verify that it is within manufacturer's specified range.

b. Perform temperature tests after flows have been verified.

7. For systems without pressure-independent valves or flow-measuring devices at terminals:

   a. Measure and balance coils by either coil pressure drop or temperature method.
   b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
9. Prior to verifying final system conditions, determine system differential-pressure set point.
10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
11. Mark final settings and verify that memory stops have been set.
12. Verify final system conditions as follows:

    a. Re-measure and confirm that total water flow is within design.
    b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
    c. Mark final settings.

13. Verify that memory stops have been set.

3.10 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.
5. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.

6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Preheat-coil static-pressure differential in inches wg.
    g. Cooling-coil static-pressure differential in inches wg.
    h. Heating-coil static-pressure differential in inches wg.
    i. Outdoor airflow in cfm.
    j. Return airflow in cfm.
    k. Outdoor-air damper position.
    l. Return-air damper position.
    m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

    a. System identification.
    b. Location.
    c. Coil type.
    d. Number of rows.
    e. Fin spacing in fins per inch o.c.
    f. Make and model number.
    g. Face area in sq. ft..
    h. Tube size in NPS.
    i. Tube and fin materials.
    j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

    a. Airflow rate in cfm.
    b. Average face velocity in fpm.
    c. Air pressure drop in inches wg.
    d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
    e. Return-air, wet- and dry-bulb temperatures in deg F.
    f. Entering-air, wet- and dry-bulb temperatures in deg F.
    g. Leaving-air, wet- and dry-bulb temperatures in deg F.
    h. Water flow rate in gpm.
    i. Water pressure differential in feet of head or psig.
    j. Entering-water temperature in deg F.
    k. Leaving-water temperature in deg F.
    l. Refrigerant expansion valve and refrigerant types.
    m. Refrigerant suction pressure in psig.
    n. Refrigerant suction temperature in deg F.
    o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Fuel type in input data.
    g. Output capacity in Btu/h.
    h. Ignition type.

i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Airflow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.

h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

    a. System and air-handling-unit identification.
    b. Location and zone.
    c. Room or riser served.
    d. Coil make and size.
    e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

    a. Airflow rate in cfm.
    b. Entering-water temperature in deg F.
    c. Leaving-water temperature in deg F.
    d. Water pressure drop in feet of head or psig.
    e. Entering-air temperature in deg F.
    f. Leaving-air temperature in deg F.

M. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Service.
    d. Make and size.
    e. Model number and serial number.
    f. Water flow rate in gpm.
    g. Water pressure differential in feet of head or psig.
    h. Required net positive suction head in feet of head or psig.
    i. Pump rpm.
    j. Impeller diameter in inches.
    k. Motor make and frame size.
    l. Motor horsepower and rpm.
    m. Voltage at each connection.
    n. Amperage for each phase.
    o. Full-load amperage and service factor.
    p. Seal type.

2. Test Data (Indicated and Actual Values):

    a. Static head in feet of head or psig.
    b. Pump shutoff pressure in feet of head or psig.
    c. Actual impeller size in inches.
    d. Full-open flow rate in gpm.
    e. Full-open pressure in feet of head or psig.
    f. Final discharge pressure in feet of head or psig.
    g. Final suction pressure in feet of head or psig.
    h. Final total pressure in feet of head or psig.
    i. Final water flow rate in gpm.
    j. Voltage at each connection.
    k. Amperage for each phase.

N. Instrument Calibration Reports:

1. Report Data:

    a. Instrument type and make.
    b. Serial number.
    c. Application.
    d. Dates of use.
    e. Dates of calibration.

3.12 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of commissioning authority.

B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Owner or design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Related Sections:

1. Section 230716 "HVAC Equipment Insulation."
2. Section 230719 "HVAC Piping Insulation."
3. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

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.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. 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).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. 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. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. 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. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.

D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Sheet and roll stock ready for shop or field sizing.
2. Finish and thickness are indicated in field-applied jacket schedules.
3. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
4. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with aluminum-foil facing.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.

6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020-inch-thick, 1/2-inch-wide with closed seal.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030-inch-thick by 2 inches' square.
   b. Spindle: zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
   c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Wire: 0.080-inch nickel-copper alloy.

2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.7 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
4. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber board, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.
2. PVC: 20 mils thick.
3. Aluminum, Corrugated: 0.016 inch thick.

END OF SECTION

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.
6. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233116 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 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" and ASCE/SEI 7. SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
3. Duct-Cleaning Test Report for Prerequisite IEQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."

4. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
5. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, and vibration isolation.

D. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

B. Welding certificates.

1.5 QUALITY ASSURANCE

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

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. 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).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.

5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. 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).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. 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. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. 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.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. 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.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. 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.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "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 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "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.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.7 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Underground Ducts: Concrete-encased, galvanized sheet steel.

B. Supply Ducts:

1. Ducts Connected to Constant-Volume Air-Handling Units:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Return Ducts:

1. Ducts Connected to Air-Handling Units <Insert equipment>:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. PVC-Coated Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

3. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminum.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, and Larger in Diameter: Standing seam.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Centrifugal wall ventilators.
   2. Ceiling-mounted ventilators.

1.2 ACTION SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL WALL VENTILATORS

A. ACME PNURGW, KEF-1

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

   1. Resiliently mounted to housing.
   2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
   5. Fan and motor isolated from exhaust airstream.

E. Accessories:

   1. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

F. Capacities and Characteristics:

   1. Airflow: 1,080 cfm.

2. External Static Pressure: 1 inches wg.
3. Fan Diameter: 33 inches.
4. Drive Arrangement: Belt drive.
5. Fan rpm: 2,465.
6. Sound: 20.
7. Brake Horsepower: .428.
8. Motor Size: 3/4 hp.
9. Motor rpm: 1,750.
10. Electrical Characteristics:

    a. Volts: 208.
    b. Phase: 1.
    c. Hertz: 60.

2.2 CEILING-MOUNTED VENTILATORS

A. Greenheck, SP-B110, EF-1

B. Housing: Galvanized steel, lined with acoustical insulation.

C. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

D. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

E. Capacities and Characteristics:

1. Airflow: 110 cfm.
2. External Static Pressure: 0.125 inches wg.
3. Sound: 1.5 Sones.
4. Motor Size: 80 W.
5. Electrical Characteristics:

    a. Volts: 120.
    b. Phase: 1.
    c. Hertz: 60.

2.3 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:

1. Install power ventilators as per manufacturer’s recommendations.

B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

C. Support suspended units from structure using threaded steel rods and elastomeric hangers.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Section 23 0 553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 23 35 33 - LISTED KITCHEN VENTILATION SYSTEM EXHAUST DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Listed grease ducts.
2. Access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For listed grease ducts.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of hangers and seismic restraints.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in listed grease ducts and field-fabricated grease ducts.

PART 2 - PRODUCTS

2.1 GREASE DUCTS

A. Description: Factory-fabricated, -listed, and -labeled, double-wall ducts tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a **1-inch** annular space filled with high-temperature, ceramic-fiber insulation.

1. Inner Shell: ASTM A 666, **Type 316** stainless steel.
2. Outer Jacket: **Aluminized steel** where concealed. Stainless steel where exposed.

C. Gaskets and Flanges: Ensure that gaskets and sealing materials are rated at 1500 deg F minimum.

D. Hood Connectors: Constructed from same material as grease duct with internal or external continuously welded or brazed joints.

E. Accessories: Tees, elbows, increasers, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Include unique components required to comply with NFPA 96 including cleanouts, transitions, adapters, and drain fittings.

F. Grease Duct Supports: Construct duct bracing and supports from non-combustible material.

1. Design bracing and supports to carry static and seismic loads within stress limitations of the International Building Code.
2. Ensure that bolts, screws, rivets and other mechanical fasteners do not penetrate duct walls.

G. Comply with ASTM E 2336.

H. Factory Tests: Test and inspect fire resistance of grease duct system according to ASTM E 2336.

1. Allow consultant **two** days' minimum notification before test is performed.

2.2 ACCESS DOORS

A. Description: Factory-fabricated, -listed, and -labeled, double-wall **personnel and maintenance** access doors tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.

1. Construction: **0.0625 inch** ASTM A 666, **Type 316** stainless-steel inner shell and **aluminized-steel** outer cover with two handles.
2. Fasteners: Stainless-steel bolts and wing nuts.

a. Ensure that bolts do not penetrate interior of duct space.

3. Maintenance Access Door Dimensions: **7 x 7 inches**.
4. Personnel Access Door Dimensions: **24 x 24 inches**.
5. Door Label: Mark door with uppercase lettering as follows: "ACCESS PANEL. DO NOT OBSTRUCT."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

B. Coordinate connections to kitchen exhaust hoods with requirements in Section 23 38 13 "Commercial-Kitchen Hoods."

C. Coordinate connections to exhaust fans with requirements.

D. Coordinate firestopping where grease ducts penetrate fire separations.

E. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211 and UL 2221, whichever is most stringent.

F. Install airtight **personnel and maintenance** access doors where indicated.

G. Seal between sections of grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

H. Connections: Make grease duct connections according to the International Mechanical Code.

1. Grease duct to exhaust fan connections: Connect grease ducts to inlet side of fan using flanges, gaskets, and bolts.
2. Grease duct to hood connections:

    a. Make grease duct to hood joints connections using internal or external continuously welded or brazed joints.
    b. Make watertight grease duct to hood joints connections using flanges, gaskets, and bolts.

I. Support ducts at intervals recommended by manufacturer to support weight of ducts and accessories, without applying loading on kitchen hoods.

1. Securely attach supports and bracing to structure.

J. Grease Duct Enclosures: Comply with requirements of the International Building Code and ASTM E 2336.

K. Repair damage to adjacent materials caused by listed kitchen ventilation system exhaust ducts installation.

3.2 FIELD QUALITY CONTROL

A. Perform air leakage test before concealment of any portion of the grease duct system.

1. Notify Owner a minimum of **two** days before test is performed.

END OF SECTION

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rectangular and square ceiling diffusers.
2. Perforated diffusers.
3. Louver face diffusers.
4. Adjustable bar [registers] [grilles] [registers and grilles].

B. Related Sections:

1. Section 089116 "Operable Wall Louvers" and Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers A, B and C:

1. Titus TMSA

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, white.
5. Face Size: 24 by 24 inches (A, C) 12 by 12 inches (B).
6. Face Style: Three cone.
7. Mounting: Surface (B,C) and Lay-in (A).
8. Pattern: Adjustable.
9. Dampers: Radial opposed blade.

B. Perforated Return Grille D and F:

1. Titus 50F-CODE A.
2. Material: Steel backpan and pattern controllers, with aluminum face.
3. Finish: Baked enamel, white.
4. Face Size: 24 by 24 inches.
5. Duct Outlet: Round.
6. Face Style: Flush.
7. Mounting: Surface (F) Lay-in (D).

C. Louver Face Diffuser G:

1. Greenheck ESD-202
2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Size: 12 x 12 inch.
5. Mounting: Surface.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Grille H:

1. Titus 300FS
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Vertical spaced 3/4 inch apart.
5. Core Construction: Removable.
6. Rear-Blade Arrangement: Horizontal 3/4 inch wide.
7. Mounting: Countersunk screw.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 38 13 - COMMERCIAL-KITCHEN HOODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes Type I commercial-kitchen hoods.

B. Related Requirements:

1. Section 23 35 33 "Listed Kitchen Ventilation System Exhaust Ducts" for fire-rated ducts connecting to kitchen hoods.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Filters/baffles.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
2. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
3. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Project-site elevation.
4. Show control cabinets.
5. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
6. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
7. Design Calculations: Calculate requirements for selecting seismic restraints.
8. Include diagrams for power, signal, and control wiring.
9. Duct Connections: Detail connections between ducts and hoods, including access doors and panels.
10. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D 1.1M, "Structural Welding Code - Steel," for hangers and supports; and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 HOOD MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Minimum Thickness: 18 GA.
2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.

    a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.

B. Zinc-Coated Steel Shapes: ASTM A 36/A 36M, zinc coated according to ASTM A 123/A 123M requirements.

C. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial-kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR 177.2600, for use in areas that come in contact with food.

1. Color: As selected by Architect from manufacturer's full range.
2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

D. Sound Dampening: NSF-certified, non-absorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch thickness that does not chip, flake, or blister.

E. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.3 GENERAL HOOD FABRICATION REQUIREMENTS

A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.

1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.

B. For metal butt joints, comply with SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.

D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.

E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.

F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.

G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.

I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets unless otherwise indicated.

J. Fabricate seismic restraints according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," Appendix A, "Seismic Restraint Details."

K. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

2.4 TYPE I EXHAUST HOOD FABRICATION

A. Greenheck GXFW

B. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.

1. Fabricate hoods according to NSF 2, "Food Equipment."
2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
3. Include access panels as required for access to fire dampers and fusible links.
4. Duct Collars: Minimum 0.0598-inch- thick steel at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a 0.5-inch- wide duct flange.
5. Duct-Collar Fire Dampers: Collar and damper shall comply with UL 710 testing and listing required for the entire hood.

    a. Collar: Minimum 0.0598-inch- thick stainless steel, at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a minimum 0.5-inch- wide duct flange.
    b. Blades: Minimum 0.1046-inch- thick stainless steel, counterbalanced to remain closed after actuation.
    c. Blade Pivot and Spring: Stainless steel.
    d. Fusible Link: Replaceable, 212 deg F rated.

6. Makeup Air Fire Dampers: Labeled, according to UL 555, by a testing agency acceptable to authorities having jurisdiction.

    a. Fire Rating: 1-1/2 hours.
    b. Frame: SMACNA Type A, with blades in airstream; fabricated with roll-formed, galvanized steel; with mitered and interlocking corners.
    c. Blades: Roll-formed, interlocking or folded, minimum 0.034-inch- thick, galvanized-steel sheet.
    d. Horizontal Dampers: Include a blade lock and stainless-steel closure spring.
    e. Fusible Link: Replaceable, 212 deg F rated.

C. Hood Configuration: Exhaust and makeup air.

1. Makeup air shall be introduced by induction inside canopy. If makeup air is not heated, insulate interior of makeup air plenum with high-density insulation having maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
2. Makeup air shall be introduced through front of canopy through supply-air registers with adjustable guide vanes.
3. Makeup air shall be introduced through laminar-flow-type, perforated metal panels on front of hood canopy.

D. Hood Style: Wall-mounted canopy.

E. Filters/Baffles: Removable, stainless steel, with spring-loaded fastening. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Safety for Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.

F. Lighting Fixtures: Surface-mounted, incandescent fixtures and lamps with lenses sealed vapor tight. Wiring shall be in conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc at 30 inches above finished floor.

1. Light switches shall be mounted on front panel of hood canopy.
2. Lighting Fixtures: Incandescent complying with UL 1598.

G. Hood Controls: Hood mounting control cabinet, fabricated of stainless steel.

1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with makeup air supply fan to operate simultaneously. Interlock exhaust fan with fire-suppression system to operate fan(s) during fire-suppression-agent release and to remain in operation until manually stopped.
2. High-Temperature Control: Alarm shall sound and cooking equipment shall shut down before hood discharge temperature rises to actuation temperature of fire-suppression system.

H. Capacities and Characteristics:

1. Nominal Hood Length: 96 inches.
2. Nominal Hood Width: 52 inches.
3. Exhaust Airflow: 1,080 cfm.
4. Exhaust-Air Pressure Loss: 1 inches wg.
5. Makeup Air Airflow: 1,026 cfm.
6. Makeup Air Pressure Loss: 0.5 inches wg.

2.5 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

A. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.

1. Steel Pipe, NPS 2 and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends.
2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on wall. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
4. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
5. Furnish electric-operated gas shutoff valve.
6. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
7. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
8. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and

control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

B. Complete field assembly of hoods where required.

1. Make closed butt and contact joints that do not require filler.
2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in "General Hood Fabrication Requirements" Article.

C. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.

D. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.

E. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners unless otherwise indicated.

F. Install hoods to operate free from vibration.

G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.

H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

J. Set initial temperatures, and calibrate sensors.

K. Set field-adjustable switches.

L. Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquidtight joint.

M. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Perform hood performance tests required by authorities having jurisdiction.
4. Perform fire-suppression system performance tests required by authorities having jurisdiction.

B. Commercial-kitchen hoods will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 23 74 23.16 - PACKAGED, OUTDOOR, MAKEUP-AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes indirect-fired makeup-air units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and configuration of outdoor, indirect-fired makeup-air unit.

B. Shop Drawings: For each type and configuration of outdoor, indirect-fired heating and ventilating unit.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of indirect-fired heating and ventilating units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ACME AFSI, MAU-1

2.2 SYSTEM DESCRIPTION

A. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, and indirect-fired gas burner to be installed exterior to the building.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
2. Casing Joints: Sheet metal screws or pop rivets, factory sealed with water-resistant sealant.
3. Factory Finish for Galvanized-Steel Casings: Apply manufacturer's standard primer immediately after cleaning and pretreating.
4. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

    a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to air-handling-unit sections, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when air-handling-unit frame is anchored to building structure.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Configuration: Horizontal unit with bottom discharge for platform mounting installation.

C. Cabinet: Galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Duct flanges at inlet and outlet. Pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

2.4 SUPPLY-AIR FAN

A. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings. Bearing rating: L10 of 150,000 hours.

B. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.

C. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with elastomeric isolators.

D. Fan-Shaft Lubrication Lines: Extended to a location outside the casing.

2.5 AIR FILTERS

A. Cleanable Filters: Cleanable metal mesh.

2.6 DAMPERS

A. Outdoor-Air Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. of damper area, at a differential pressure of 2-inch wg.

B. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.

2.7 CONTROLS

A. Fan Control: Interlock fan to start with exhaust fan(s) to which this heating and ventilating unit is associated for makeup air.

1. Smoke detectors, located in supply air, shall stop fans when the presence of smoke is detected.

B. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.

2.8 CAPACITIES AND CHARACTERISTICS

A. Fan:

1. Discharge Configuration: Vertical.
2. Airflow in CFM: 1,026 CFM.
3. External Static Pressure: .5 inches wg.
4. Maximum RPM: 852 rpm.

B. Fan Motor:

1. Horsepower: 1/2.
2. RPM: 1,750.
3. Service Factor: 1.5
4. Speed: Single.

C. Single-Point Electrical Connection:

1. Volts: 240.
2. Phase: Single.
3. Hertz: 60.
4. Full-Load Amperes: 3.9.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:

1. Install heating and ventilating units on metal platform as per manufacturer’s recommendations.

B. Unit Support: Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

C. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."

D. Install controls and equipment shipped by manufacturer for field installation with non-tempered heating and ventilating units.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Gas Piping: Connect gas piping with shutoff valve and union, and with sufficient clearance for burner removal and service. Make final connections of gas piping to unit with corrugated, stainless-steel tubing flexible connectors complying with ANSI LC 1/CSA 6.26 equipment connections.

B. Duct Connections: Connect supply ducts to indirect-fired heating and ventilating units with flexible duct connectors.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Units will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heating and ventilating units.

END OF SECTION

SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. YORK (THE60/AVC60, YHE48/AE48, YHE35/AE36)

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
4. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch; leak tested to 300 psig underwater; with a two-position control valve.
5. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
6. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
7. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
9. Filters: Permanent, cleanable.
10. Condensate Drain Pans:

    a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 2 inches deep.

    b. Single-wall, galvanized-steel sheet.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

        1) Minimum Connection Size: 3/4 inch NPS .

    d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
    e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Compressor Type: Scroll.
    b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    c. Refrigerant Charge: R-410A.
    d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. Programable Thermostat: To control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

E. Drain Hose: For condensate.

2.5 CAPACITIES AND CHARACTERISTICS

A. As per equipment schedules and plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s) as per manufacturer's recommendations.

D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 23 31 13 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 23 33 00 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 26 00 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 SUMMARY

A. Drawings are necessarily diagrammatic by their nature and are not intended to show every connection in detail or every pipe or conduit in its exact location. Carefully investigate structural and finish conditions and coordinate the separate trades in order to avoid interference between the various phases of Work. Organize and lay out Work so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Install all Work parallel or perpendicular to building lines unless otherwise noted.

B. The intent of the Drawings is to establish the types of systems and functions; not to set forth each item essential to the functioning of the system. Install the Work complete, including minor details necessary to perform the function indicated. Review pertinent Drawings and adjust the Work to conditions shown. Where discrepancies occur between Drawings, Specifications, and actual field conditions, immediately notify the Owner's Project Manager for Owner's interpretations.

C. Coordinate the actual locations of electrical outlets and equipment with building features and equipment as indicated on architectural, structural, mechanical, and plumbing Drawings. Review any proposed changes in electrical wiring devices or equipment location with the Owner's Project Manager. Owner may direct relocation of outlets before installation, up to five (5) feet from the position indicated, without additional cost. Remove and relocate outlets placed in an unsuitable location when requested by the Owner, at no additional cost to the Owner.

D. All dimensional information related to new structures shall be taken from the appropriate Drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the Site.

E. Existing Structures: The building floor slabs, structure, and outer walls are generally existing to remain. The only existing penetrations are openings where indicated on the Drawings. This Contract requires the Contractor to core drill all other floor or wall penetrations as required. All floor penetrations shall include a sleeve that extends two (2) inches above the floor. Bus duct penetrations shall have a minimum 4-inch high curb as per NEC requirement or per drawing, whichever is higher.

1.3 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the Contract Documents.

1.4 DEFINITIONS

A. Concealed: Concealed areas are those areas that cannot be seen by building occupants.

B. Exposed: Exposed areas are all areas that are exposed to view by building occupants, including areas below counter tops, inside cabinets and closets, inside all equipment rooms, and areas outside the building exterior envelope, exposed to the outdoors.

1.5 QUALITY ASSURANCE

A. Regulations: Work, materials and equipment shall comply with the latest rules and regulations specified in National Fire Protection Association (NFPA).

B. Discrepancies: The Drawings and Specifications are intended to comply with listed codes, ordinances, regulations and standards. Where discrepancies occur, immediately notify the Owner's Project Manager in writing and ask for an interpretation. Should installed materials or workmanship fail to comply, the Contractor is responsible for correcting the improper installation at no additional cost to the Owner. Additionally, where sizes, capacities, or other such features are required in excess of minimum code or standards requirements, provide those specified or shown.

C. Contractor Qualifications: An acceptable Contractor for the Work under this Division must have personnel with experience, training and skill to provide a practical working system. The Contractor shall furnish acceptable evidence of having installed not less than three systems of size and type comparable to this Project. All personnel installing equipment under this Division shall possess valid City of Houston and State of New Mexico licenses for their skill level. Each Journeyman shall supervise no more than two apprentice helpers. Refer also to Owner's Special Conditions.

1.6 SUBMITTALS

A. Product Data: Provide coordination Drawings with submittals as required by Division 01.

B. Record Documents: In addition to hard copy format, all material submitted as final record products, including approved Shop Drawings and submittals, shall be submitted to the Owner in its original electronic file format on compact disc or DVD. Material may be scanned into electronic file format where necessary.

1.7 DELIVERY, STORAGE AND HANDLING

A. All equipment and materials shall be delivered to the Project Site clean and sealed for protection.

B. Moisture: During construction, protect switchgear, transformers, motors, control equipment, and other items from insulation moisture absorption and metallic component corrosion by appropriate use of strip heaters, lamps or other suitable means. Apply protection immediately upon receiving the products and maintain continually.

C. Damage: Take such precautions as are necessary to protect apparatus and materials from damage. Failure to protect materials is sufficient cause for rejection of the apparatus or material in question.

D. Finish: Protect factory finish from damage during construction operations until acceptance of the Project. Restore any finishes that become stained or damaged to Owner's satisfaction.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Equipment and control systems should match, integrate, communicate or cooperate with Owner's existing systems, such as power monitoring systems, building automation, fire alarm, motor control centers, switchgears, breakers, transformers, and lighting dimming systems.

C. Conditions: Provide new products of manufacturers regularly engaged in production of such equipment. Provide the manufacturer's latest standard design for the type of product specified. Products shall be U.S. made. Owner reserves the right to approve or disapprove foreign-made products.

D. NEC and UL: Products shall conform to requirements of the National Electrical Code. Where Underwriters' Laboratories have set standards, listed products and issued labels, products used shall be listed and labeled by UL.

E. Space Limitations: Equipment selected shall conform to the building features and shall be coordinated with all components. Do not provide equipment that will not meet arrangement and space limitations. Contractor shall submit room layouts with submitted items shown drawn to scale. Submittals will be rejected without floor plan Drawings showing submitted items.

F. Factory Finish: Equipment shall be delivered with a hard surface, factory-applied finish so that no additional field painting is required except for touch-up.

G. Common Source: Equipment specified in Sections 26 22 13, 26 23 00, 26 24 16, 26 24 19, 26 28 17, 26 29 14, 26 43 13 shall be provided by the same manufacturer.

H. Series Ratings: Overcurrent devices shall have fully rated interrupting capacity. Series rating of devices is unacceptable.

2.2 EQUIPMENT AND DEVICE MARKING

A. Conduit marking. Externally mark all conduits for feeders, branch circuits using the same circuit designations as indicated on construction drawings and final as-built documents. Such marks shall be made at the point of origin and destination of the conduits, using permanent marker.

B. Nameplates shall be black laminated rigid phenolic with white core. Emergency nameplates shall be red laminated phenolic with white cores. Nameplate minimum size shall be 1-inch-high by 3 inches long with 3/16-inch-high engraved white letters. Supply blank nameplates for spare units and spaces.

C. Nameplate Fasteners: Fasten nameplates to the front of equipment only by means of stainless steel self-tapping screws. Stick-ons or adhesives are not acceptable unless the NEMA enclosure rating is compromised, then only epoxy adhesive shall be used to attach nameplates.

D. Nameplate Information: The general naming convention shall consist of the following segments:

1. Building name in abbreviated form where equipment is located;

2. Building floor where electrical equipment is located;

3. Electrical system type: NP (normal power), EP (emergency power), LS (life safety branch), CB (critical branch), EB (equipment system branch);

4. System voltage: M (medium voltage), H (277/480V) or L (120/208V);

5. Individual equipment identification: A, B, C, etc.

E. In general, provide the following information for the types of electrical equipment as listed:

1. Switchgears, Switchboards, Distribution Panels and Motor Control Centers: On mains, identify the piece of equipment, the source, and voltage characteristics (i.e., 480/277V 3PH 4W). For each branch circuit protective device, identify the load served.

2. Transformers, Individual Starters, Contactors, Disconnect Switches, Transfer Switches and Similar Equipment: Identify the device designation, voltage characteristics source and load served.

3. Panelboards: Identify panelboard designation, voltage characteristics, and source designation.

4. Outlet Boxes: Identify Panel and Circuit Number.

F. Panelboards: Prepare a neatly typed circuit directory printed on 80 weight paper. This directory shall be installed behind clear heat-resistant plastic in a metal frame tack welded to the inside of the door for each panelboard. Identify circuits by equipment served and by building room numbers where room numbers exist. Indicate spares and spaces with light, erasable pencil marking. Adhesive mounted directory pocket is not acceptable. Removing and attaching panel schedules from the Drawings is not acceptable.

G. Panelboards, Pull, Junction and Outlet Boxes:

1. With ½ inch high permanent lettering, identify conduits connected to panelboards, pull, junction and outlet boxes with the complete circuit number of the conductors contained therein. Neutral conductors shall be identified by wire marker tags in the panelboards, pull, junction and outlet boxes. Where multiple circuits are contained in a box, identify the circuit conductors with permanent tags which indicate circuit designation.

2. Emergency circuit junction boxes and their covers shall be painted red. Circuit identification shall be marked on the junction box cover. Emergency Circuit Junction Boxes are associated with Panel 'EM".

3. Fire alarm circuits (only) shall be marked with half red covers and "Fire Alarm" marked on the face. Emergency Circuit Junction Boxes are associated with Panel 'EM".

H. Equipment and raceways over 600 Volts: Provide "WARNING - HIGH VOLTAGE - KEEP OUT" signs on all equipment. With 2-inch-high lettering, mark all exposed raceways containing conductors operating in excess of 600 volts every 100 feet and at each wall or floor penetration with the words "WARNING - HIGH VOLTAGE".

I. Power receptacles, wall switches and dedicated outlets. Identify circuits as per Specification Section 26 27 26.

J. Dedicated outlets: Dedicated is understood to be specific equipment listed by equipment number in the panel schedules or identified on the Drawings. Dedicated also includes computer outlets.

K. Remote Ballasts: For remote ballasts not within five (5) feet of their associated lighting fixture, provide appropriate permanent lettering on both the ballasts and the light fixture to identify which are mated to the other.

2.3 INDUSTRIAL CONTROL PANELS

A. The scope of the work does not intend to cover the Integrated Automation System, neither the design for a functional process control system. It is not intended to apply to the wirings that form an integral part of the equipment, such as motors, controllers, or factory assembled control equipment or listed utilization equipment. It intends to provide the guideline for constructing Industrial Control Panels defined by NFPA 70 Article 409.

B. The electrical requirements pertaining to, but not limited to, branch circuits, luminaires, motor circuits and controllers, air-conditioning and refrigerating equipment, hazardous locations, short-circuit and ground-fault protection, overcurrent/overload protection, industrial machinery, etc. shall be in accordance with the applicable requirements from the specific articles in NFPA 70 Article 409 Table 409.3.

C. Industrial Control Panels shall be built in accordance with the requirements of Division 25 Integrated Automation System, and shall utilize components that are UL listed, UL recognized, or specified by MDACC specifications. Component manufacturers shall have an established network of product distribution for parts replacement. The nearest distribution point shall be within 50 miles of the Project Site.

D. Multi-section industrial control panels shall be bonded together with an equipment grounding conductor or an equivalent equipment grounding bus sized in accordance with NFPA 70 Article 250. Equipment grounding conductors shall be connected to this equipment grounding bus or to equipment grounding termination point provided in a single-section industrial control panel.

E. NFPA 70 Article 110 Table 110.20 shall be used as the basis for selecting industrial control panel enclosures for use in specific locations other than hazardous (classified) locations. Industrial control panel enclosures shall not be used as junction boxes, auxiliary gutters, or raceways for conductors feeding through or tapping off to other switches or overcurrent devices or other equipment, unless the conductors fill less than 40 percent of the cross-sectional area of the wiring space.

F. The phase arrangement on 3-phase horizontal common power and vertical buses shall be A, B, C from front to back, top to bottom, or left to right, as viewed from the front of the industrial control panel.

G. Spacing between live bare metal parts in feeder circuits shall not be less than specified in NFPA 70 Article 430 Table 430.97.

H. Control panel internal wiring shall be installed neatly in Panduit system.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Unless otherwise noted, remove all electrical materials and equipment from areas indicated for demolition. Removal of equipment shall not interfere with existing operations.

B. Remove conduit and wire back to panelboards or to nearest junction box that is not being removed and needs to remain in service. Wire shall be removed back to point of origin. Turn off circuit breakers or switches serving abandoned circuits and tag breaker or switch and label in panel schedule as “Spare”.

C. Materials and equipment to be removed, except items specifically noted to be relocated or delivered to the Owner, become property of the Contractor and shall be immediately removed from the Project Site. If the Owner identifies other items during construction, those items become Owner property and will be turned over to the Owner.

D. Electrical services and controls to items being removed shall be disconnected and removed from the Project Site as indicated on the drawings.

E. All fluorescent lighting fixtures being removed from the Project Site that will not be turned over to the Owner shall have any PCB-containing ballasts removed from the fixtures for environmental disposal. Ballasts shall remain intact with wire leads at least twelve (12) inches long.

F. Contractor shall ensure that light switches within the Work area remain operational. Where temporary 120 volt light strings are installed, a switch shall be provided for the light strings near the Project entry door.

G. Contractor shall coordinate with Fire Department before disconnect existing fire alarm system and telephone D-Mark. In the event where the existing fire alarm system is un operational before end of work day the contractor shall provide a 24-Hour fire watch.

3.2 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. Installation shall be in accordance with manufacturer’s published recommendations.

C. Cooperation with Other Trades: Cooperate with trades of adjacent, related or affected materials or operations, and with trades performing continuations of this Work in order to effect timely and accurate placing of Work and to coordinate, in proper and correct sequence, the Work of such trades.

D. Workmanship: Work shall be performed by competent workers skilled in their trade. This installation must be complete.

E. Housekeeping Pads: Unless otherwise noted. Install 6-inch-thick concrete foundation pads for indoor floor-mounted equipment, except where direct floor mounting is required. Pour pads on roughened floor slabs, sized so that outer edges extend a minimum of 3 inches beyond equipment. Trowel pads smooth and chamfer edges to a 1-inch bevel. Secure equipment to pads as recommended by the manufacturer.

F. Setting of Equipment: Equipment must be leveled and set plumb. Sheet metal enclosures mounted against a wall must be separated from the wall not less than 1/4 inch by means of corrosion-resistant spacers or by 3 inches of air for freestanding units. Use corrosion resistant bolts, nuts and washers to anchor equipment. Provide Drawings and layout Work showing exact size and location of sleeves, openings or inserts for electrical equipment in slabs, walls, partitions and chases in sufficient time to be coordinated with Work under other divisions.

G. Sealing of Equipment: Seal openings into equipment to prevent entrance of animals, birds and insects.

H. Motors: Electrical Work includes the electrical connection of all motors, except those that are wired as a part of equipment.

I. Concealed Work: Conceal all electrical Work in walls, floors, chases, under floors, underground, and above ceilings except:

1. Where shown or specified to be exposed. Exposed is open to view.

2. Where exposure is necessary to the proper function.

3. Where size of materials and equipment preclude concealment.

J. Application: Unless otherwise indicated, power will be utilized as follows:

1. 480 volts, three phase: Motors ¾ horsepower and larger and electric heating equipment.

2. 120 volts, single phase: Motors ½ horsepower and smaller.

3. 120 volts, single phase: Incandescent lighting and fluorescent task lighting.

4. 277 volts, single phase: Fluorescent and high-intensity-discharge lighting and electric heating equipment.

5. 120 volts, single phase: Convenience outlets.

6. 208 volts, single and three phase: Power outlets.

K. Transformers: Use transformers to change the service to the required utilization voltages.

L. Provide final electrical connections to equipment furnished under other divisions and by the Owner. Furnish detailed Shop Drawings of equipment indicating the exact number and location of rough-in points. Such final Shop Drawings may indicate adjustments in total number and exact location of rough-in points, and in equipment dimensions. Making adjustments to field conditions is considered a part of the Work required.

1. Roughing-in: When roughing-in electrical branch circuits to various items of equipment, terminate at proper points as indicated on detailed equipment Shop Drawings or as directed by Owner. Do not rely on Drawings accompanying these Specifications for rough-in locations, only for general routing of circuiting.

2. Final Connections: Laboratory casework, medical equipment, and food service equipment will include service fittings such as switches, duplex receptacles, lighting fixtures, etc., on the casework or equipment. Provide branch circuit connections to meet service fitting requirements.

M. Refer to Divisions 07 and 09 for sealing and firestopping requirements where raceways penetrate smoke, fire, and sound rated walls.

N. All unused openings such as but not limited to, knockouts on panels and boxes, surface wireway openings, busway openings, circuit breaker empty slots shall be covered with approved cover plates.

O. Temporary power equipment and distribution for construction shall not occupy building spaces or block pathways that are designated for permanent installation of other trades according to design drawings.

3.3 TESTING

A. Test Conditions:

1. Place circuits and equipment into service under normal conditions, collectively and separately, as may be necessary to determine satisfactory operation. Perform specified tests in the presence of the Owner's representative(s). Furnish all instruments, wiring, equipment and personnel required for conducting tests. Demonstrate that the equipment operates in accordance with requirements of the Contract Documents. Special tests on certain items are specified hereinafter.

2. Testing shall be performed by an independent testing company that is Owner approved, and National Electrical Testing Association (NETA) certified. Submit copies of test reports.

3. Prior to testing, Contractor shall submit to Owner for approval, installation verification Prefunctional Checklists and Functional Performance Test procedures. These shall be used for documentation as part of the commissioning process.

4. All instruments required for conducting the tests shall be NIST (National Institute for Standard and Technology) certified or traceable, and calibrated at the time of testing.

B. Test Dates: Schedule final acceptance sufficiently in advance of the Contract date to permit completion of any necessary adjustment or alterations within the number of days allotted for completion of the Contract. Provide written notification to Owner at least fourteen (14) calendar days in advance of Functional Performance Test dates.

C. Retests: If retesting is required due to initial failure, conduct retests of such time duration as may be necessary to assure proper functioning of adjusted or altered parts or items of equipment. Any resultant delay as a result of such necessary retests does not relieve the Contractor of Contractor’s responsibility under this Contract.

D. Circuit Verification: All 120-volt single-phase circuits shall be verified to match the Drawings and panel schedules by “ringing out" each circuit in the presence of the Owner’s representative(s).

E. Refer to Commissioning Specification Sections for additional start-up, prefunctional and operational checkout, and for functional performance test procedures.

END OF SECTION

SECTION 26 05 00 - COMMON ELECTRICAL WORK REQUIREMENTS

PART 1 GENERAL

1.1 GENERAL

A. This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1, Division 23, Division 27, Division 28, Division 33 and Division 34. Refer to Section 01 00 00 – Bid Depository Sections where applicable for bid depository.

1.2 SUMMARY

A. This Section includes the following:

1. Raceways.
2. Cabinets and Pullboxes
3. Building wire and connectors.
4. Supporting devices for electrical components.
5. Electrical identification.
6. Electricity-metering components.
7. Concrete equipment bases.
8. Electrical demolition.
9. Cutting and patching for electrical construction.
10. Touchup painting.
11. Sleeves
12. Fire Barriers

1.3 CARE, OPERATION AND START-UP

A. Instruct Owner’s Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.

B. Operating instructions to include following:

1. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
2. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
3. Safety precautions.
4. Procedures to be followed in event of equipment failure.
5. Other items of instruction as recommended by manufacturer of each system or item of equipment.

C. Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

D. Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 DESIGN REQUIREMENTS

A. Operating voltages: to CAN3-C235

B. Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

A. Submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.

B. Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.

C. Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

D. Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

E. Quality Control: in accordance with Section 01 45 00 - Quality Control.

1. Submit test results of installed electrical systems and instrumentation.

2. Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

3. Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Owner’s Representative.

F. Manufacturer's Field Reports: submit to Owner’s Representative within 7 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.6 PERMITS, FEES AND INSPECTION

A. Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

B. Pay associated fees.

C. Owner’s Representative will provide drawings and specifications required by Electrical Inspection Division and Supply Authority at no cost.

D. Notify Owner’s Representative of changes required by Electrical Inspection Division prior to making changes.

E. Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Owner’s Representative.

1.7 CO-ORDINATION

A. Co-ordinate work with work of other divisions to avoid conflict.

B. Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.

C. Locate all existing underground services and make all parties aware of their existence and location.

D. Where interference occurs, Owner's Representative must approve relocation of equipment and materials regardless of installation order.

E. Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Owner's Representative shall decide the extent of relocation required.

1.8 CUTTING AND PATCHING

A. Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 8 inches or smaller shall be the responsibility of Division 26. Openings larger than 8 inches shall be the responsibility of Division 1. Obtain written approval of Structural engineer before drilling any beams or floors.

1.9 PROTECTION

A. Protect exposed live equipment during construction for personnel safety.

B. Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

C. Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.10 RECORD DRAWINGS

A. Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.

B. Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.

C. Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.

D. Submit record drawings within 30 days prior to start of commissioning.

1.11 INSPECTION OF WORK

A. The Owner, Owner Representative, and local authorise will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.12 SCHEDULING OF WORK

A. Work shall be scheduled in phases as per other divisions of the architectural specifications.

B. Become familiar with the phasing requirements for the work and comply with these conditions.

C. No additional monies will be paid for contractor's requirement to comply with work phasing conditions.

1.13 FIRE RATING OF PENETRATIONS

A. Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls.

B. Use 3M brand, Hilti or equal fire barrier products at each penetration to provide a UL Listed penetration.

C. Acceptable products for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.

D. Acceptable manufacturers: Hilti, Nelson, Fire Stop Systems, 3M or approved equal. Material of same manufacturer to be used throughout project.

PART 2 PRODUCTS

2.1 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

A. Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings, where applicable.

B. Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25 and shown on mechanical drawings. Division 25 – EMCS Controls Contractor is responsible for all conduit, wiring and connections below 50V which are related to control systems in Division 25 and shall comply with the requirements of Division 26 for standard of quality.

2.2 MATERIALS AND EQUIPMENT

A. Provide materials and equipment in accordance with Division 01 - Common Product Requirements.

B. Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Division.

C. Factory assemble control panels and component assemblies.

2.3 FINISHES

A. Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

1. Paint all expose conduit, j-boxes and hanger to match wall color.

2.4 WARNING SIGNS

A. As specified and to meet requirements of Electrical Inspection Department and Owner’s Representative.

B. Provide Lock-Out tags per OSHA.

2.5 WIRING TERMINATIONS

A. Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

A. Identify electrical equipment with nameplates and labels as follows:

1. Nameplates: Lamicoid 1/8-inch-thick plastic engraving sheet, black white face, black white core, mechanically attached with self-tapping screws, no self-tape or glue will be acceptable

2. Sizes as follows:

NAMEPLATE SIZES

a.	Size 1	¼" x 2"	1 line	¼" high letters
b.	Size 2	½" x 3"	1 line	¼" high letters
c.	Size 3	½" x 3"	2 lines	1/8" high letters
d.	Size 4	¾" x 3.5"	1 line	1/8" high letters
e.	Size 5	¾" x 3.5"	2 lines	1/8" high letters
f.	Size 6	1" x 4"	1 line	1/4" high letters
g.	Size 7	1" x 4"	2 lines	1/8" high letters

B. Labels:

1. Embossed plastic labels with ¼" high letters unless specified otherwise.

C. Wording on nameplates and labels to be approved by Owner's Representative prior to manufacture.

D. Allow for average of twenty-five (25) letters per nameplate and label.

E. Identification to be English (and Spanish where applicable).

F. Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.

G. Disconnects, starters and contactors: indicate equipment being controlled and voltage.

H. Terminal cabinets and pull boxes: indicate system name and voltage.

I. Transformers: Equipment Tag, indicate capacity, primary and secondary voltages and transformer number.

2.7 WIRING IDENTIFICATION

A. Identify wiring with permanent indelible identifying markings, either numbered or colored plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

B. Maintain phase sequence and color coding throughout.

C. Color code: National Electrical Code.

D. Use color coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

A. Color code conduits, boxes and metallic sheathed cables.

B. Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at .5" intervals.

C. Colors: 1" wide prime color and ¾" wide auxiliary color.

1. Conduit System — Prime Color — Auxiliary Color

   a. up to 250 V — Yellow

   b. up to 600 V — Yellow — Green

c. Telephone	Green	Blue	
d. Other Communication Systems		Green	Blue
e. Fire Alarm	Red		
f. Emergency Voice	Red	Blue	
g. Other Security Systems		Red	Yellow

PART 3 EXECUTION

3.1 NAMEPLATES AND LABELS

A. Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.2 LOCATION OF OUTLETS

A. Locate outlets in accordance with Section 26 27 26 – Wiring Devices.

B. Do not install outlets back-to-back in wall; allow minimum 6” horizontal clearance between boxes.

C. Change location of outlets at no extra cost or credit, providing distance does not exceed 10 feet, and information is given before installation.

D. Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

3.3 CONDUIT AND CABLE INSTALLATION

A. Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 2 inch.

B. If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

C. Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to a minimum.

3.4 MOUNTING HEIGHTS

A. Mounting height of equipment is from finished floor to centerline of equipment unless specified or indicated otherwise.

B. If mounting height of equipment is not specified or indicated, verify before proceeding with installation, mounting heights to meet all ADA standards.

C. Install electrical components at following heights unless indicated otherwise.

1. Local switches: 48 inches.
2. Wall receptacles: 18 inches
3. Above top of continuous baseboard heater: 44 inches.
4. Above top of counters or counter splash backs
5. Panelboards: as required by Code or as indicated.
6. Telephone and interphone outlets: 18 inches

7. Wall mounted telephone and interphone outlets: 48 inches

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

A. Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.6 FIELD QUALITY CONTROL

A. All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the respecting manpower vocational training and qualification. Employees registered in a provincial apprentice's program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

B. The work of this division to be carried out by a contractor who holds a valid Electrical Master and Contractor License as issued by governing authorize.

C. Load Balance:

1. Measure phase current to panelboard with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record operating under normal load. State hour and date on which each load was measured, and voltage at time of test.changes.

2. Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

3. Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centers.

D. Conduct and pay for following tests:

1. Circuits originating from branch distribution panels.

2. Lighting and its control.

3. Motors, heaters and associated control equipment including sequenced operations of systems where applicable.

4. Systems: fire alarm system, communications.

E. Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

F. Insulation resistance testing.

1. Megger and record circuits, feeders and equipment up to 350 V with a 500 V instrument.

2. Megger and record 350 – 600 V circuits, feeders and equipment with a 1000 V instrument.

3. Check resistance to ground before energizing and record value.

G. Carry out tests in presence of Owner's Representative.

H. Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.

I. Submit test results for Owner's Representative's review.

3.7 CLEANING

A. Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

B. Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

SECTION 26 05 23 - OCCUPANCY SENSORS

PART 1 – GENERAL

Introduction

The work covered in this section is subject to all the requirements in the General Conditions of the Specifications.

The contractor shall coordinate all of the work in this section with all trades covered in the other sections of the specifications to provide a complete and operable system.

1.1 DESCRIPTION OF WORK

A. The extent of the lighting control system work is indicated by the drawings and by the requirements of this section. It is defined to include, but is not limited to, occupancy sensors, power packs and auxiliary relays.
B. System installation includes the installation of occupancy sensors, power packs and auxiliary relays in accordance with manufacturer's installation instructions.

1.2 QUALITY ASSURANCE

A. Component Testing: All electronic component board assemblies are to be factory tested and burned in prior to installation.
B. System Support: Factory fax/telephone/email support shall be available free of charge during normal business hours.
C. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
D. NEC Compliance: Comply with applicable portions of the NEC.
E. UL Compliance: UL Listed in compliance with applicable UL Safety Standard.
F. FCC Emissions: All assemblies are to be in compliance with FCC Part 15, Class B.

1.3 WARRANTY

A. Manufacturer shall warrant specified equipment to be free from defects in materials and workmanship for at least 5 years from the date of manufacture.

1.4 EQUIPMENT

A. Equipment shall be LSI, Hubbell, or Schneider Electric Occupancy Sensors or approved equal.

1.5 SUBSTITUTIONS

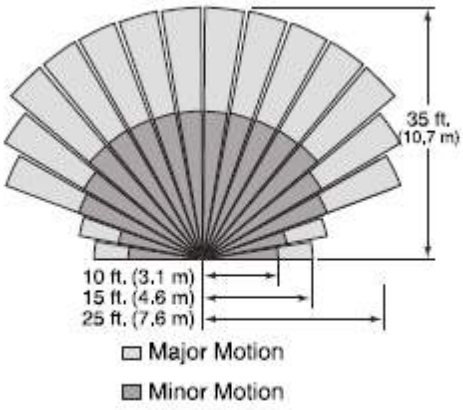
A. If equipment from another manufacturer is submitted for approval, identification of any and all exceptions to the specifications must be provided with a detailed explanation of each exception.

PART 2 – PRODUCTS

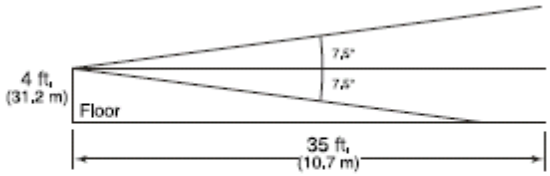
2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Schneider Electric or a comparable product by one of the following:
   1. Hubbell
   2. Leviton
   3. LSI

2.2 PASSIVE INFRARED (PIR) WALL SWITCH OCCUPANCY SENSOR



Top view of sensor field of view



Side view of sensor field of view

A. Sensor shall recess into standard single gang wall switch box.
B. Sensor shall meet NEC grounding requirements, providing a green grounding wire with ring terminal and thread-forming screw.
C. Sensor shall have one-line lead (black) and one load lead (red) for connection to lighting circuit.
D. Sensor shall be rated 120VAC and 277VAC input at line frequency of 60 hertz.
E. Sensor shall be rated for electronic and magnetic ballasts, incandescent and motor loads.

	Load Rating @ 120V	Load Rating @ 277V
Ballast	1000VA	1800VA
Incandescent	1000W	
Motor	1/4hp	

F. Sensor shall employ a mechanical relay to stop current flow to load when sensor is inactive (off).
G. Sensor shall employ a dual element PIR sensor having highest sensitivity to infrared with wavelength of 9.8 microns to detect human occupancy.
H. Sensor shall have major motion coverage up to 1000 square feet and minor motion coverage up to 300 square feet.
I. Sensor shall employ a multi-segmented lens having a 180-degree coverage pattern.
J. Coverage pattern and sensitivity shall be verified in accordance with NEMA WD-7 Guide for Occupancy Sensors.
K. Sensor shall have a bypass and time delay adjustment located behind a removable cover. A tool is required to remove cover, activate sensor bypass or adjust time delay.
L. Sensor shall have time delay adjustment ranging from 15 seconds to 30 minutes.
M. Sensor shall include mounting hardware, decorator wall plate cover and screws to mount cover. Wall plate cover color shall match the sensor.

Auto-On Wall Switch Sensors

N. Sensor shall have an Auto/Off latching push button allowing user to turn off lighting (off) in the out position, and enable the sensor to turn lighting on and off automatically in the in position (auto-on).
O. Sensor shall be the following Square D catalog numbers:

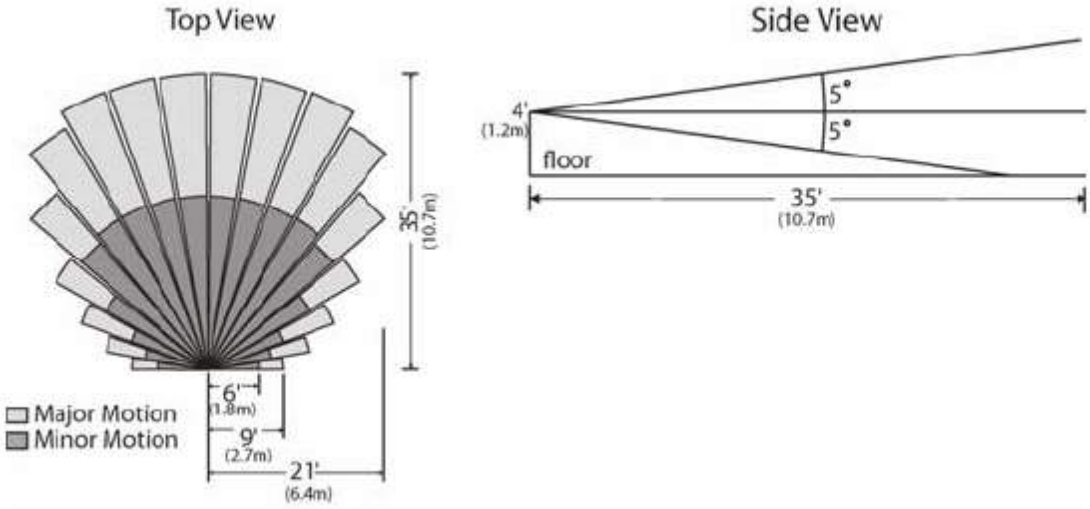
Catalog Number	Description
SLSPWS1277AI	PIR Wall Switch Auto-On, Ivory color
SLSPWS1277AW	PIR Wall Switch Auto-On, White color

Manual-On Wall Switch Sensors

P. Sensor shall have a Manual On/Off momentary push button allowing the user to toggle the sensor on and off. In the on state, sensor will automatically turn off lighting after last occupancy was detected and time delay. When the sensor is in an off state, user must push button to turn on lighting.
Q. Sensor shall be the following Square D catalog numbers:

Catalog Number	Description
SLSPWS1277MI	PIR Wall Switch Manual-On, Ivory color
SLSPWS1277MW	PIR Wall Switch Manual-On, White color

2.3 COMMERCIAL GRADE PIR WALL SWITCH OCCUPANCY SENSOR



A. Sensor shall recess into standard single gang wall switch box.
B. Sensor shall meet NEC grounding requirements, providing a green grounding wire with ring terminal and thread-forming screw.
C. Sensor shall have one-line lead (black) and one load lead (red) for connection to lighting circuit.
D. Sensor shall be rated 120VAC to 277VAC input at line frequency of 50 or 60 hertz.

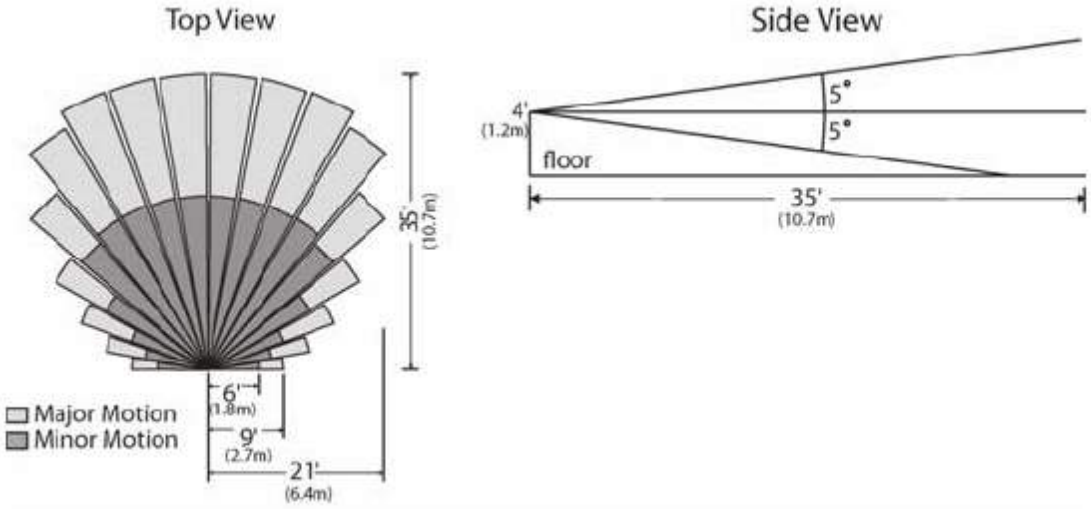
	Load Rating @ 120V	Load Rating @ 277V
Ballast	1000VA	1800VA
Incandescent	1000W	
Motor	1/4hp	

E. Sensor shall employ a mechanical relay to stop current flow to load when sensor is inactive (off).
F. Sensor shall not require a neutral connection or minimum load.
G. Sensor shall employ a dual element PIR sensor having highest sensitivity to infrared with wavelength of 9.8 microns to detect human occupancy.
H. Sensor shall have major motion coverage up to 1000 square feet and minor motion coverage up to 300 square feet.
I. Sensor shall employ a multi-segmented lens having a 180-degree coverage pattern.
J. Coverage pattern and sensitivity shall be verified in accordance with NEMA WD-7 Guide for Occupancy Sensors.
K. Sensor multi-segmented lens shall match the color of the occupancy sensor and decorator style wall plate.
L. Sensor shall have a 3-position service switch located behind a removable cover with OFF, AUTO and ON positions. In the OFF position, the switch and connected load are disconnected from the AC power. In the AUTO position, the switch operates normally. In the ON position, the sensor is bypassed and connected load is turned on.
M. Sensor shall have a time delay adjustment located behind a removable cover to allow the adjustment of the time delay from 30 seconds to 30 minutes.
N. Sensor shall have a Test Mode in which the time delay is 15 seconds to reduce commissioning time.
O. Sensor shall have a light level sensor to prevent turning on lights when adequate natural light is present. Light level adjustment ranges from 0.5-250 foot-candles and is located behind a removable cover.
P. Sensor shall have a Walk-Through Mode that detects brief periods of occupancy and turns off lights within 2 minutes.

Q. Sensor shall employ Adaptive Technology to automatically adjust time delay and sensitivity to maximize energy efficiency and minimize nuisance activation and shut off.
R. Sensor shall include mounting hardware, decorator wall plate cover and screws to mount cover. Wall plate cover color shall match the sensor.

Catalog Number	Description
SLSPWS1277UW	Commercial Grade PIR Wall Switch White
SLSPWS1277UI	Commercial Grade PIR Wall Switch Ivory
SLSPWS1277UG	Commercial Grade PIR Wall Switch Gray
SLSPWS1277UL	Commercial Grade PIR Wall Switch Light Almond
SLSPWS1277UB	Commercial Grade PIR Wall Switch Black

2.4 COMMERCIAL GRADE DUAL CIRCUIT PIR WALL SWITCH OCCUPANCY SENSOR



A. Sensor shall have two independent relays to switch connected rated 120V to 277V at 50/60Hz.
B. Sensor shall have a Lamp Saver mode for 50/50 bi-level lighting control applications where an A and B group each provide 50% lighting in a uniform manor. When Lamp Saver mode enabled, the sensor alternates A and B groups each time sensor is activated to extend lamp life and reduce maintenance.
C. Sensor shall have (2) buttons for manual control of connected loads (primary and secondary loads).
D. Sensor shall recess into standard single gang wall switch box.
E. Sensor shall meet NEC grounding requirements, providing a green grounding wire with ring terminal and thread-forming screw.
F. Sensor shall have two leads for primary (black) and secondary (blue) inputs and two leads for primary (red) and secondary (brown) loads.
G. Sensor shall be rated 120VAC to 277VAC input at line frequency of 50 or 60 hertz.

	Load Rating @ 120V	Load Rating @ 277V
Ballast	1000VA	1800VA
Incandescent	1000W	
Motor	1/4hp	

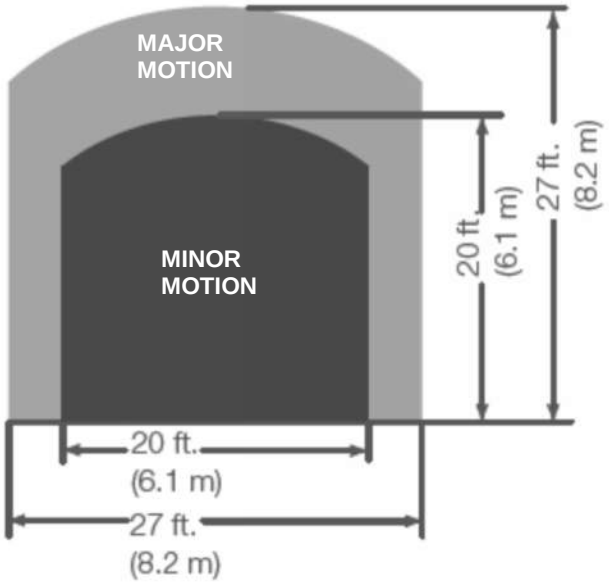
Note: Primary and secondary relays equally rated.

H. Sensor shall employ two mechanical relays to stop current flow to connected loads when sensor is inactive (off).

I. Sensor shall not require a neutral connection or minimum load.
J. Sensor shall employ a dual element PIR sensor having highest sensitivity to infrared with wavelength of 9.8 microns to detect human occupancy.
K. Sensor shall have major motion coverage up to 1000 square feet and minor motion coverage up to 300 square feet.
L. Sensor shall employ a multi-segmented lens having a 180 degree coverage pattern.
M. Coverage pattern and sensitivity shall be verified in accordance with NEMA WD-7 Guide for Occupancy Sensors.
N. Sensor multi-segmented lens shall match the color of the occupancy sensor and decorator style wall plate.
O. Sensor shall have a 3-position service switch located behind a removable cover with OFF, AUTO and ON positions. In the OFF position, the switch and connected load are disconnected from the AC power. In the AUTO position, the switch operates normally. In the ON position, the sensor is bypassed and connected load is turned on.
P. Sensor shall have a time delay adjustment located behind a removable cover to allow the adjustment of the time delay from 30 seconds to 30 minutes.
Q. Sensor shall have a Test Mode in which the time delay is 15 seconds to reduce commissioning time.
R. Sensor shall have a light level sensor to prevent turning on lights when adequate natural light is present. Light level adjustment ranges from 0.5-250 foot-candles and is located behind a removable cover.
S. Sensor shall have a Walk-Through Mode that detects brief periods of occupancy and turns off lights within 2 minutes.
T. Sensor shall employ Adaptive Technology to automatically adjust time delay and sensitivity to maximize energy efficiency and minimize nuisance activation and shut off.
U. Sensor shall include mounting hardware, decorator wall plate cover and screws to mount cover. Wall plate cover color shall match the sensor.

Catalog Number	Description
SLSPWD1277UW	Commercial Grade Dual Circuit PIR Wall Switch White
SLSPWD1277UI	Commercial Grade Dual Circuit PIR Wall Switch Ivory
SLSPWD1277UG	Commercial Grade Dual Circuit PIR Wall Switch Gray
SLSPWD1277UL	Commercial Grade Dual Circuit PIR Wall Switch Light Almond
SLSPWD1277UB	Commercial Grade Dual Circuit PIR Wall Switch Black

2.5 COMMERCIAL GRADE ULTRASONIC WALL SWITCH OCCUPANCY SENSOR



A. Sensor shall recess into standard single gang wall switch box.
B. Sensor shall meet NEC grounding requirements, providing a green grounding wire with ring terminal and thread-forming screw.

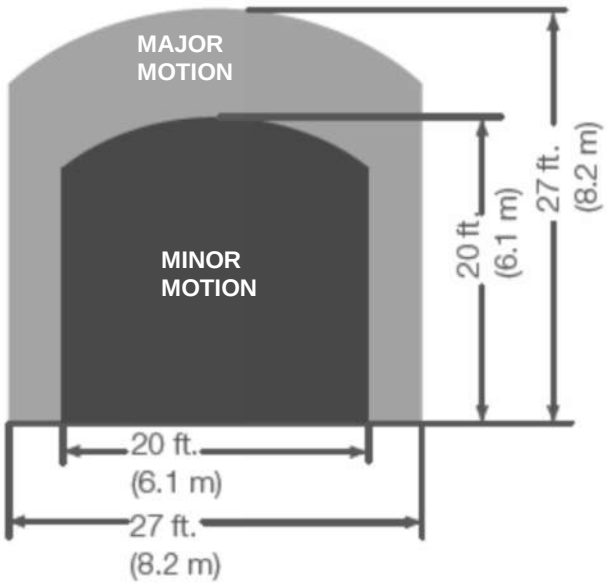
C. Sensor shall have one-line lead (black) and one load lead (red) for connection to lighting circuit.
D. Sensor shall be rated 120VAC to 277VAC input at line frequency of 50 or 60 hertz.

	Load Rating @ 120V	Load Rating @ 277V
Ballast	1000VA	1800VA
Incandescent	1000W	
Motor	1/4hp	

E. Sensor shall employ a mechanical relay to stop current flow to load when sensor is inactive (off).
F. Sensor shall not require a neutral connection or minimum load.
G. Sensor shall employ active ultrasonic motion detection having a frequency of 40 kHz.
H. Sensor shall have major motion coverage up to 700 square feet and minor motion coverage up to 400 square feet.
I. Sensor shall employ two transducers, with one transducer transmitting and one transducer receiving.
J. Coverage pattern and sensitivity shall be verified in accordance with NEMA WD-7 Guide for Occupancy Sensors.
K. Sensor shall have a 3-position service switch located behind a removable cover with OFF, AUTO and ON positions. In the OFF position, the switch and connected load are disconnected from the AC power. In the AUTO position, the switch operates normally. In the ON position, the sensor is bypassed and connected load is turned on.
L. Sensor shall have a time delay adjustment located behind a removable cover to allow the adjustment of the time delay from 30 seconds to 30 minutes.
M. Sensor shall have a Test Mode in which the time delay is 15 seconds to reduce commissioning time.
N. Sensor shall have a light level sensor to prevent turning on lights when adequate natural light is present. Light level adjustment ranges from 0.5-250 foot-candles and is located behind a removable cover.
O. Sensor shall have a Walk-Through Mode that detects brief periods of occupancy and turns off lights within 2 minutes.
P. Sensor shall employ Adaptive Technology to automatically adjust time delay and sensitivity to maximize energy efficiency and minimize nuisance activation and shut off.
Q. Sensor shall include mounting hardware, decorator wall plate cover and screws to mount cover. Wall plate cover color shall match the sensor.

Catalog Number	Description
SLSUWS1277UW	Commercial Grade Ultrasonic Wall Switch White
SLSUWS1277UI	Commercial Grade Ultrasonic Wall Switch Ivory
SLSUWS1277UG	Commercial Grade Ultrasonic Wall Switch Gray
SLSUWS1277UL	Commercial Grade Ultrasonic Wall Switch Light Almond
SLSUWS1277UB	Commercial Grade Ultrasonic Wall Switch Black

2.6 COMMERCIAL GRADE DUAL CIRCUIT ULTRASONIC WALL SWITCH OCCUPANCY SENSOR



A. Sensor shall have two independent relays to switch connected rated 120V to 277V at 50/60Hz.
B. Sensor shall have a Lamp Saver mode for 50/50 bi-level lighting control applications where an A and B group each provide 50% lighting in a uniform manor. When Lamp Saver mode is enabled, the sensor alternates A and B groups each time sensor is activated to extend lamp life and reduce maintenance.
C. Sensor shall have (2) buttons for manual control of connected loads (primary and secondary loads).
D. Sensor shall recess into standard single gang wall switch box.
E. Sensor shall meet NEC grounding requirements, providing a green grounding wire with ring terminal and thread-forming screw.
F. Sensor shall have two leads for primary (black) and secondary (blue) inputs and two leads for primary (red) and secondary (brown) loads.
G. Sensor shall be rated 120VAC to 277VAC input at line frequency of 50 or 60 hertz.

	Load Rating @ 120V	Load Rating @ 277V
Ballast	1000VA	1800VA
Incandescent	1000W	
Motor	1/4hp	

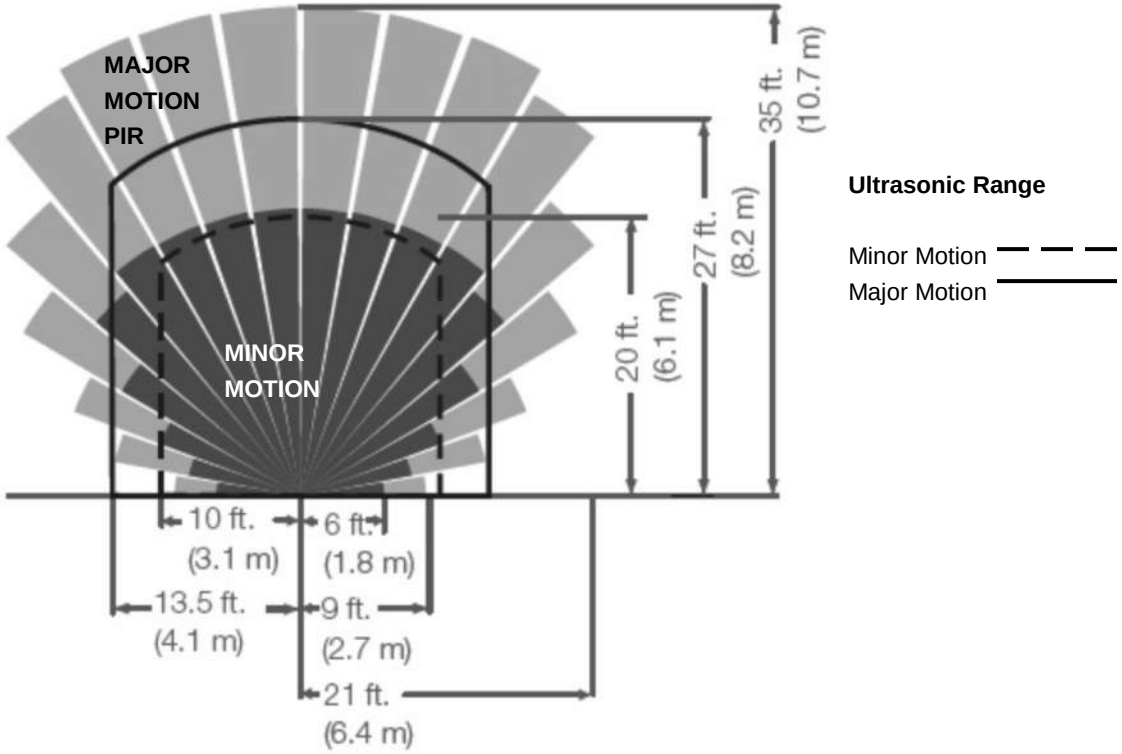
Note: Primary and secondary relays equally rated.

H. Sensor shall employ two mechanical relays to stop current flow to connected loads when sensor is inactive (off).
I. Sensor shall not require a neutral connection or minimum load.
J. Sensor shall employ active ultrasonic motion detection having a frequency of 40 kHz.
K. Sensor shall have major motion coverage up to 700 square feet and minor motion coverage up to 400 square feet.
L. Sensor shall employ two transducers, with one transducer transmitting and one transducer receiving.
M. Coverage pattern and sensitivity shall be verified in accordance with NEMA WD-7 Guide for Occupancy Sensors.
N. Sensor shall have a 3-position service switch located behind a removable cover with OFF, AUTO and ON positions. In the OFF position, the switch and connected load are disconnected from the AC power. In the AUTO position, the switch operates normally. In the ON position, the sensor is bypassed and connected load is turned on.
O. Sensor shall have a time delay adjustment located behind a removable cover to allow the adjustment of the time delay from 30 seconds to 30 minutes.
P. Sensor shall have a Test Mode in which the time delay is 15 seconds to reduce commissioning time.
Q. Sensor shall have a light level sensor to prevent turning on lights when adequate natural light is present. Light level adjustment ranges from 0.5-250 foot-candles and is located behind a removable cover.

R. Sensor shall have a Walk-Through Mode that detects brief periods of occupancy and turns off lights within 2 minutes.
S. Sensor shall employ Adaptive Technology to automatically adjust time delay and sensitivity to maximize energy efficiency and minimize nuisance activation and shut off.
T. Sensor shall include mounting hardware, decorator wall plate cover and screws to mount cover. Wall plate cover color shall match the sensor.

Catalog Number	Description
SLSUWD1277UW	Commercial Grade Dual Circuit PIR Wall Switch White
SLSUWD1277UI	Commercial Grade Dual Circuit PIR Wall Switch Ivory
SLSUWD1277UG	Commercial Grade Dual Circuit PIR Wall Switch Gray
SLSUWD1277UL	Commercial Grade Dual Circuit PIR Wall Switch Light Almond
SLSUWD1277UB	Commercial Grade Dual Circuit PIR Wall Switch Black

2.7 COMMERCIAL GRADE DUAL TECH WALL SWITCH OCCUPANCY SENSOR



B. Sensor shall meet NEC grounding requirements, providing a green grounding wire with ring terminal and thread-forming screw.
C. Sensor shall have one-line lead (black) and one load lead (red) for connection to lighting circuit.
D. Sensor shall be rated 120VAC to 277VAC input at line frequency of 50 or 60 hertz.

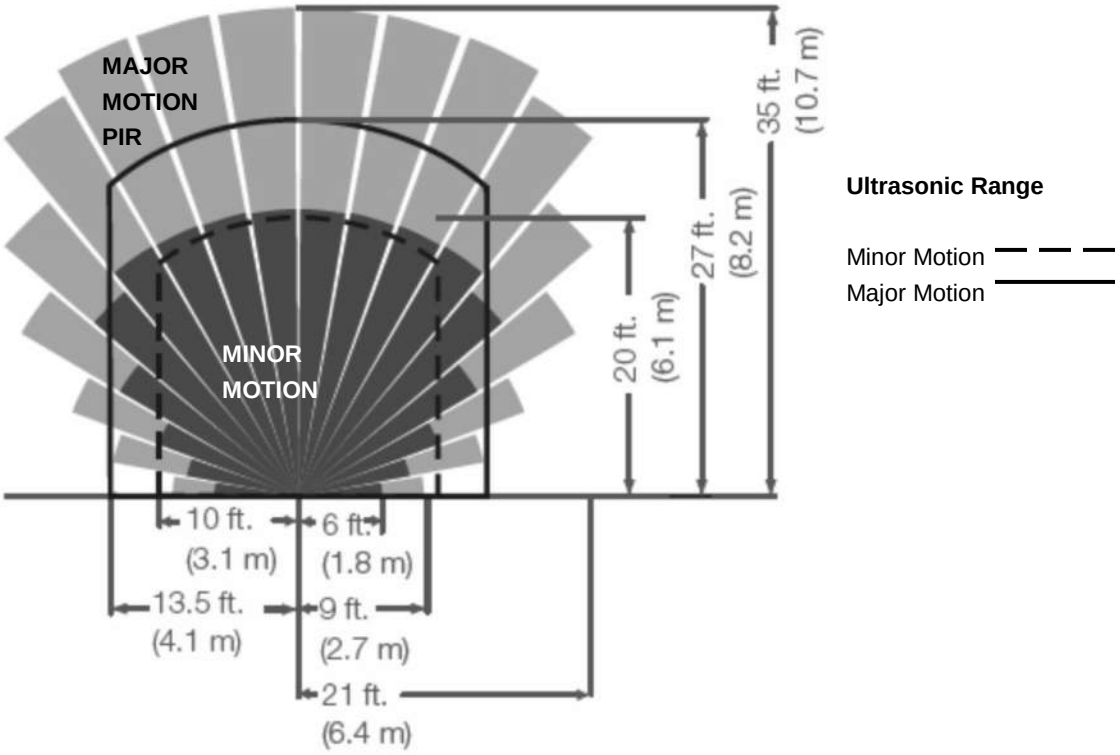
	Load Rating @ 120V	Load Rating @ 277V
Ballast	1000VA	1800VA
Incandescent	1000W	
Motor	1/4hp	

E. Sensor shall employ a mechanical relay to stop current flow to load when sensor is inactive (off).
F. Sensor shall not require a neutral connection or minimum load.
G. Sensor shall employ active ultrasonic motion detection having a frequency of 40 kHz.
H. Sensor shall have major motion coverage up to 700 square feet and minor motion coverage up to 400 square feet.
I. Sensor shall employ two transducers, with one transducer transmitting and one transducer receiving.

J. Sensor shall employ a dual element PIR sensor having highest sensitivity to infrared with wavelength of 9.8 microns to detect human occupancy.
K. Sensor shall have PIR major motion coverage up to 1000 square feet and minor motion coverage up to 300 square feet.
L. Sensor shall employ a multi-segmented lens having a 180-degree coverage pattern.
M. Coverage pattern and sensitivity shall be verified in accordance with NEMA WD-7 Guide for Occupancy Sensors.
N. Sensor multi-segmented lens shall match the color of the occupancy sensor and decorator style wall plate.
O. Sensor shall have a 3-position service switch located behind a removable cover with OFF, AUTO and ON positions. In the OFF position, the switch and connected load are disconnected from the AC power. In the AUTO position, the switch operates normally. In the ON position, the sensor is bypassed and connected load is turned on.
P. Sensor shall have a time delay adjustment located behind a removable cover to allow the adjustment of the time delay from 30 seconds to 30 minutes.
Q. Sensor shall have a Test Mode in which the time delay is 15 seconds to reduce commissioning time.
R. Sensor shall have a light level sensor to prevent turning on lights when adequate natural light is present. Light level adjustment ranges from 0.5-250 foot-candles and is located behind a removable cover.
S. Sensor shall have a Walk-Through Mode that detects brief periods of occupancy and turns off lights within 2 minutes.
T. Sensor shall employ Adaptive Technology to automatically adjust time delay and sensitivity to maximize energy efficiency and minimize nuisance activation and shut off.
U. Sensor shall include mounting hardware, decorator wall plate cover and screws to mount cover. Wall plate cover color shall match the sensor.

Catalog Number	Description
SLSDWS1277UW	Commercial Grade Ultrasonic Wall Switch White
SLSDWS1277UI	Commercial Grade Ultrasonic Wall Switch Ivory
SLSDWS1277UG	Commercial Grade Ultrasonic Wall Switch Gray
SLSDWS1277UL	Commercial Grade Ultrasonic Wall Switch Light Almond
SLSDWS1277UB	Commercial Grade Ultrasonic Wall Switch Black

2.8 COMMERCIAL GRADE DUAL CIRCUIT DUAL TECH WALL SWITCH OCCUPANCY SENSOR



A. Sensor shall have two independent relays to switch connected rated 120V to 277V at 50/60Hz.

B. Sensor shall have a Lamp Saver mode for 50/50 bi-level lighting control applications where an A and B group each provide 50% lighting in a uniform manor. When Lamp Saver mode is enabled, the sensor alternates A and B groups each time sensor is activated to extend lamp life and reduce maintenance.
C. Sensor shall have (2) buttons for manual control of connected loads (primary and secondary loads).
D. Sensor shall recess into standard single gang wall switch box.
E. Sensor shall meet NEC grounding requirements, providing a green grounding wire with ring terminal and thread-forming screw.
F. Sensor shall have two leads for primary (black) and secondary (blue) inputs and two leads for primary (red) and secondary (brown) loads.
G. Sensor shall be rated 120VAC to 277VAC input at line frequency of 50 or 60 hertz.

	Load Rating @ 120V	Load Rating @ 277V
Ballast	1000VA	1800VA
Incandescent	1000W	
Motor	1/4hp	

Note: Primary and secondary relays equally rated.

H. Sensor shall employ two mechanical relays to stop current flow to connected loads when sensor is inactive (off).
I. Sensor shall not require a neutral connection or minimum load.
J. Sensor shall employ active ultrasonic motion detection having a frequency of 40 kHz.
K. Sensor shall have major motion coverage up to 700 square feet and minor motion coverage up to 400 square feet.
L. Sensor shall employ two transducers, with one transducer transmitting and one transducer receiving.
M. Sensor shall employ a dual element PIR sensor having highest sensitivity to infrared with wavelength of 9.8 microns to detect human occupancy.
N. Sensor shall have major motion coverage up to 1000 square feet and minor motion coverage up to 300 square feet.
O. Sensor shall employ a multi-segmented lens having a 180-degree coverage pattern.
P. Coverage pattern and sensitivity shall be verified in accordance with NEMA WD-7 Guide for Occupancy Sensors.
Q. Sensor multi-segmented lens shall match the color of the occupancy sensor and decorator style wall plate.
R. Sensor shall have a 3-position service switch located behind a removable cover with OFF, AUTO and ON positions. In the OFF position, the switch and connected load are disconnected from the AC power. In the AUTO position, the switch operates normally. In the ON position, the sensor is bypassed and connected load is turned on.
S. Sensor shall have a time delay adjustment located behind a removable cover to allow the adjustment of the time delay from 30 seconds to 30 minutes.
T. Sensor shall have a Test Mode in which the time delay is 15 seconds to reduce commissioning time.
U. Sensor shall have a light level sensor to prevent turning on lights when adequate natural light is present. Light level adjustment ranges from 0.5-250 foot-candles and is located behind a removable cover.
V. Sensor shall have a Walk-Through Mode that detects brief periods of occupancy and turns off lights within 2 minutes.
W. Sensor shall employ Adaptive Technology to automatically adjust time delay and sensitivity to maximize energy efficiency and minimize nuisance activation and shut off.
X. Sensor shall include mounting hardware, decorator wall plate cover and screws to mount cover. Wall plate cover color shall match the sensor.

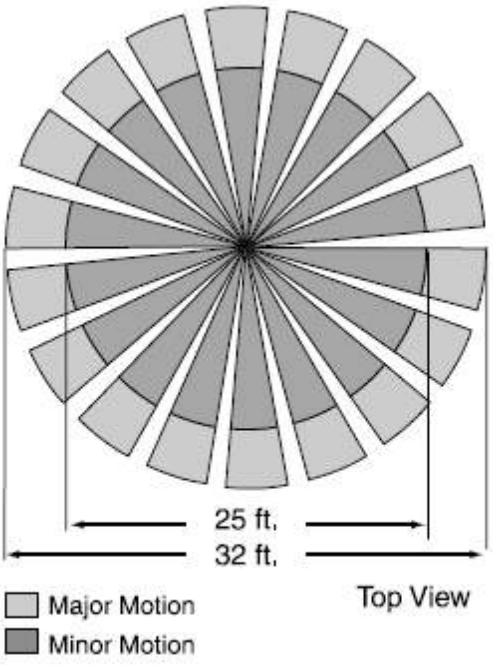
Catalog Number	Description
SLSDWD1277UW	Commercial Grade Dual Circuit PIR Wall Switch White
SLSDWD1277UI	Commercial Grade Dual Circuit PIR Wall Switch Ivory
SLSDWD1277UG	Commercial Grade Dual Circuit PIR Wall Switch Gray
SLSDWD1277UL	Commercial Grade Dual Circuit PIR Wall Switch Light Almond
SLSDWD1277UB	Commercial Grade Dual Circuit PIR Wall Switch Black

2.9 CEILING MOUNTED OCCUPANCY SENSORS

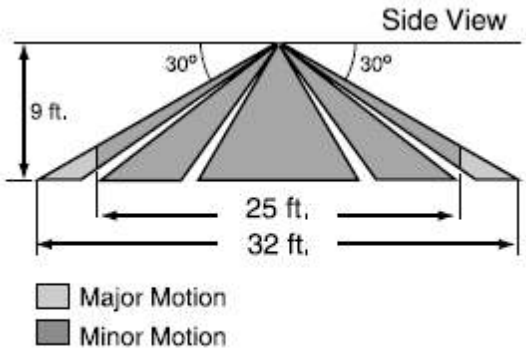
A. Sensors shall operate on a class 2, three-conductor system. Sensors shall operate at nominal 24VDC.

B. Sensor shall immediately turn on lighting when occupancy is detected.
C. Sensor shall employ a Square D Power Pack to supply power to sensor.
D. Sensor shall employ power pack or auxiliary relay to switch class 1 lighting loads and control switching of lighting loads.
E. Sensor shall employ a light level sensor with range from 0.5 to 250 foot candles, and shall come factory set at 250 foot candles to override light level feature.
F. Sensor shall have sensitivity, mode and time delay adjustments located behind a snap-on cover which is accessible when sensor is fully installed and mounted, and does not require the sensor to be moved or removed to make adjustments.
G. Sensor shall have a sensitivity adjustment ranging from 60 to 100%.
H. Sensor shall have a set of normally opened and normally closed contacts, called an isolated form c relay, rated no less than 1A@24VDC, allowing the sensor to interface with building automation systems (BAS), HVAC, security, lighting control and other control systems.

PIR Ceiling Sensor



Top view of sensor field of view

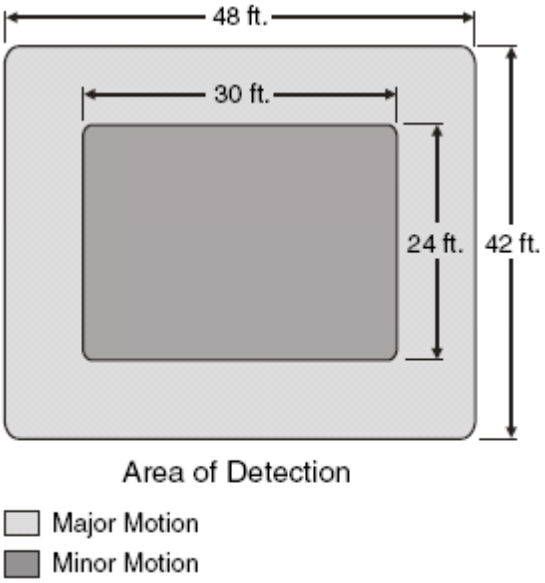


Side view of sensor field of view

I. Sensor shall detect occupancy using passive infrared (PIR) technology and employ a lens with 360-degree coverage pattern covering up to 1000 sq. ft. at a mounting height of 9 ft.
J. Sensor shall have a mode selector switch and have 2 operating modes; automatic and manual. In the manual mode, sensor remains activated and will not turn off (for service and maintenance use only).
K. PIR Ceiling sensor shall be the following Square D catalog number:

Catalog Number	Description
SLSCPS1000	Ceiling Mounted PIR

Ultrasonic Ceiling Sensor

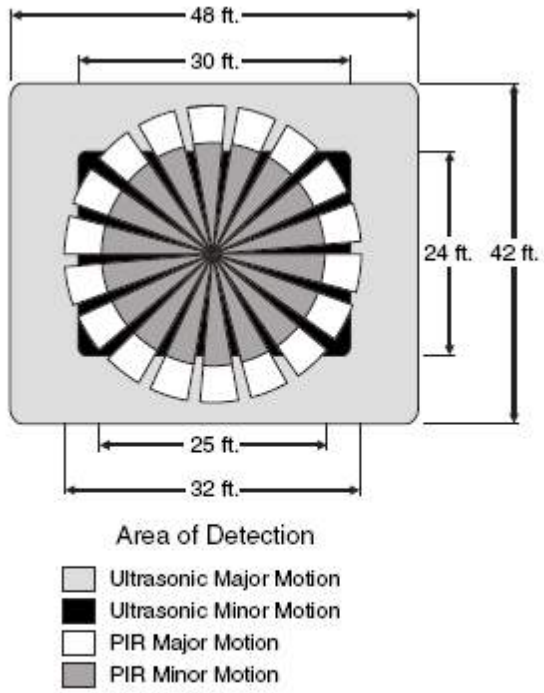


Top view of sensor field of view

L. Sensor shall detect occupancy using ultrasonic technology and radiate a signal of 32.8 kHz (+/- 3 kHz) less than 110dB at a distance of 5 ft.
M. Sensor shall have a 360-degree coverage pattern covering up to 2000 sq. ft. at a mounting height of 9 ft.
N. Sensor shall have a mode selector switch and have 2 operating modes; automatic and manual. In the manual mode, sensor remains activated and will not turn off (for service and maintenance use only).
O. Ultrasonic Ceiling sensor shall be the following Square D catalog number:

Catalog Number	Description
SLSCUS2000	Ceiling Mounted Ultrasonic

Dual Tech Ceiling Sensor



Top view of sensor field of view

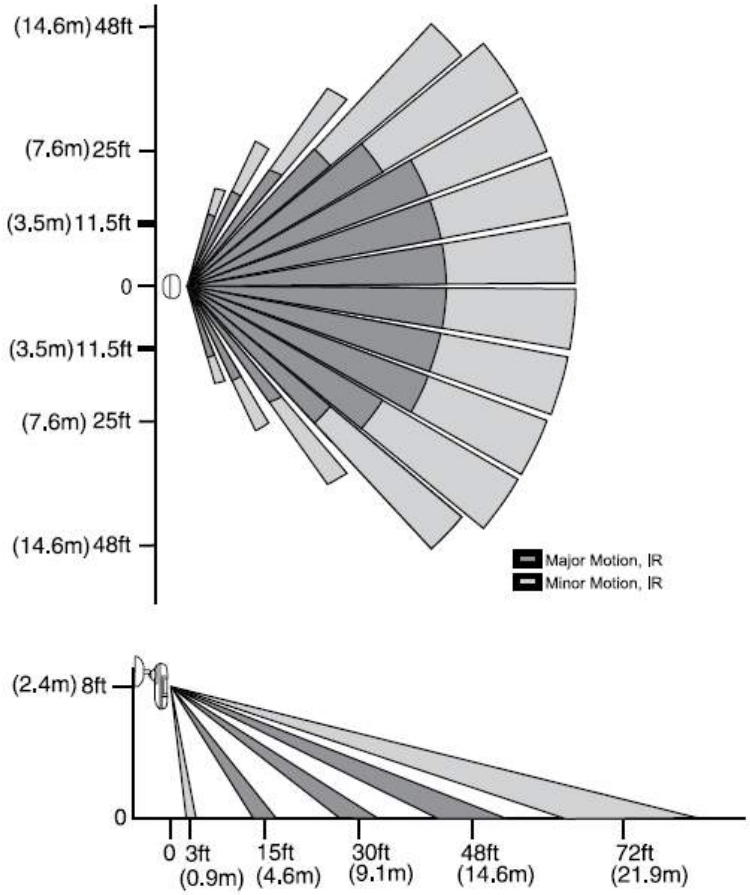
A. Sensor shall detect occupancy using both PIR and ultrasonic technology and radiate an ultrasonic signal of 32.8 kHz (+/- 3 kHz) less than 110dB at a distance of 5 ft.
B. Sensor shall have 360-degree coverage pattern for both PIR and ultrasonic detection covering up to 1000 sq. ft. for both and 2000 sq. ft. for ultrasonic only at a mounting height of 9 ft.
C. Sensor shall have a mode selector switch and have 3 operating modes; instant, normal and manual. In instant mode, sensor employs both PIR or ultrasonic to turn on lighting. In normal mode, sensor employs PIR only to turn on lighting. In manual mode, sensor remains activated and will not turn off (for service and maintenance use only). In instant and normal modes, sensor employs both PIR and ultrasonic to hold lighting on.
D. Dual Tech Ceiling sensor shall be the following Square D catalog number:

Catalog Number	Description
SLSCDS2000	Ceiling Mounted Dual Tech

2.6 WALL MOUNTED OCCUPANCY SENSORS

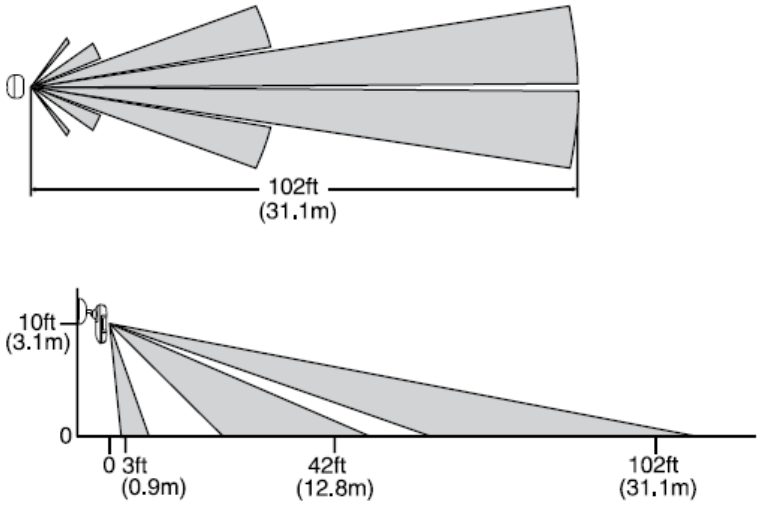
A. Sensors shall operate on a class 2, three-conductor system. Sensors shall operate at nominal 24VDC.
B. Sensor shall immediately turn on lighting when occupancy is detected.
C. Sensor shall employ a Square D Power Pack to supply power to sensor.
D. Sensor shall employ power pack or auxiliary relay to switch class 1 lighting loads and control switching of lighting loads.
E. Sensor shall employ a light level sensor with range from 0.5 to 250 foot candles, and shall come factory set at 250 foot candles to override light level feature.
F. Sensor shall have sensitivity, mode and time delay adjustments located behind a snap-on cover which is accessible when sensor is fully installed and mounted, and does not require the sensor to be moved or removed to make adjustments.
G. Sensor shall have a sensitivity adjustment ranging from 60 to 100%.
H. Sensor shall have a set of normally opened and normally closed contacts, called an isolated form c relay, rated no less than 1A@24VDC, allowing the sensor to interface with building automation systems (BAS), HVAC, security, lighting control and other control systems.

Wall Mounted PIR Sensor with Wide-View Lens



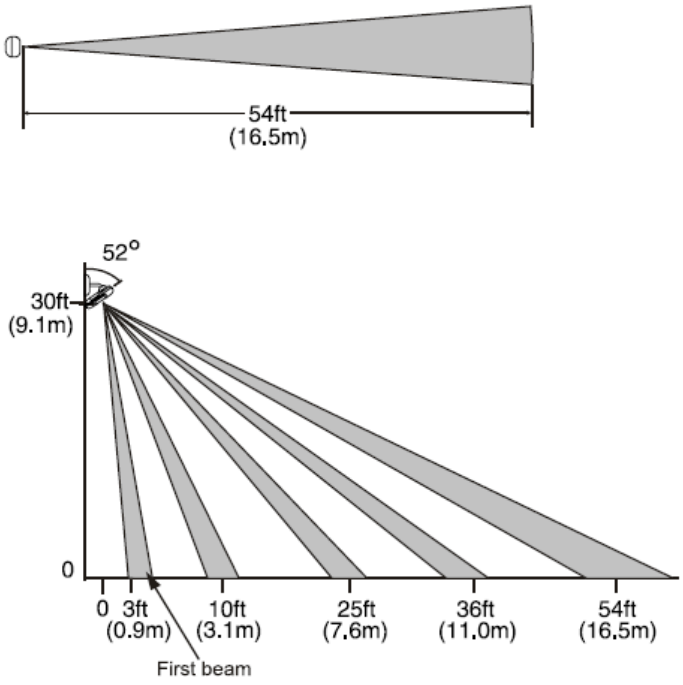
Wide Angle Lens Field of View Top and Side

Wall Mounted PIR Sensor with Long Range Lens



Long Range Lens Field of View Top and Side

Wall Mounted PIR with High Bay Lens



High Bay Lens Field of View Top and Side

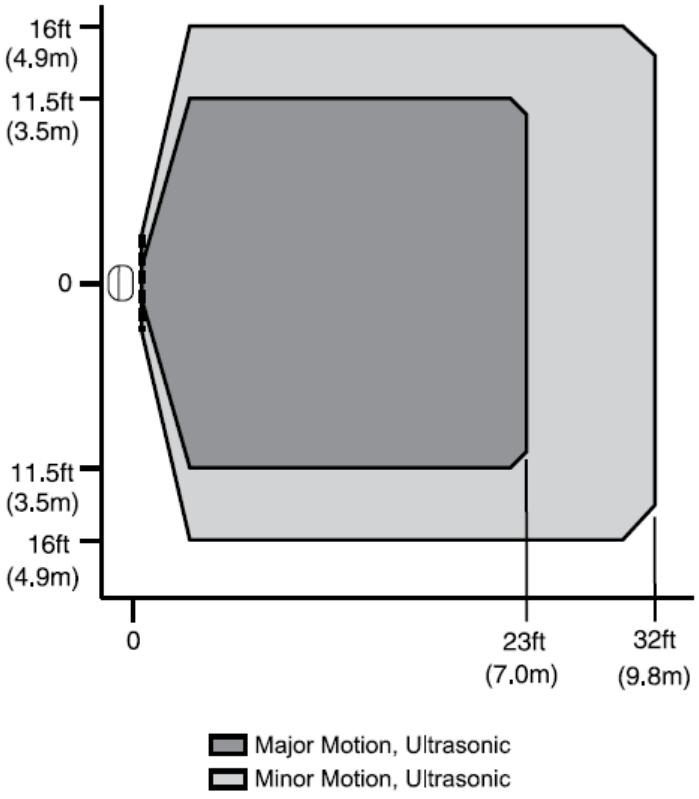
I. Sensor shall detect occupancy using passive infrared (PIR) technology and be capable of being field configured to provide either wide-view, long range or high bay coverage.
   1. Wide-View: Employ a segmented lens to provide 110° field of view covering at least 1500 square feet (shown above) from a mounting height of 9 feet.
   2. Long Range: Employ a segmented lens to provide a narrow viewing angle with a range of at least 102 linear feet from a mounting height of 10 feet.
   3. High Bay: Employ a segmented lens to provide a narrow viewing no less than 10 feet wide covering at least 54 linear feet from a mounting height of 30 feet.

J. Sensor shall have a mode selector switch and have 2 operating modes; automatic and manual. In the manual mode, sensor remains activated and will not turn off (for service and maintenance use only).

K. Wall mounted PIR sensor shall be the following Square D catalog number:

Catalog Number	Description
SLSWPS1500	Wall Mounted PIR

Wall Mounted Ultrasonic Sensor

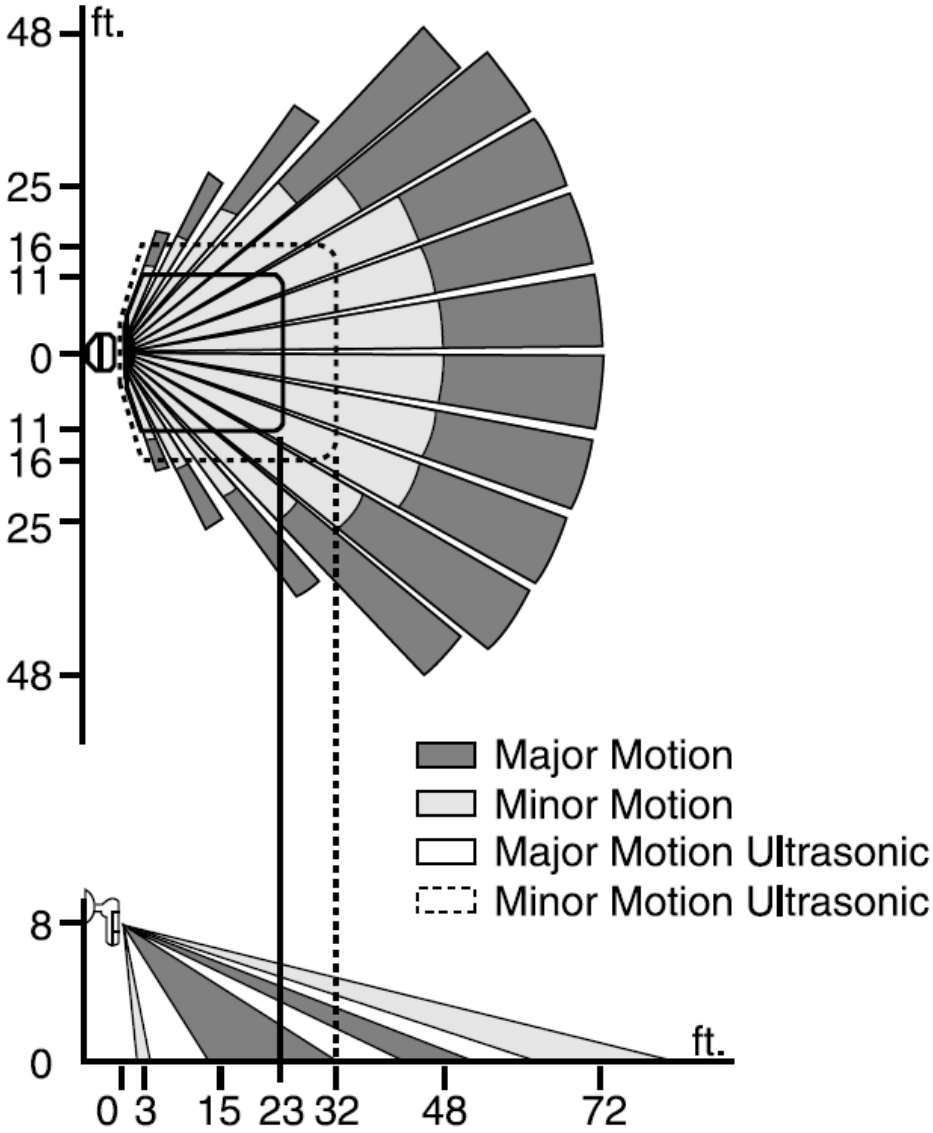


Ultrasonic Sensor Field of View Top

L. Sensor shall detect occupancy using ultrasonic technology and radiate a signal of 32.8kHz (+/- 3kHz) less than 110dB at a distance of 5 ft.
M. Sensor shall have a 180° coverage pattern covering up to 1500 sq. ft. at a mounting height of 9 ft.
N. Sensor shall have a mode selector switch and have 2 operating modes; automatic and manual. In the manual mode, sensor remains activated and will not turn off (for service and maintenance use only).
O. Ultrasonic Ceiling sensor shall be the following Square D catalog number:

Catalog Number	Description
SLSWUS1500	Ceiling Mounted Ultrasonic

Wall Mounted Dual Tech Sensor



Ultrasonic Sensor Field of View Top

P. Sensor shall detect occupancy using both PIR and ultrasonic technology and radiate an ultrasonic signal of 32.8 kHz (+/- 3 kHz) less than 110dB at a distance of 5 ft.
Q. Sensor shall have a 180° ultrasonic viewing angle and a 110° PIR viewing angle and achieve a coverage area of at least 1500 sq. ft. from a mounting height of 8 feet.
R. Sensor shall have a mode selector switch and have 3 operating modes; instant, normal and manual. In instant mode, sensor employs both PIR or ultrasonic to turn on lighting. In normal mode, sensor employs PIR only to turn on lighting. In manual mode, sensor remains activated and will not turn off (for service and maintenance use only). In instant and normal modes, sensor employs both PIR and ultrasonic to hold lighting on.
S. Wall mounted dual tech sensor shall be the following Square D catalog number:

Catalog Number	Description
SLSWDS1500	Ceiling Mounted Dual Tech

2.7 POWER PACK & AUXILIARY RELAY

A. Power pack and auxiliary relay shall be rated for 120VAC and 277VAC loads at line frequency of 60Hz.
B. Power pack shall have an input voltage selector switch to select 120VAC or 277VAC input and switch shall require a tool.
C. Power pack shall supply 100mA@24VDC to power class 2 sensors and auxiliary relays.
D. Power pack and auxiliary relay shall have plenum rated enclosure.
E. Power pack and auxiliary relay shall have separate threaded ½ in. chase nipples for class 1 and class 2 wiring, allowing both power pack and auxiliary relay to be mounted in or out of a standard 4 in. x 4 in. junction box, and providing separation of class 1 and class 2 wiring. Power pack and auxiliary relay may be mounted between two junction boxes, allowing both class 1 and class 2 wiring to be enclosed in conduit as may be required by code.
F. Power pack and auxiliary relay shall incorporate one relay rated no less than 16A for tungsten filament incandescent lighting loads and 20A for fluorescent ballast loads at either 120 or 277VAC 60Hz.
G. Power pack and Auxiliary relay shall have a 24VDC control input to allow class 2 sensors to turn on lighting connected to power pack or auxiliary relay.
H. Power pack and auxiliary relay shall be the following Square D catalog numbers:

Catalog Numbers	Description
SLSPP1277	Power Pack
SLSSP24	Auxiliary Relay

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.

B. “Grounding electrode system” refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.

C. The terms “connect” and “bond” are used interchangeably in this section and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

D. Section 26 12 19, PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS: pad-mounted, liquid-filled, medium-voltage transformers.

E. Section 26 13 13, MEDIUM-VOLTAGE CIRCUIT BREAKER SWITCHGEAR: Medium-voltage circuit breaker switchgear.

F. Section 26 23 13, GENERATOR PARALLELING CONTROLS: Generator paralleling controls.

G. Section 26 13 16, MEDIUM-VOLTAGE FUSIBLE INTERRUPTER SWITCHES: Medium-voltage fusible interrupter switches.

H. Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low-voltage transformers.

I. Section 26 23 00, LOW-VOLTAGE SWITCHGEAR: Low-voltage switchgear.

J. Section 26 24 13, DISTRIBUTION SWITCHBOARDS: Low-voltage distribution switchboards.

K. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

L. Section 26 24 19, MOTOR CONTROL CENTERS: Motor control centers.

M. Section 26 32 13, ENGINE GENERATORS: Engine generators.

N. Section 26 36 23, AUTOMATIC TRANSFER SWITCHES: Automatic transfer switches.

O. Section 26 41 00, FACILITY LIGHTNING PROTECTION: Lightning protection.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:

a. Submit sufficient information to demonstrate compliance with drawings and specifications.

b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.

2. Test Reports:

a. Two weeks prior to the final inspection, submit ground resistance field test reports to the Engineer of record.

3. Certifications:

a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Society for Testing and Materials (ASTM):

1. B1-07 Standard Specification for Hard-Drawn Copper Wire

2. B3-07 Standard Specification for Soft or Annealed Copper Wire

3. B8-11 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. 81-83 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

D. National Fire Protection Association (NFPA):

1. 70-11 National Electrical Code (NEC)

2. 70E-12 National Electrical Safety Code

3. 99-12 Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):

1. 44-10 Thermoset Insulated Wires and Cables

2. 83-08 Thermoplastic Insulated Wires and Cables

3. 467-07 Grounding and Bonding Equipment

PART 2 – PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.

B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

D. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power and cable tray systems.

2.2 GROUND RODS

A. Steel or copper clad steel 19 mm (0.75 inch) diameter by 3 M (10 feet) long.

B. Quantity of rods shall be as shown on the drawings, and as required to obtain the specified ground resistance.

2.3 CONCRETE ENCASED ELECTRODE

A. Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

2.4 GROUND CONNECTIONS

A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.

B. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use //zinc-plated//cadmium-plated// steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2. Connection to Building Steel: Exothermic-welded type connectors.

3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with //zinc-plated//cadmium-plated// steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with //zinc-plated//cadmium-plated// steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.5 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. Ground bars shall have minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required or as shown on the drawings. Provide insulators and mounting brackets.

2.6 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with zinc-plated or cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.7 GROUNDING BUS BAR

A. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets.

PART 3 – EXECUTION

3.1 GENERAL

A. Install grounding equipment in accordance with the NEC, as shown on the drawings, and as specified herein.

B. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.

2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

3. Isolation transformers and isolated power systems shall not be system grounded.

C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

D. For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS

A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.

B. Duct Banks and Manholes: Provide an insulated equipment grounding conductor in each duct containing medium-voltage conductors, sized per NEC except that minimum size shall be No. 2 AWG. Bond the equipment grounding conductors to the switchgear ground bus, to all

C. manhole grounding provisions and hardware, to the cable shield grounding provisions of medium-voltage cable splices and terminations, and to equipment enclosures. Pad-Mounted Transformers:

1. Provide a driven ground rod and bond with a grounding electrode conductor to the transformer grounding pad.

2. Ground the secondary neutral.

D. Lightning Arresters: Connect lightning arresters to the equipment ground bus or ground rods as applicable.

3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):

1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.

2. Provide a supplemental ground electrode as shown on the drawings and bond to the grounding electrode system.

C. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers, Engine-Generators, Automatic Transfer Switches, and other electrical equipment:

1. Connect the equipment grounding conductors to the ground bus.

2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

D. Transformers:

1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.

2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the ground bar at the service equipment.

3.5 RACEWAY

A. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.

2. Nonmetallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.

3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.

4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).

2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:

1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.

2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).

3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.

4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

H. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.

I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

3.6 OUTDOOR METALLIC FENCES AROUND ELECTRICAL EQUIPMENT

A. Fences shall be grounded with a ground rod at each fixed gate post and at each corner post.

B. Drive ground rods until the top is 300 mm (12 inches) below grade. Attach a No. 4 AWG copper conductor by exothermic weld to the ground rods, and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 300 mm (12 inches) of fence mesh and fasten by two approved bronze compression fittings, one to bond the wire to post and the other to bond the wire to fence. Each gate section shall be bonded to its gatepost by a 3 mm x 25 mm (0.375-inch x 1 inch) flexible, braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

3.7 CORROSION INHIBITORS

A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.8 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus

B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

3.9 LIGHTNING PROTECTION SYSTEM

A. NOT USED

3.10 MAIN ELECTRICAL ROOM GROUNDING

A. Provide ground bus bar and mounting hardware at each main electrical room where incoming feeders are terminated, as shown on the drawings. Connect to pigtail extensions of the building grounding ring, as shown on the drawings.

3.11 EXTERIOR LIGHT POLES

A. Provide 6.1 M (20 feet) of No. 4 AWG bare copper coiled at bottom of pole base excavation prior to pour, plus additional unspliced length in and above foundation as required to reach pole ground stud.

3.12 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.

B. Grounding system resistance shall comply with the electric utility company ground resistance requirements.

3.13 GROUND ROD INSTALLATION

A. For outdoor installations, drive each rod vertically in the earth, until top of rod is 610 mm (24 inches) below final grade.

B. For indoor installations, leave 100 mm (4 inches) of each rod exposed.

C. Where buried or permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.

D. Where rock or impenetrable soil prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified ground resistance.

3.14 ACCEPTANCE CHECKS AND TESTS

A. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the Engineer of Record or staff prior to backfilling. The Contractor shall notify the Engineer of Record or staff 24 hours before the connections are ready for inspection.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.

2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of times the applied force.

1.3 SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.

2. Steel slotted channel systems. Include Product Data for components.

3. Equipment supports.

C. Welding certificates.

1.4 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.; a division of Cooper Industries.

c. ERICO International Corporation.

d. GS Metals Corp.

e. Thomas & Betts Corporation.

f. Unistrut; Tyco International, Ltd.

g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1) Hilti Inc.

2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

3) MKT Fastening, LLC.

4) Simpson Strong-Tie Co., Inc.; MasterSet Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1) Cooper B-Line, Inc.; a division of Cooper Industries.

2) Empire Tool and Manufacturing Co., Inc.

3) Hilti Inc.

4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacing's less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps or [single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1 EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.

7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa) 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 9 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33 - RACEWAYS, CABLE TRAYS, AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 SUMMARY

A. This Section specifies the requirements for raceways, conduits and boxes.

1.3 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.
2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
3. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
4. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
5. ANSI/UL 1 - Flexible Metal Conduit.
6. ANSI/UL 5 - Surface Metal Raceways and Fittings.
7. ANSI/UL 360 - Liquid-tight Flexible Steel Conduit.
8. ANSI/UL 467 - Electrical Grounding and Bonding Equipment.
9. ANSI/UL 797 - Electrical Metallic Tubing.
10. ANSI/UL 870 - Wireways, Auxiliary Gutters and Associated Fittings.
11. ANSI/UL 884 - Underfloor Raceways and Fittings.
12. NEMA VE I - Metallic Cable Tray Systems.
13. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
14. UL6 - Standard for Safety, Rigid Metal Conduit.
15. UL514B - Standard for Safety, Fittings for Conduit and Outlet Boxes
16. ANSI/UL 651 - Schedule 40 and 80 Rigid PVC Conduit.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.5 SUBMITTALS

A. Product Data:

1. Submit manufacturer's product data for raceways, conduits, outlet boxes, and wireways.

B. Shop Drawings:

1. Submit Shop Drawings of the complete metal surface raceway system.

2. Shop Drawings shall include sizes and lengths of raceways as verified with laboratory furniture Shop Drawings, inside corners, outside corners, end caps, raceway cover spacing, grounding, branch circuiting and wiring including locations of service entrances, receptacle types and manufacturers, receptacle spacing, and receptacle labeling with proper voltage, phase, circuit and panelboard designations as indicated on the Drawings.

3. Submit firestopping installation Shop Drawings to cover the following scope, but not limited to. The Contractor shall obtain Owner’s approval prior to installation.

a. Product data sheet from a manufacturer that is specified by Section 07 84 13 Penetration Firestopping.

b. Dimensioned installation Shop Drawing detail(s) with UL listed firestopping assembly number that is associated to the same material manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 WIREWAYS AND TERMINAL BOXES

A. Wireways and terminal boxes shall be of steel construction, oil-tight with knockouts.

B. Size shall be minimum 4 x 4 inches or as indicated on the Drawings.

C. Cover shall be hinged.

D. Fittings shall be so constructed to continue the” lay in" feature throughout the entire installation.

E. Provide all sheet metal parts with a rust-inhibiting phosphatizing primer coating and finished in gray enamel. All hardware shall be cadmium plated to prevent corrosion.

F. Inside Terminal Boxes: Provide 25-ampere, 300-volt industrial rated terminal blocks with marking strip. Mark strip with black ink identifying circuit connection. Provide nameplate on exterior of each terminal box indicating panelboard served.

2.3 CONDUIT AND FITTINGS

A. Manufacturers:

1. Conduit and Electrical Metallic Tubing: Allied Tube & Conduit or equal.

2. Fittings: Appleton Electric, Midwest Electric Products or O-Z/Gedney.

3. Expansion Fittings: O-Z/Gedney Type DX, Crouse-Hinds Type XC, or equal by Midwest Electric Products or Appleton Electric.

4. Flexible Metal Conduit and Fittings: Anaconda Sealtite, Type UA.

B. Application:

1. Conduit and fittings for all electrical systems on this Project shall include the following:

a. Service entrance.

b. Electrical power and lighting feeders.

c. Electrical power and lighting circuits.

d. Building automation systems (BAS).

e. Fire alarm and signaling systems.

f. CCTV rough-in system.

g. Telecommunications rough-in system (minimum 6-inch bending radius for telecommunications conduits).

h. Nurse call system.

i. Security systems.

j. Other electrical systems, as identified on the Drawings.

C. For each electrical wireway system indicated, provide a complete assembly of conduit, tubing or duct with fittings including, but not necessarily limited to, connectors, nipples, couplings, locknuts, bushings, expansion fittings, and other components and accessories as needed to form a complete system of the type indicated.

D. Conduit fittings shall be designed and approved for the specific use intended. Conduit fittings, including flexible, shall have insulated throats or bushings. Rigid conduits shall have insulated bushings, unless grounding bushings are required by NEC Article 250-28. Grounding bushings shall have insulated throats.

E. Rigid metal conduit shall be hot-dipped galvanized. Fittings shall be threaded type.

F. Electrical metallic tubing shall be galvanized. Fittings shall be all steel set screw deep socket UL marked and approved for the application. Compression fittings uses shall be in, not limited to, wet damp and environmental areas type.

G. Flexible metal conduit and fittings shall be zinc-coated steel.

H. Liquid-tight flexible conduit and fittings shall consist of single strip, continuous, flexible interlocked, double-wrapped steel, galvanized inside and outside, forming smooth internal wiring channel with liquid-tight covering of flexible polyvinyl chloride (PVC).

I. Crimp type fittings are not acceptable.

J. Raceways such as electrical nonmetallic tubing (ENT) and liquid-tight flexible nonmetallic conduit (LFNC) are not acceptable for use on any Project.

2.4 WALL AND CEILING OUTLET BOXES

A. Manufacturers: Appleton Electric, RACO-Hubbell, Thomas & Betts - Steel City, Cooper Crouse-Hinds.

B. Galvanized steel interior outlet wiring boxes of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Minimum switchbox depth shall be 2 inches. Outlet boxes for electrical power shall be 2-1/8 inches deep. Outlet boxes for communication (voice and data) shall be minimum 3-1/2 inches deep.

1. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes.

2. Accessories shall be compatible with outlet boxes being used and shall meet requirements of individual situations.

C. Corrosion-resistant cast-metal weatherproof exterior outlet wiring boxes of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap and corrosion-proof fasteners.

D. Outlet boxes in poured concrete shall be plenum type without holes and with reset knockouts. Where extension rings are used to offset conduit between wall reinforcing steel, joint between extension ring and box shall be sealed to prevent concrete from entering box during pour.

2.5 FLOOR BOXES

A. Manufacturers: RACO-Hubbell, Wiremold, FSR.

B. Boxes shall be NEMA OS 1, fully adjustable, minimum 1-1/2-inch depth for electrical power only; 4-1/2-inch minimum depth for communication.

C. Boxes shall conform to regulatory requirements for concrete-tight floor boxes.

D. Service fittings shall be as specified on Drawings.

E. Poke-thru box fittings shall maintain a minimum two-hour fire rating.

2.6 PULL AND JUNCTION BOXES

A. Boxes shall be galvanized sheet metal with screw-on cover and welded seams, stainless steel nuts, bolts, screws and washers.

B. Boxes larger than 12 inches in any dimension shall be panelboard code gauge galvanized steel with hinged cover.

C. Boxes shall be sized in accordance with NEC.

2.7 CABLE TRAY AND FITTINGS

A. Manufacturers: Square D, B-Line, Chalfant.

B. Material: Hot rolled, carbon steel strip, hot-dipped galvanized after fabrication with either hot-dipped galvanized or cadmium-plated fasteners.

C. Dimensions: (exceptions as noted on Drawings):

1. Depth: 6 inches or as indicated otherwise.

2. Width: 24 inches or as indicated otherwise.

3. Radius: 36 inches or as indicated otherwise.

D. Type: Ladder.

E. Covers: Where indicated on the Drawings, provide trough-type cable tray with galvanized bolt-on covers.

2.8 SURFACE METAL RACEWAYS

A. Manufacturers: The Wiremold Company 3000 or 4000 Single-Channel System. Systems of other manufacturers may be considered equal if they meet all performance standards as specified herein. Wiremold 4000 shall be used for communication applications.

B. Raceway base and cover sections shall be UL Listed, manufactured of cold rolled steel, and finished in gray enamel.

1. Raceway shall be a two-piece design with a metal base and a Snap-On metal cover.

2. Surface metal raceways installed in controlled environmental and cold rooms. Install gasket flip type weather resistant cover plates in lieu of stainless cover plates for receptacles.

C. Furnish with all entrance fittings, elbows, end caps, covers, and device brackets and plates as indicated on the Drawings for a complete system.

1. Fittings shall be finished in enamel to match the raceway.

2. Fittings shall be supplied with a base where applicable to eliminate mitering.

D. Provide couplings, elbows, connectors, boxes, extension rings and outlet covers specifically designed for use with surface raceway system.

E. Provide factory fittings for vertical raceway riser connection to horizontal raceway runs. Such directional change fittings must accommodate required radius flex for Category 6a communication cable under both load and no load conditions.

F. All internal exposed surfaces within the raceway, including joints and covers shall be free of nicks, cuts, sharp edges, and other imperfections.

G. Grommets shall be used to accommodate building automation system cabling to critical equipment or as noted on Drawings.

H. Multiple raceways shall be provided for normal power, emergency power, and communication / critical alarm as noted on the Drawings.

1. Raceway lengths shall be as shown on the Drawings.

I. Multi-Outlet Assembly Devices:

1. Provide hospital grade, duplex receptacles mounted 12 inches on center unless noted otherwise. Unless otherwise noted, alternate circuits between receptacles.

2. In laboratory applications, normal power receptacles shall have alternating colors for different circuits:

a. Phase A = gray

b. Phase B = brown

c. Phase C = white

3. Exceptions to the color would be single circuit raceway, which shall be white.

4. Receptacles serving emergency circuits shall be red in color.

5. Isolated ground receptacles shall be orange in color.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

C. Concrete metal hit anchor and fastener is an unacceptable fastening system for concrete, brick and block.

D. Where raceways or cable trays penetrate fire-rated floors or roofs, sleeve and seal opening around raceways and cable trays with UL listed firestop assemblies equal to fire rating of floors or roofs. Seal penetrations through all floors or roofs to provide and maintain a watertight installation. Conduit sleeves, where required, shall be two (2) trade sizes larger for proper sealing and extend 2 inches above the surface. Refer to Section 07 84 13 Penetration Firestopping and Section 09 29 00 Gypsum Drywall for

sealing and firestopping requirements where raceways penetrate smoke, fire, and sound rated walls. The installation shall be in compliance with UL listed firestopping assembly.

E. Support all conduits and J-boxes above ceilings from the building structure. All J-boxes being installed above suspended ceilings must have a minimum of 12-inch working clearance between the bottom of J-boxes and the top of the ceiling grid except where approved by the Owner in writing prior to installation.

F. No raceways, metallic or non-metallic, flexible or rigid, shall be installed in any floor slab elevated above slab on grade. The only exception may be for the lighting grid in the parking deck areas of a parking garage.

G. Bushings and throats shall be installed for fittings, raceways, boxes or other enclosures prior to installing cables and wiring systems.

H. Provide raceway support in intervals not exceeding the maximum spacing per NEC.

3.2 INSTALLATION - CONDUIT

A. Install raceway and conduit system from point of origin in outlets shown, complete with offsets, pull boxes, junction boxes and fittings.

B. Installation of all new conduits must be minimum 12 inches from ceiling grid except where approved by Owner.

C. No raceway shall be run horizontally inside of walls or partitions. Exceptions: building perimeter walls under windows, clerestory panel walls, and where structural conditions do not allow vertical access to tops of walls. The contractor shall obtain written approval from the Owner for exceptions prior to installation.

D. Install rigid wall hot-dipped galvanized steel conduit. Minimum size shall be ½-inch unless noted otherwise on the Drawings. Minimum size for communication shall be 1-inch. The following exceptions are permitted:

1. Electrical Metallic Tubing (EMT): In sizes ½-inch up to and including 4 inches, may be used inside dry locations where not subject to mechanical damage. ½-inch EMT may only be used for connections between distribution J-boxes in the ceiling and J-boxes in the walls within the same room, serving 15-20 Amp single phase receptacles, lighting occupancy sensors, switches, dimmers, and fire alarm respectively. In such application the length of ½-inch EMT shall not exceed 25 feet. EMT shall be used in air-conditioned spaces, such as accessible ceilings, and dry wall partitions. EMT shall not be used outside, in concrete, underground, in underfloor spaces, in masonry walls and in locations likely to be damp. EMT shall not be used for circuits with system voltage over 480 volts.

2. Liquid-tight Flexible Metal Conduit:

    a. Install liquid-tight flexible metal conduit for connections to rotating, vibrating, moving or movable equipment, including dry-type transformers. Install internal ground wire on flexible conduit with grounding bushings.

    b. Maximum length shall be four (4) feet, minimum two (2) feet; minimum size shall be ½-inch.

3. Flexible Metal Conduit:

    a. Where required, install standard flexible steel metal conduit (not liquid-tight) with internal ground wire, in spaces above ceilings.

    b. Install flexible conduit connection such that vibrations are not transmitted to adjoining conduit or building structure. Maximum length shall be four (4) feet, minimum two (2) feet; minimum size shall be ½-inch.

    c. Communication flexible conduit size in walls shall be minimum 1-inch.

    d. Flexible conduit for lay-in fixtures may be 3/8-inch factory whip assemblies (6 feet maximum).

    e. Flexible conduit for receptacles in office applications can be used in the walls as long as the flexible conduit length does not exceed 12 feet and the flexible conduit run is not horizontal. Where fished in existing walls, the length shall not exceed 12 feet.

4. PVC Conduit:

    a. Utilize PVC conduit for underground outdoor installations, minimum size 1-inch. All PVC conduit runs shall have PVC coated rigid steel stub outs from the ground, including the last 90-degree bend.

    b. All underground PVC conduit shall be installed in concrete with 12-inch x 12-inch x 3-inch concrete markers at every 100 feet and at every turn in direction.

    c. All underground conduits shall be encased in concrete and shall have their locations identified by a warning tape that is placed in the trench at least 12 inches above the underground installation. Provide trace wire for major underground feeders.

    d. Warning tape. Underground cable and conduit detectable marking tape shall be 6 inches wide, red with black letters, imprinted with "CAUTION – BURIED ELECTRIC CABLE BELOW" or similar. Tape shall be installed a minimum of 12 inches above the underground installation, and not more than 12 inches below finished grade. Warning tape shall be visible at the point where the conduit emerges above ground at the service stubs. Where fiber optic cable is to be installed in the conduit, an underground cable marking tape with a metallic detection strip shall be imprinted with 'CAUTION – BURIED FIBER OPTIC CABLE BELOW' or similar. Splicing of the tape shall be accomplished with metal clips to maintain electrical continuity along the length of the tape. Splices shall be wrapped with a waterproof adhesive tape.

5. PVC Coated Rigid Steel Conduit:

    a. PVC coated rigid steel conduit may be direct burial for underground installation when concrete encasement is not required.

    b. The PVC coated conduit shall be hot dip galvanized inside and out. The PVC coated conduit factory-cut threads shall be protected with hot galvanized threads and a clear urethane coating. Thread protectors shall be used on the exposed threads of the PVC coated conduit. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid galvanized steel conduit. The PVC coated rigid galvanized steel conduit must be certified and authorized to wear the ETL Verification Mark.

    c. Ferrous fittings for general service locations must be UL Listed with PVC as the primary corrosion protection.

    d. A PVC sealing sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening, except unions. The inside sealing sleeve diameter shall be matched to the outside diameter of the conduit.

E. Multiple Conduit Installation:

1. Install all conduits parallel to or at 90 degrees to the structure. Multiple conduits shall not be installed using a single rod support. Multiple conduits running the same direction with spacing 48 inches apart or less shall be installed on the same trapeze. Conduits shall be installed on metal framing constructed trapeze hangers that have minimum 24-inch width. Trapeze hangers shall be supported on minimum 3/8-inch diameter all-thread rod attached to the structure with coupling nuts and expansion bolts or beam clamps. Conduit straps or other devices specifically designed for the purpose shall be used to secure conduits to the metal framing. Wire ties and hanger wires are not permitted. Conduits shall only be installed on the top surface of the metal framing, with multiple layered trapeze supports if required. Hanger rods shall not extend more than 1 inch past the lower trapeze metal framing. Use double nuts for all-thread rods.

2. Where parallel conduits are strapped, fastened or anchored, the devices used shall be of the same type and installed on the same plane whether vertical or horizontal.

3. Conduit hangers from drop rod (like Caddy B18 Series) are acceptable only upon prior written approval from the Owner.

F. Single Conduit Installation:

1. Install single conduits parallel to or at 90 degrees to the structure and suspended from the structure on all thread rods (1/4-inch minimum) or clamped and/or clipped to the structure with manufactured clamps/clips. When single conduits are suspended from all thread rods, conduit clamps with bolts and nuts shall be used. Through partition wall penetration shall not be construed as a means of conduit support. Wire ties and hanger wires are not permitted. No powder actuated, compressed

air, propane or similar powered “shot” anchor systems shall be installed under any circumstance. Wire ties and hanger wires are not permitted. Single conduits may be secured as follows:

a. Wood screws on wood.

b. Toggle bolts on hollow masonry.

c. Bolts and expansion anchors in concrete or brick.

d. Machine screws, threaded rods and clamps on steel.

e. Conduit clips on steel joists.

f. Plastic anchors are not allowed.

g. Conduit hangers from drop rod (like Caddy B18 Series) are acceptable only upon prior written approval from the Owner.

G. Fittings shall be approved for grounding purposes or shall be jumped with a copper grounding conductor of appropriate ampacity. Leave termination of such jumpers exposed. Conduit and wireway systems shall not serve as branch circuit grounding conductors.

H. Install expansion fittings in metal conduit as follows:

1. Conduit Crossing Building Expansion Joints:

a. EMT all sizes.

b. Rigid Galvanized Steel (RGS) all sizes.

2. Conduits entering environmental rooms and other locations subject to thermal expansion and as required by NEC.

3. Provide conduit expansion fitting with an integral bonding braid, as in Crouse-Hinds Type XC.

4. Expansion fittings are not required where offsets, expansion loops, or flexible conduit are placed in conduit runs. =

I. Install conduit concealed in walls, partitions and above ceilings. Install exposed in overhead conduit (at structure) of mechanical rooms and in other similar rooms where ceilings are not provided.

J. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

K. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

L. Install pull wires in empty conduits. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Jet line 232 or equal by Greenlee. Leave at least 12 inches of slack at each end of pull wire.

M. Cap ends of spare conduits and extend into space above accessible ceiling a minimum of 18 inches. Label conduit as spare.

N. Do not daisy chain conduit installations in or on walls, provide a single conduit wall drop per device.

O. The support means for conduit installation, whether threaded rods, trapeze or other system, shall not be shared with non-electrical system. Any deviation from this standard due to space constrain shall be submitted to the Owner. Owner’s review does not necessarily guarantee an approval, therefore the Contractor is advised not to start installation prior to final approval.

3.3 INSTALLATION - WIREWAYS AND TERMINAL BOXES

A. Bolt wireways and terminal boxes to steel channels fastened to the wall or in self-supporting structure. Install level.

B. Gasket each joint in oil-tight wireway.

C. Mount rain-tight wireway in horizontal position only.

3.4 INSTALLATION - BOXES

A. Provide electrical boxes as shown on Drawings, and as required for wire pulling, equipment connection, and code compliance. Electrical box locations shown on Drawings are approximate unless dimensioned. Verify location of outlets prior to rough in. Locate and install boxes to allow access and clearances per NEC.

B. J-boxes shall be provided for branch circuits in excess of 100 feet.

C. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, and metal strap for supporting outlet boxes. Accessories shall be compatible with outlet boxes being used and shall meet requirements of individual situations.

D. Do not install boxes back-to-back in walls. Provide minimum 6-inch separation in non-fire-rated walls. Provide minimum 24-inch horizontal separation in acoustic-rated walls.

E. Membrane penetration of minimum 1-hour, up to maximum 2-hour fire rating walls and partitions by recessed steel electrical boxes that do not exceed 16 square inches in area are permitted, provided the aggregate area of the openings does not exceed 100 square inches in any 100 square feet of wall area. The annular space between the wall membrane and the box shall not exceed 1/8 inch. Such boxes on opposite sides of the wall or partition shall be either separated by a horizontal distance of not less than 24 inches or separated by protecting both boxes by listed putty pads or other listed materials and methods.

F. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly imbed boxes in concrete or masonry. Boxes shall not be permitted to move laterally. Boxes shall be secured between two studs. Boxes connected to one stud are not permitted.

G. Provide knockout plugs for unused openings.

H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

I. Install boxes in walls without damaging wall insulation.

J. Outlet boxes in plaster partitions shall be “shallow-type” set flush in wall so there is at least 5/8-inch plaster covering back of box.

K. Switch boxes shall not be used as junction boxes.

L. Typical outlet box centerline heights shall be as listed in the following table. Coordinate outlet heights with Architectural Drawings, millwork details, casework details and equipment installation. Where discrepancies occur, ask for an interpretation from the Architect/Engineer and Owner.

Function	Receptacles	Telecommunications
Offices	18-inches	18-inches
Corridors	18-inches	48-inches
Exam Rooms	48 or 18-inches	48 or 18-inches
Millwork	Coordinate with millwork	Coordinate with millwork
Casework	Coordinate with millwork	Coordinate with millwork
Headwalls	Refer to Architectural Drawings	Refer to Architectural Drawings
Mechanical/Electrical Equipment Rooms	48-inches	48-inches
Laboratories	Coordinate with casework	Coordinate with casework

M. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaires, to be accessible through luminaire ceiling opening.

N. Outlet boxes supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures with separate supports, not from acoustic ceiling or ceiling tile wire. Lighting fixture outlets shall be coordinated with mechanical and architectural equipment and elements to eliminate conflicts and to provide a workable neat installation.

O. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.

P. Support pull and junction boxes independent of conduit. Combination box/conduit hangers from drop rod (like Caddy B18 Series) are acceptable only upon prior written approval from the Owner.

Q. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations. Set floor boxes level, and adjust floor box flush with finish flooring material.

3.5 INSTALLATION - CABLE TRAY

A. Coordinate cable tray installation with piping ductwork and light fixture installation. Maintain clearance inside cable tray for installation of cables. Install according to manufacturer's instructions. Provide "Caution - Do Not Use as Walkway" signs suitably displayed as designated by the Owner.

B. Avoid proximity to light fixture ballast (minimum 12-inch clearance) since electronic fields can cause interference with some telecommunication signals.

3.6 INSTALLATION - SURFACE METAL RACEWAYS

A. All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer’s installation sheets. All unused raceway openings shall be closed.

B. Install raceways above ceilings, exposed, on walls and casework parallel to or at right angles to structure and casework. Securely support raceway at intervals not exceeding 10 feet or in accordance with manufacturer’s recommendations.

C. The number of conductors installed in any raceway shall not be greater than the number for which the raceway is approved.

D. Maintain grounding continuity between raceway components to provide a continuous grounding path by means of separate insulated code-size grounding conductors.

1. Each equipment grounding conductor in a conduit homerun entering the raceway shall be connected to the ground terminals of the receptacles.

END OF SECTION

SECTION 26 05 48 - PROTECTION FOR ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

1.2 RELATED SECTIONS

A. Section 26 05 33.23 – Surface Raceways for Electrical Systems

1.3 DEFINITIONS

A. BOCA: BOCA National Building Code, 1999.

B. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.

C. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independent of other mobile structural elements during an earthquake.

1.4 SUBMITTALS

A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.

1. Anchor Bolts and Studs: Tabulate types and sizes, complete with report numbers and rated strength in tension and shear as evaluated by an agency approved by authorities having jurisdiction.

B. Shop Drawings: For anchorage and bracing not defined by details and charts on Drawings. Indicate materials, and show designs, details, and calculations signed and sealed by a Professional Engineer.

1. Design Calculations and Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
2. Details: Detail fabrication and arrangement. Detail attachment of restraints to both structural and restrained items. Show attachment locations, methods, and spacing's, identifying components and listing their strengths. Indicate direction and value of forces transmitted to the structure during seismic events.

C. Coordination Drawings: Plans and sections drawn to scale and coordinating seismic bracing for electrical components with other systems and equipment, including other seismic restraints, in the vicinity.

D. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

1.5 QUALITY ASSURANCE

A. Comply with seismic restraint requirements in BOCA, 1999, unless requirements in this Section are more stringent.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

D. Tradesman Qualification: Perform all work by skilled mechanics in a manner that satisfies the National Electrical Code and Bi-State policy and practice.

E. Welder Qualifications: Perform welding by certified welding operators currently qualified in accordance with the testing procedures of AWS D1.1 for the weld types and positions for the fabrications and installations indicated.

F. Regulatory Requirements: Select only drilled-In anchors with published ICBO ES Evaluation Reports indicating conformance with current applicable ICBO ES Acceptance Criteria. Comply with all findings and other limitations stipulated in the corresponding Evaluation Reports.

1.6 PROJECT CONDITIONS

A. Acceleration Factor: AV = 0.12

B. Project Seismic Hazard Exposure as Defined in BOCA: Group II.

C. Seismic Coefficient (CC): Per BOCA Table 1610.6.4(1).

D. Performance Criteria Factor (P): Per BOCA Table 1610.6.4(1).

E. Attachment Amplification Factor (aC): Per BOCA Table 1610.6.4(2).

1.7 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structural system and engineering features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.

B. Coordinate concrete bases with building structural system.

C. Drawings are diagrammatical and do not show offsets, fittings, and accessories that may be required. Carefully investigate the structural and finish conditions affecting the Work, and provide required fittings and accessories.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Ship each component securely packaged and labeled for safe handling to avoid damage or distortion.

B. Store materials in secure and dry facility and in original packaging in a manner to prevent soiling, physical damage, wetting or corrosion before installation.

C. Where possible, maintain protective coverings until installation is complete and remove as part of final clean up.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amber/Booth Company, Inc.
2. B-Line Systems, Inc.

3. Erico, Inc.
4. GS Metals Corp.
5. Loos & Company, Inc.
6. Mason Industries, Inc,
7. Powerstrut.
8. Thomas & Betts Corp.
9. Unistrut Corporation.

2.2 MATERIALS

A. Use preformed structural channels, tubing, supports, and hangers that is hot-dipped galvanized corrosion resistant structural grade steel conforming to ASTM A 570, Grade 33 and ASTM A 653, Grade 33 and suitable for the environment where it is installed.

B. Provide isolating material including sleeves, washers and pads between dissimilar materials.

C. Hardware: Complete set of hardware, including machine bolts, washers, lock washers, nuts and lock nuts required to complete the hanger and associated support, anchor and concrete insert installation.
   1. Stainless steel fasteners: Use stainless steel nuts and washers of matching alloy group and minimum proof stress equal to, or greater than, the specified minimum full-size tensile strength of the externally threaded fastener. Nuts: conform to ASTM F 594.
   2. Galvanized fasteners: Use hot dipped galvanized or stainless steel material as required for compatibility with associated support, hangar, anchor or insert material.
   3. Threaded fastener adhesive compound: "Threadlockers" liquid as manufactured by Henkel Loctite Corporation.

D. Use the following materials for restraints:
   1. Coordinate three subparagraphs below with Drawings.
   2. Indoor Dry Locations: Steel, zinc plated.
   3. Outdoors and Damp Locations: Galvanized steel.
   4. Corrosive Locations: Stainless steel.

E. Conduit, cable tray and bus duct hangers:
   1. Finish: Hot-dip galvanize hangars, rods, channels and hardware after fabrication.
   2. Capacity: Total weights of conduits, cable trays or bus ducts and wires, hanger dead load, plus an additional 200 pounds.
   3. Hangers: Fabricate hangers from two or more steel hanger rods, horizontal member (preformed channel), U-bolts, clamps, and other attachments as necessary for securing hanger rods, conduits, cable trays and bus ducts.
   4. Hanger rods: stress at the root of the thread less than 9,475 psi at design load.
   5. Horizontal members: Size not to exceed maximum stress of 12,650 psi at design load.

2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.
   1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.

C. Concrete Inserts: Steel-channel type.

D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

E. Welding Lugs: Comply with MSS SP-69, Type 57.

F. Use Not Permitted:

1. Lead shield anchors.
2. Explosive fasteners.

G. Wedge Anchors: Wedge type, torque-controlled, with impact section to prevent thread damage and wedge dimples to prevent spinning during installation, complete with required nuts, washers and manufacturer's installation instructions. Ensure that wedge anchors are marked with length identification markings conforming to ICBO ES AC01. Furnish anchors as manufactured by Hilti Kwik Bolt II, ITW Ramset/Red Head Trubolt Wedge, or approved equal.

1. Interior Use in Conditioned Environments within the Building: carbon steel conforming to ASTM A 510 with zinc plating in accordance with ASTM B 633.
2. Exposed Use in Plenums, Utility Shafts, Track Stairs, Tunnels, and Outdoor Locations: Type 316 stainless steel.

H. Heavy-duty sleeve anchors: torque-controlled, pull-down, prestressable type with provisions for rotation prevention and resistance to vibratory and dynamic loading. Dynamic loading suitability includes resistance to fatigue, seismic, and shock loading.

1. Interior Use in Conditioned Environments within the Building: carbon steel anchors conforming to ISO 898, Part 1, Class 8.8.
2. Exposed Use in Plenums, Utility Shafts, Track Stairs, Tunnels, and Outdoor Locations: Type 316 stainless steel.

I. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.

J. Equipment Supports: prefabricated hot dipped galvanized channels, unless noted:

1. Standard structural steel channels, nominal 1-1/2 inch by 1-1/2 inch, 12-gauge, cold formed, lipped channel, and designed to accept special spring-held hardened steel nuts for securing anchor bolts or hangar rods and other attachments. Provide securing equipment compatible with channel. Provide hot-dipped galvanized hanger rods and associated hardware as required.
2. Adjust channel depth as required to satisfy the load requirements and safety factor. Two or more channels welded together to form members of greater strength is permitted.

K. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

L. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

M. Conduit straps: one-hole or heavy-duty two-hole. Material: hot-dipped galvanized steel or malleable iron.

N. Support Grip: Conduit-Riser Kellems support grips as manufactured by Hubbell Wire Management Products.

O. Riser Clamps: hot-dipped galvanized steel.

2.4 SEISMIC BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch (41-by-41-mm) cross section, formed from 0.1046-inch- (2.7-mm-) thick steel, with 9/16-by-7/8-inch (14-by-22-mm) slots at a maximum of 2 inches (50 mm) o.c. in webs, and flange edges turned toward web.
   1. Materials for Channel: ASTM A 570, GR 33.
   2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.
   3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
   4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
   1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
   2. Wire Rope Cable: Comply with ASTM 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.

D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install electrical materials, equipment, and accessories rigid and secure, plumb and level, and in alignment with related and adjoining work to provide a complete and operable system. Do not weld electrical materials for attachment or support.

B. Install exposed conduit, cable tray and bus ducts to avoid conflicts with other work. Install horizontal raceways close to the ceiling or ceiling beams and above water or other piping wherever possible.

C. Apply galvanizing touch-up paint to all field cut channel edges. Use brush-applied touch-up paint; spray-applied galvanizing touch-up paint is not permitted.

D. Electrical Conduit, Cable Tray and Bus Duct - Installation Requirements
   1. Properly support and anchor conduit to be embedded to maintain correct location and spacing and to prevent flotation during concreting operations. Provide suitable metal supports for conduits embedded and stubbing out of concrete surfaces.
   2. Install conduit so that moisture collecting in the conduit will be drained to the nearest outlet or pull box; provide weep holes at junction boxes where appropriate.
   3. Wall- or Ceiling-Conduit Support:
      a. Maximum Spacing: 6-foot centers.
      b. Conduits not larger than 1 inch: one-hole.
      c. Conduits larger than 1-inch: heavy-duty two-hole.
      d. Space conduits installed against concrete surfaces 1/4 inch away from the surface by clamp backs or other approved means.
   4. Suspended Conduits:

a. Support individual horizontal conduits larger than 1-1/2 inch in diameter by individual hangers and hot dipped galvanized steel conduit straps, associated support rod, and anchor for vertical runs.

b. Support parallel conduits on trapeze hangers, associated support rods, and anchors. Secure each conduit to the preformed channel member by a U-bolt, one-hole strap or other specially designed and approved fastener suitable for use with the pipe hangers or channel inserts. Install conduits at least 6 inches away from parallel runs of pipes and mechanical ductwork.

5. Support cable trays and bus duct on trapeze hangers, support rods and drill-in anchors. Secure each side of the cable tray and bus duct to the preformed channel member by a U-bolt or other specially designed and approved fastener suitable for use with the channel. Install cable trays and bus duct at least 6 inches away from pipes of mechanical ductwork.
6. Support vertical conduit and cable tray risers with preformed channel anchored to concrete walls. Provide 1/4-inch nonmetallic spacer between channel and concrete spaces. Support cables installed in conduits at the top of each utility shaft and at the bottom of each pull box located in the utility shaft with Use riser clamps and horizontal channels made from
7. Hanger rods used in connection with spring-steel fasteners, clips and clamps shall be a minimum of 1/2-inch diameter hanger rods shall be hot dipped galvanized steel rods. Do not use wire for support of conduit.
8. Space supports for conduits, cable trays and bus ducts not over six feet on centers. Spacing and location of cable tray and bus fittings supports shall be as described in Section 26 05 33.23, 3.4C. Securely anchor conduits, cable trays and bus duct at each end, and run so as not to interfere with the installation and operation of equipment at the location.
9. Install Kellems support grips for cables installed in utility shaft vertical trays where cables enter the shaft and at a maximum spacing of twenty-five feet on center within the shafts. Secure Kellems support grips to preformed cable tray supports using approved channel fittings suitable for the cable loads. Install Kellems conduit riser cable supports in conduits as they enter the utility shafts. Riser clamps shall rest on conduit couplings. Kellems support grips and conduit riser clamps shall be installed in accordance with the manufacturer's recommendations and instructions.

E. Consider the Drawings as diagrammatic, showing general arrangement and location of equipment, boxes, cable tray, bus ducts, and conduits. Follow the Drawings as closely as practical; final location may be field-adjusted slightly to avoid interference after prior approval in writing is obtained from the CM. Maintain maintenance aisles and clearances and coordinated with any modifications to equipment or raceway locations.

F. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

G. Locate steel reinforcement to avoid drilling, coring or cutting of steel reinforced before drilling into concrete with a portable detection and measurement device that provides an immediate and visible image of steel reinforcement. Notify CM of any cutting or drilling of steel reinforcement. Use rebar detection tool Ferroscan FS10 System by Hilti.

3.2 STRUCTURAL ATTACHMENTS

A. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.

B. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.

C. Attachments to Existing Concrete: Use expansion anchors.

D. Holes for Expansion Anchors in Concrete:

1. Drill at locations and to depths that avoid reinforcing bars.
2. Cored Holes: Match tolerances of anchors and core bits where installed in cored holes.

E. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.

F. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.

G. Attachments to Wood Structural Members: Install bolts through members.

H. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

I. Do not install stainless steel anchors in contact with dissimilar metals.

3.3 ELECTRICAL EQUIPMENT ANCHORAGE

A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.

B. Anchor panelboards, motor-control centers, motor controls, switchboards, switchgear, transformers, unit substations, fused power-circuit devices, transfer switches, busways, battery racks, static uninterruptible power units, power conditioners, capacitor units, communication system components, and electronic signal processing, control, and distribution units as follows:

1. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
2. Concrete Bases for Floor-Mounted Equipment: Use female expansion anchors and install studs and nuts after equipment is positioned.
3. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.
4. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
5. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

3.4 SEISMIC BRACING INSTALLATION

A. Install bracing according to spacing and strengths indicated by approved analysis.

B. Thermal Expansion: Install to allow for thermal movement of braced components.

C. Cable Braces: Install with maximum cable slack recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform field quality-control tests for pull-out resistance of seismic anchorage devices:
   1. Provide necessary test equipment required for reliable testing.
   2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
   3. Schedule test with the Agency, through the CM, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
   4. Obtain CM's approval before transmitting test loads to the structure. Provide temporary load-spreading members.
   5. Test at least four of each type and size of installed anchors and fasteners selected by Engineer.
   6. Test to 90 percent of rated proof load of device.
   7. If a device fails the test, modify all installations of same type and retest until satisfactory results are achieved.
   8. Record test results.

B. Changes: only as approved by the CM
   1. Submit calculations documenting the capability of the revised support, hangar, and anchorage system can adequately restrain the equipment, conduit, cable tray and bus duct systems during the seismic event, signed and sealed by a Professional Engineer registered in the State of Missouri.

3.7 TRAINING

A. Provide manufacturer’s direct representative for on-site consultation and to train appropriate Contractor personnel during initial start-up of drilled-in anchoring. Distributor or agent not permitted. Do not proceed with installation of drilled-in anchors without complete understanding of the manufacturer’s published installation instructions by installation personnel and a copy of the published procedures on-site at the time of installation.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the panelboards as specified and as shown on the contract drawings.

1.2 RELATED SECTIONS

A. Section 26

1.3 REFERENCES

A. The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and UL as follows:

1. UL 67 – Panelboards
2. UL 50 – Cabinets and boxes
3. NEMA PB1
4. Fed. Spec. W-P-115C
5. Circuit breaker – Type I class I
6. Fusible switch – Type II class I

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Breaker layout drawing with dimensions indicated and nameplate designation
2. Component list
3. Conduit entry/exit locations
4. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
5. Cable terminal sizes
6. Product data sheets

B. Where applicable, the following additional information shall be submitted to the Engineer:

1. Key interlock scheme drawing and sequence of operations.

1.5 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process

2. Installation information

3. Seismic certification and equipment anchorage details as specified

1.6 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic tested equipment as follows:

E. The manufacturer may certify the equipment based on a detailed computer analysis of the entire assembly structure and its components. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment

1. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.

b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.7 REGULATORY REQUIREMENTS

A. The panelboards shall be UL labeled.

1.8 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.9 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Eaton / Cutler-Hammer products

B. Siemens

C. Square D

D. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 RATINGS

A. Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.

B. Panelboards rated 480 Vac shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 14,000 amperes RMS symmetrical.

C. Panelboards shall be labeled with a UL short-circuit rating. When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:

1. Size and type of upstream device

2. Branch devices that can be used

3. UL series short-circuit rating

2.3 CONSTRUCTION

A. Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

B. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three-point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owner's option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.

C. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

D. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.

E. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

F. All locks shall be keyed alike.

2.4 BUS

A. Main bus bars shall be [tin-plated aluminum] [copper] sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.

B. A □[system] [insulated/isolated] [system and insulated/isolated] ground bus shall be included in all panels.

C. Full-size (100%-rated) insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

200%-rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.5 BRANCH CIRCUIT PANELBOARDS

A. The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be [fully rated] [series rated]. Panelboards shall be Cutler-Hammer Type Pow-R-Line 1a, Pow-R-Line 2a or Pow-R-Line 3a.

B. Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

C. Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits.

1. Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

D. Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical at 240 volts, and 14,000 amperes symmetrical at 480 volts, unless otherwise noted on the drawings.

2.6 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE

A. Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings. Panelboards shall be [fully rated] [series rated]. Panelboards shall be Cutler-Hammer Type Pow-R-Line 3a or Pow-R-Line 4B. Panelboards shall have molded case circuit breakers as indicated below.

B. Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.

C. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

2.7 DISTRIBUTION PANELBOARDS – FUSIBLE SWITCH TYPE

A. Distribution panelboards shall have fusible switches as specified below and include fuses with ratings indicated on the drawings. Panelboards shall be Cutler-Hammer Type Pow-R-Line 4F.

2.8 MAIN AND FEEDER PROTECTIVE DEVICES

2.9 RETROFIT PANELBOARDS

A. The panelboard shall be specifically designed for retrofit applications in existing panelboard boxes. The manufacturer shall supply in advance to the consultant complete application instructions and information on the panelboards.

B. Trims for retrofit panelboards shall be designed specifically for retrofit applications. Trim mounting shall not be dependent nor attached to the existing enclosure. The trim and door shall attach directly to the panelboard dead front assembly so that no external trim-fastening hardware shall be required. Trims shall have concealed hardware. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Doors over 48 inches in height shall have auxiliary fasteners.

C. The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be [fully rated] [series rated]. Panelboards shall be Cutler-Hammer Type Pow-R-Line 1R.

D. Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

E. Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits.

   1. Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

F. Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical at 240 volts, unless otherwise noted on the drawings.

G. Existing enclosures shall be identified for retrofit suitability in advance. The structural integrity of all existing enclosures shall be verified. Any enclosure that is damaged shall be replaced with a new enclosure and panelboard under Section 26 24 16 of this specification. The contractor shall provide exact dimensions of the existing enclosure to the manufacturer.

H. Existing enclosures shall have a minimum width of 14 inches and a minimum depth of 4½ inches. Minimum gutter space shall be verified and shall be in accordance with the National Electrical Code.

2.10 ENCLOSURE

A. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

B. Enclosures shall be provided with blank ends.

C. Where indicated on the drawings, branch circuit panelboards shall be column width type.

2.11 NAMEPLATES

A. Provide an engraved nameplate for each panel section.

B. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied.

PART 3 EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.2 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer’s recommendations and the contract drawings.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall switches; wall dimmers; receptacles; multioutlet assembly; and device plates and decorative box covers.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

B. All switches, receptacles and device plates throughout project shall be from the same manufacturer unless otherwise specified.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. Manufacturers:

1. Pass & Seymour
2. Hubbell
3. Leviton
4. Cooper
5. Approved equal

B. Product Description: Specification Grade, NEMA WD 1, Heavy duty general use receptacle. Combination head brass grounding screw. Brass alloy triple wipe contacts shall grip both sides of plug prongs.

C. Device Body: Ivory thermoplastic rectangular design with smooth face.

D. Wiring: Back and side wired. Back wiring with clamp type terminals suitable for stranded or solid wire.

E. Configuration: NEMA WD 6.

F. Convenience Receptacle: Type 5-15.

G. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

H. Special Purpose Receptacles: Type and rating and number of poles indicated or required for the anticipated purpose.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 EXISTING WORK

A. Disconnect and remove abandoned wiring devices.

B. Modify installation to maintain access to existing wiring devices to remain active.

C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

A. Install devices plumb and level.

B. Install receptacles with grounding pole on top.

C. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

D. Connect wiring devices by wrapping solid conductor around screw terminal. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

3.5 LABELS AND INSCRIPTIONS:

A. Identify receptacle cover plate with designation as indicated on service pedestal wiring diagram (for example “Receptacle 2”). Provide label as described in Section 26 05 53.

3.6 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Verify each receptacle device is energized.

C. Test each receptacle device for proper polarity.

D. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level

3.8 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS, MOLDED CASE CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install circuit breakers of the types, sizes and quantities indicated on the contract drawings. Provide all lugs, accessories and mounting hardware necessary for proper installation and operation.

1.2 RELATED DOCUMENTS

A. All drawings and general provisions of the Contract including Division 1 requirements apply to this section.

B. The following sections shall be adhered to in the performance of work specified by this section:

1. [Section [26 05 19] [16120] – Low Voltage Electrical Power Conductors and Cables
2. Section [26 05 26] [16060] – Grounding and Bonding for Electrical Systems]

1.3 SUBMITTALS

A. Provide product information prior to fabrication and installation. Product data shall include all dimensions, weights, electrical ratings, wiring diagrams, required clearances and maintenance data.

1.4 RELATED STANDARDS

A. The molded case circuit breakers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of the following:

1. UL 489, Molded Case Circuit Breakers and Circuit Breaker Enclosures
2. NEMA AB-1, Molded Case Circuit Breakers and Molded Case Switches
3. CSA C22.2 No 5
4. Federal Specification W-C-375B/GEN
5. NEMA 250, Enclosures for Electrical Equipment (1000V Max)

1.5 QUALITY ASSURANCE

A. Manufacturer: For equipment required for the work of this section, provide product which is the responsibility of one manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in factory labeled packages or equipment. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. [The low voltage molded case circuit breakers shall be Sentron or VL as manufactured by Siemens or pre-approved equal. Approved manufacturers are as follows:

1. Siemens

2.2 MOLDED CASE CIRCUIT BREAKERS

A. Molded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics and shall be Siemens Sentron, VL or approved equal.

B. All circuit breakers shall have a quick-make, quick break over center toggle type mechanism and the handle mechanism shall be trip free to prevent holding contacts closed against a short circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. Multiple pole circuit breakers shall be common trip such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Arc extinction is to be accomplished by magnetic arc chutes. All ratings are to be clearly visible.

C. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings. The interrupting rating of the circuit breakers shall be at least equal to the available short circuit current at the line terminals of the circuit breaker. [Where indicated, circuit breakers shall be UL listed for series application.]

D. Where indicated, circuit breakers shall be current limiting. Current limiting circuit breakers shall limit the let-through I2t to a value less than the I2t of one-half cycle wave of the symmetrical prospective current without any fusible elements when operating within its current range.

E. Where combination motor control is indicated on the drawings, instantaneous only circuit breakers shall be furnished as the means to provide short circuit protection. The magnetic trip settings for each phase shall be individually adjustable from the front of each circuit breaker.

F. Where indicated, 400A and above breakers shall be UL listed for application at 100% of their continuous ampere rating in an applicable enclosure.

G. Unless otherwise noted on the drawings, all circuit breakers [125A] [250A] [400A] [600A] [800A] [1200A] [1600A] [2000A] ampere frame and below shall have thermal-magnetic trip units, with inverse time-current characteristics.

1. Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. Instantaneous pick-up settings for each phase shall be individually adjustable on all frames 250A and above.

2. Circuit breakers shall be ambient compensating in that, as the ambient temperature increases over 40º C, the circuit breaker automatically derates itself to better protect its associated conductor.

3. Circuit breakers from 250 to 2000A frames shall have thermal magnetic interchangeable trip units. When reverse feed is indicated on the drawings, in accordance with UL, circuit breakers with sealed trip units shall be supplied.

H. As indicated on the drawings, all circuit breakers [400A] [600A] [800A] [1200A] [1600A] ampere frame and above shall have microprocessor-based RMS sensing trip units.

1. Solid State sensing shall measure true RMS current with capability to measure through to the 21st harmonic. Automatic operation of all circuit breaker frames 400A and larger shall be obtained by means of solid state tripping elements providing inverse time delay and [instantaneous] [instantaneous and short-time] circuit protection. Continuous current rating shall be adjustable from 40% to 100% of trip unit rating. Instantaneous trip settings shall also be adjustable. The optional short time pick-up trip shall have adjustable pick-up settings at definite times and with 12t delay.

2. Longtime current adjustment shall be possible without the need for a rating plug.

3. Where indicated, main and feeder circuit breakers shall be provided with integral ground fault protection.

2.3 ACCESSORIES

A. Provide shunt trips, bell alarms and auxiliary switches as shown on the contract drawings. Auxiliary switches used for PLC communication shall be rated for low current use.

B. All accessories shall be UL Listed for field installation.

C. Unless otherwise noted, mechanical lugs shall be provided with all Molded Case Breakers.

D. Where indicated on the drawings, compression lugs shall be provided on 1200A frame and below circuit breakers. All compression lugs shall be supplied by the circuit breaker manufacturer.

E. Where indicated on the drawings, UL listed plug-in or rear connectors shall be provided.

F. Where indicated on the drawings, a motor driven remote operator shall be supplied with the circuit breaker.

2.4 ENCLOSURES

A. Enclosed circuit breakers shall have NEMA 1 general purpose ratings unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below.

1. [NEMA 1 surface or flush-mounted general purpose enclosures primarily intended for indoor use.]

2. [NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping non-corrosive liquids.]

3. [NEMA 3R rain tight enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation.]

4. [NEMA 4 watertight stainless steel intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water and damage from external ice formation.]

5. [NEMA 7, Class I, Group D hazardous location cast aluminum intended for indoor use in locations classified as Class I, Group D as defined in the National Electrical Code]

6. [NEMA 9, Class II, Groups E, F, G hazardous location cast aluminum intended for indoor use in locations classified as Class II, Groups E, F and G as defined in the National Electrical Code.]

2.5 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment in accordance with the latest version of applicable NEMA and UL standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall install all equipment in accordance with the contract drawings and manufacturers recommendations.

3.2 ADJUSTMENTS

A. The Contractor shall perform necessary field adjustments of the circuit breakers to place the equipment in final operating condition. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

3.3 TESTING

A. Perform factory and installation tests in accordance with applicable NEC, NEMA and UL requirements.

3.4 WARRANTY

A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than eighteen months from date of shipment.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps, and ballasts.
2. LED Lighting fixtures
3. Emergency lighting units.
4. Exit signs.
5. Lighting fixture supports.

B. See Division 16 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.2 DEFINITIONS

A. BF: BALLAST FACTOR

B. CRI: Color-rending Index

C. HID: High-Intensity Discharge

D. LER: Luminaire efficiency rating

E. Luminaire: Complete lighting fixture, including ballast housing if provide.

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast.
4. Energy-efficiency data.
5. Life, output, and energy-efficiency data for lamps.
6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
    a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.

1.4 LED LIGHTING FACT SHEET

A. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power wiring.

B. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

C. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

D. Warranties: Special warranties specified in this Section.

E. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

C. Compliance: Provide fixtures that comply with the following and additional local regulations.

1. Finish areas designated by Architect.

2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

3. Refinish mock-up area as required to produce acceptable work.

D. Comply with NFPA 70.

1.5 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warrant period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

C. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Two year(s) from date of Substantial Completion.

D. Warranty Period for LED Lighting Units: 10 years from date of Substantial Completion. Full warranty shall apply.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 25 of each type and rating installed. Furnish at least one of each type.

2. Plastic Diffusers and Lenses: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

3. Battery and Charger Data: One for each emergency lighting unit.

4. Ballasts: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

B. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging, out of extreme heat or direct sunlight, until ready for installation.

1.8 PROJECT CONDITIONS

A. Coordinate locations of lighting fixtures with ceilings, ceiling mounted components, fire protection and mechanical components, and partitions.

B. Maintain environmental conditions within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

a. LITHONIA

b. COLUMBIA

c. COOPER

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

3. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

4. Laminated Silver Metallized Film: 90 percent.

I. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.

b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

J. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 15 Section "Diffusers, Registers, and Grilles."

1. Air Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.

2. Heat Removal Units: Air path leads through lamp cavity.

3. Combination Heat Removal and Air Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air supply units.

4. Dampers: Operable from outside fixture for control of return-air volume.

5. Static Fixture: Air supply slots are blanked off, and fixture appearance matches active units.

2.3 BALLASTS

A. Electronic Ballasts for Linear Fluorescent Lamps: Comply with ANSI C82.11; instant start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A

2. Total Harmonic Distortion Rating: Less than 10 percent.

3. Transient Voltage Protection: IEEE C62.41, Category A or better.

4. Operating Frequency: 42 kHz or higher.

5. Lamp Current Crest Factor: 1.7 or less.

6. BF: 0.85 or higher.

7. Power Factor: 0.95 or higher.

B. Electromagnetic Ballasts for Linear Fluorescent Lamps: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

C. Ballasts for Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher for Linear Fluorescent Lamps: Electromagnetic type designed for use with indicated lamp types.

D. Ballasts for Dimmer-Controlled Lighting Fixtures with Linear Fluorescent Lamps: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.

2. Ballast Input Watts: Can be reduced to 20 percent of normal.

3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

E. Ballasts for Bi-Level Controlled Lighting Fixtures with Linear Fluorescent Lamps: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

a. High-Level Operation: 100 percent of rated lamp lumens.

b. Low-Level Operation: 50 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.

3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

F. Ballasts for Compact Fluorescent Lamps: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.

2. Automatic lamp starting after lamp replacement.

3. Sound Rating: A.

4. Total Harmonic Distortion Rating: Less than 20 percent.

5. Transient Voltage Protection: IEEE C62.41, Category A or better.

6. Operating Frequency: 20 kHz or higher.

7. Lamp Current Crest Factor: 1.7 or less.

8. BF: 0.95 or higher, unless otherwise indicated.

9. Power Factor: 0.95 or higher.

10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

11. Ballast Case Temperature: 75 deg C, maximum.

G. Ballasts for Dimmer-Controlled Lighting Fixtures with Compact Fluorescent Lamps: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.

2. Ballast Input Watts: Can be reduced to 20 percent of normal.

3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

H. Internal-Type Emergency Fluorescent Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate1 fluorescent lamp(s) continuously at an output of 1400 lumens each. Connect un-switched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Night-Light Connection: Operate one fluorescent lamp continuously.

3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.

5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

I. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.

2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.

3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).

4. Open-circuit operation that will not reduce average life.

5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

J. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Lamp end-of-life detection and shutdown circuit.

2. Sound Rating: A.

3. Total Harmonic Distortion Rating: Less than 15 percent.

4. Transient Voltage Protection: IEEE C62.41, Category A or better.

5. Lamp Current Crest Factor: 1.5 or less.

6. Power Factor: .90 or higher.

7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

8. Protection: Class P thermal cutout.

2.4 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate 1 fluorescent lamp(s) continuously at an output of 1500 lumens each. Connect un-switched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Night-Light Connection: Operate one fluorescent lamp continuously.

3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.

5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.5 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.

2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.

b. Charger: Fully automatic, solid-state type with sealed transfer relay.

c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

f. Integral Self-Test: Factory-installed electronic device automatically initiates code required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.6 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type. See Luminaire Schedule on plans for battery requirements or connection to emergency generator.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

6. Wire Guard: If indicated on plans provide heavy-chrome-plated wire guard to protect lamp heads or fixtures.

7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.7 LAMPS

A. Low-Mercury Fluorescent Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. T8 Rapid-Start low-mercury Fluorescent Lamps: Rated 32 W maximum, nominal length 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours, unless otherwise indicated.

C. T8 Rapid-Start low-mercury Fluorescent Lamps: Rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours, unless otherwise indicated.

D. Compact Fluorescent Lamps: 4-Pin, low mercury RI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours' operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

E. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.

F. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.

G. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

H. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K

2.8 LED LIGHTING FIXTURES

A. TruWhite Technology

B. Active Color Managements

C. Minimum of 3500K Temperature

D. Room-Side Heat Sink

E. 90-110 Lumens per Watt Efficiency

F. Delivered Light Output: 2200, 3100, 4000, 5000 Lumens

G. Input Power: 22-50 Watts

H. CRI: Minimum of 90

I. Ballast: Step Level to 50%, 0-10V Dimming to 5%

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Electrical Supports and Seismic Restraints" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm)

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm)

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Division 16 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.

2. Luminaire-mounted photoelectric relays.

3. Poles and accessories.

B. See Division 16 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.2 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports and supporting structure, applied as stated in AASHTO LTS-4.

B. Ice Load: Load of 3 lbf/sq. ft. (143.6 Pa), applied as stated in AASHTO LTS-4.

C. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.

1. Wind speed for calculating wind load for poles exceeding 50 feet in height is 110 mph.

2. Wind speed for calculating wind load for poles 50 feet or less in height is 110 mph

1.3 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Include anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

3. Basis of Design Product: The design of each item of exterior luminaire and its support is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. 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. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Color as selected by Architect. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

N. Factory-Applied Finish for Aluminum Luminaires: Color shall be dark bronze. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay.

1. Relay with locking-type receptacle shall comply with NEMA C136.10.

2. Adjustable window slide for adjusting on-off set points.

2.4 FLUORESCENT BALLASTS AND LAMPS

A. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures 0 deg F and higher.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.

2. Sound Rating: A.

3. Total Harmonic Distortion Rating: Less than 10 percent.

4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.

5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.

6. Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F and higher.

D. Fluorescent Lamps: Low-mercury type. Comply with the EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

2.5 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction average life. Include the following features, unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.

2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).

3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).

4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.

a. Restrike Range: 105- to 130-V ac.

b. Maximum Voltage: 250-V peak or 150-V ac RMS.

2. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).

2.6 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.

B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000K.

C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000K.

2.7 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-4.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.

2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.

2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.

3. Anchor-Bolt Template: Plywood or steel.

D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

2.8 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); 1-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.

1. Shape: Square, straight.

2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole and bracket, then bolted together with galvanized-steel bolts.

2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.

3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.

F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 16 Section "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Color shall be as selected by Architect.

2.9 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429, Alloy 6063-T6 with access handhole in pole wall.

B. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

C. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 16 Section "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

D. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.

2. Finish: Same as pole luminaire.

E. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

F. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Color shall be dark bronze.

2.10 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 16 Section "Wiring Devices" for ground-fault circuit-interrupter type.

1. Surface mounted, [12 inches (300 mm)] above finished grade.

2. Nonmetallic polycarbonate plastic or reinforced fiberglass cover, that when mounted results in NEMA 250, Type [3R] enclosure.

3. With cord opening.

4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.

C. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

D. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept ballast(s).

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.2 POLE INSTALLATION

A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).

2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).

3. Trees: 15 feet (5 m).

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 3 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.

2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.

3. Install base covers, unless otherwise indicated.

4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Dig holes large enough to permit use of tampers in the full depth of hole.

2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.

2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.

3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.

4. Cure concrete a minimum of 72 hours before performing work on pole.

G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

H. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 3 Section "Cast-in-Place Concrete."

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

A. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 3 Section "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 16 Section "Raceways and Boxes." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 GROUNDING

A. Ground metal poles and support structures according to Division 16 Section "Grounding and Bonding."

1. Install grounding electrode for each pole, unless otherwise indicated.

2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 16 Section "Grounding and Bonding."

1. Install grounding electrode for each pole.

2. Install grounding conductor and conductor protector.

3. Ground metallic components of pole accessories and foundations.

END OF SECTION

County of Lincoln
2019-2020 New Hondo Senior Citizen Center
Hondo, NM

100% CD CIVIL SPECIFICATIONS

TABLE OF CONTENTS

SECTION 31 1000 - SITE CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

1.2 ADMINISTRATIVE REQUIREMENTS

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

1.3 QUALITY ASSURANCE

A. Clearing Firm: Company specializing in the type of work required.
   1. Minimum of three years of documented experience.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fill Material: As specified in Section 31 2300 – Excavation and Fill.

PART 3 EXECUTION

3.1 PREPARATION

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify New Mexico 811 before site clearing.

D. Do not commence site clearing operations until temporary erosion and sedimentation-control and plant protection measures are in place.

E. Protect and maintain benchmarks and survey control points from disturbance.

F. Protect site improvements to remain from damage. Restore damaged improvements to condition existing before start of site clearing.

G. Do not store materials or equipment or permit excavation within drip line of remaining trees.

H. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the Erosion Control Drawings, as approved by local jurisdiction.

I. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

3.2 SITE CLEARING

A. Comply with other requirements specified in Section 01 7000.

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

C. Protect remaining trees and shrubs from damage and maintain vegetation. Employ a licensed arborist to repair tree and shrub damage. Restore damaged vegetation. Replace damaged trees that cannot be restored to full growth, as determined by arborist.

D. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

E. Strip topsoil. Stockpile topsoil that will be reused in the Work.
   1. Stockpile surplus topsoil to allow for respreading deeper topsoil.

F. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

G. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Neatly saw-cut length of existing pavement to remain before removing existing pavement.

H. In areas not to be further excavated, fill depressions resulting from site clearing. Place and compact satisfactory soil materials in 8-inch-thick layers to density of surrounding original ground.

I. Dispose of waste materials, including trash, debris, and excess topsoil, off Owner's property. Burning waste materials on-site is not permitted.
   1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

3.3 EXISTING UTILITIES AND BUILT ELEMENTS

A. Protect existing utilities to remain from damage.

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

C. Protect existing structures and other elements that are not to be removed.

3.4 VEGETATION

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, and planting beds.

B. Do not begin clearing until vegetation to be relocated has been removed.

C. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain.
   1. At vegetation removal limits.
   2. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
   3. Around other vegetation to remain within vegetation removal limits.
   4. See Section 01 5000 – Temporary Facilities and Controls for fence construction requirements.

D. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

E. Locate and clearly flag trees and vegetation to remain or to be relocated.

F. Vegetation Removed: Do not burn, bury, landfill, or leave on site.
   1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
   2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
   3. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
   4. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
   5. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.

G. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.5 DEBRIS

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 31 1000

SECTION 31 2200 – GRADING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 Sections, Apply to this Section.

1.2 SECTION INCLUDES:

A. Removal and storage of topsoil.

B. Rough grading the site for site structures and building pads.

C. Finish grading.

1.3 RELATED REQUIREMENTS

A. Section 31 1000 – Site Clearing

B. Section 31 2300 – Excavation and Fill

C. Section 31 2323 – Fill and Backfill

1.4 REGULATORY REQUIREMENTS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: Topsoil excavated on-site. Use stripped topsoil stockpiled on site if conforming to the following requirements. Provide imported topsoil meeting specified physical characteristics, as required to supplement stockpiled topsoil.

B. Graded.
1. Acidity Range (pH) of 5.5 to 7.5; containing a minimum of 4 percent and a maximum of 25 percent organic matter.
2. Free of roots, rocks larger than 1 inch, subsoil, debris, large weeds and foreign matter.

C. Other Fill Materials: See Section 31 2300 – Excavation and Fill and Section 31 2323 Fill and Backfill

PART 3 EXECUTION

3.1 GENERAL

A. Protect above- and below-grade utilities that remain.

B. Known underground, surface and aerial utility lines, and buried objects are indicated on the Drawings. Contractor shall satisfy himself as to the exact location of utilities, and be responsible for contacting appropriate utility companies to have underground utilities flagged prior to excavation. For location of existing utilities, contact New Mexico One Call service.

C. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

E. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Notify utility company to remove utilities.

E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

F. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

G. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

3.3 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
   1. See Procedures listed in Section 31 1000 – Site Clearing.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31 2300 – Excavation and Fill and Section 31 2323 – Fill and Backfill for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 SOIL REMOVAL and STOCKPILING

A. Stockpile excavated topsoil and subsoil on site, unless otherwise noted on the Contract Drawings
   1. Stockpiles: Unless otherwise noted on the Contract Drawings, or General Conditions, use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.5 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Regrade surfaces formed from rough grading as necessary to eliminate uneven areas and low spots. Remove debris, roots, branches, stones, in excess of 1 inch in size. Remove soil contaminated with petroleum products and replace with new material in conformance with the specifications.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

E. Place topsoil in areas where seeding, sodding, and planting are indicated.

F. Place topsoil where required to level finish grade. Make changes gradual. Blend slopes into level areas.

G. Place topsoil to the following compacted thicknesses:
   1. Areas to be Seeded with Grass: 6 inches.
   2. Areas to be Sodded: 4 inches.
   3. Shrub Beds: 18 inches.
   4. Flower Beds: 12 inches.
   5. Planter Boxes: To within 3 inches of box rim.

H. Place topsoil during dry weather.

I. Remove roots, weeds, rocks, and foreign material while spreading.

J. Near plants, buildings, and site improvements spread topsoil manually to prevent damage.

K. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

L. Lightly compact placed topsoil.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

B. Top Surface of Finish Grade: Plus or minus 1/2 inch.

3.7 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.8 FIELD QUALITY CONTROL

A. See Section 00 710 Paragraph 14 Materials Testing for compaction density testing.

3.9 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION 31 2200

SECTION 31 2300 – EXCAVATION AND FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rough grading the site for site structures and building pads.

B. Excavating for footings, slabs-on-grade, paving, site structures, and utilities within the building.

C. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, site structures, and utilities within the building.

D. Trenching for utilities outside the building to utility main connections.

E. Backfilling and compacting for utilities outside the building to utility main connections.

1.2 RELATED SECTIONS

A. Section 00 220 – Available Project Information: Geotechnical report; borehole locations and findings of subsurface materials.

1.3 DEFINITIONS

A. Finish Grade Elevations: Indicated on Drawings.

B. Subgrade Elevations: Indicated on Drawings.

1.4 REFERENCE STANDARDS

A. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. 2014.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)). 2012 e2.

C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method. 2015 e1.

D. ASTM D2940/D2940M - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways and Airports. 2015.

E. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth). 2017a.

F. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. 2017 e1.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate requirements for special foundations and load bearing elements specified in other Sections.

B. Preinstallation Meeting: Conduct a preinstallation meeting minimum one week prior to the start of the work of this Section; require attendance by all affected installers, and Owner's geotechnical engineering consultant.
   1. Convene under general provisions of Section 01 7000.
   2. Discuss all earthwork requirements specified, and document any additional requirements or modified requirements received from Owner and Owner's geotechnical engineer which require a modification of the Contract.

1.6 SUBMITTALS

A. See Section 01 3300 – Submittal Procedures for administrative requirements and submittal procedures.

B. Samples: 50 lb sample of each type of fill; submit in air-tight containers to testing laboratory.

C. Materials Sources: Submit name of imported materials source.

D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

E. Compaction Density Test Reports.

F. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.7 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. Locate stockpiles where designated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.1 MATERIALS - GENERAL

A. Soil materials, whether from sources on or off site must be approved by Owner's geotechnical engineer as suitable for intended use, and from same source throughout.

2.2 MATERIALS

A. Engineered Fill: On-site or imported soils consisting of crushed stone, crushed or screened gravel, caliche, and/or sand; free of vegetable matter and all other deleterious materials, including silt and clay balls; maximum liquid limit of 35 and plasticity index of 4 minimum to 15 maximum in accordance with ASTM D4318.
   1. Applications: All fill and backfill applications, unless otherwise specified.
   2. Graded in accordance with ASTM C136, within the following limits:
      a) 2 inch Sieve: 100 percent passing
      b) 1/2 inch Sieve: 30 to 80 percent passing.
      c) No. 4 Sieve: 20 to 60 percent passing.
      d) No. 200 Sieve: 5 to 20 percent passing.

B. Controlled Fill: On-site or imported soils consisting of crushed stone, crushed or screened gravel, caliche, and/or sand; free of vegetable matter and all other deleterious materials, including silt and clay balls; 2-1/2 inch maximum particle size; liquid limit of 35 maximum and plasticity index of 4 minimum to 15 maximum in accordance with ASTM D4318.
   1. Applications: Non-load bearing embankments.

C. Imported Granular Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; free of clay, shale, organic matter.
   1. Graded in accordance with ASTM C136, within the following limits:
      a) 1 inch Sieve: 100 percent passing
      b) No. 200 Sieve: 8 percent passing.

2.3 SOURCE QUALITY CONTROL

A. See Section 01 4000 – Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Verify damp proofing installation has been inspected.

C. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect from damage above- and below-grade utilities that remain.
C. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

D. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

E. Protect plants, lawns, and other features to remain as a portion of final landscaping.

F. Proof roll entire site; minimum 5 passes with heavy vibratory roller to observe for unsuitable or weak soils; observed by Owner's geotechnical engineering consultant.

3.3 SOIL STOCKPILING

A. Proof roll initially excavated areas; minimum 5 passes with heavy vibratory roller to identify unsuitable or weak soils; observed by Owner's geotechnical engineering consultant.

B. Stockpiling:
   1. Stockpile excavated topsoil to be re-used on site; remove remainder from site.
   2. Stockpile excavated subsoil to be re-used on site; remove remainder from site.
   3. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

C. Use of explosives is not permitted.

3.4 EXCAVATING

A. Perform additional excavation, if necessary, to accommodate new structures and construction operations.

B. Excavate subsoil required for building pad to depths required for footing bearing on undisturbed natural caliche or minimum 12 inches of engineered fill, and to a depth of 16 inches below bottom of floor slab elevation, and to a point 5 feet beyond the building line.
   1. Excavate for utilities trenches, construction operations, and other work as specified in this Section and other Sections.
   2. Notify Architect of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Hand trim excavations. Remove loose matter.

F. Correct areas that are over-excavated and load-bearing surfaces that are disturbed.

G. Grade top perimeter of excavation to prevent surface water from draining into excavation.

H. Excavate to required subgrade elevations for vehicular paving areas. Coordinate depth of excavations based on indicated paving sections.

I. Prepare excavated building pad and paving areas prior to backfilling; scarify subgrade surfaces to a depth of minimum 12 inches.
   1. Cut out soft areas of subgrade not capable of compaction in place. Backfill with engineered fill.
   2. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
   3. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.5 TRENCHING

A. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

B. Do not interfere with 45 degree bearing splay of foundations.

C. Cut trenches wide enough to allow inspection of installed utilities.

D. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

E. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

F. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

G. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

3.6 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Moisture Content: Maintain moisture content of fill and backfill materials, expressed as a percentage in relation to optimum moisture content, to attain required compaction density.
   1. All Specified Soils: Plus 2 percent to minus 2 percent.
   2. Protect moisture content of prepared soil materials from moisture loss at all times.

E. Fill Lift Thickness:
   1. Engineered and Controlled Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches loose depth.

F. Correct areas that are over-excavated.
   1. All Areas: Use engineered fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

G. Compaction Density Unless Otherwise Specified or Indicated (ASTM D698):
   1. At All Locations: 95 percent of maximum dry density.

H. Reshape and re-compact fills subjected to vehicular traffic.

3.7 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. General: Comply with local jurisdiction requirements for earthwork bedding and fill work in public rights-of-way.

B. The paragraphs below identify location, fill material to be used (identified from lower to upper fill type), and compacted thickness of each fill:

C. Utility Piping, Conduits, Duct Bank, and Similar Items:
   1. Bedding: Use engineered fill.
   2. Backfill: Cover with engineered fill.
   3. Fill up to subgrade elevation.

D. At Interior Slab-on-Grade:
   1. Use engineered fill.
   2. Fill 10 inches deep.
   3. Fill up to subgrade elevation.
   4. Place 6 inch thick layer of imported granular fill.
   5. Place vapor retarder over finished subgrade as specified in Section 03 3000 – Cast-in Place Concrete.

E. At Exterior Side of Foundation Walls and Retaining Wall Backfill:
   1. Use engineered fill.
   2. Fill up to subgrade elevation.

F. Fill Under Footings and Foundations:
   1. Use minimum 12 inches of engineered fill if necessary to establish required bearing elevations.
   2. Fill up to required subgrade elevation.

G. Fill Under Exterior Concrete Walks and Pedestrian Paving:
   1. Use engineered fill to establish subgrade elevations.
   2. Fill up to subgrade elevation.

H. Fill Under Asphalt and Concrete Vehicular Paving:
   1. Use engineered fill if required to establish subgrade elevations.
   2. Fill up to subgrade elevation.
   3. Place aggregate base course to thickness indicated on Drawings.

I. Fill Under Landscaped Areas and Non-Load Bearing Areas:
   1. Use engineered fill or controlled fill.
   2. Fill up to subgrade elevation.

3.8 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

D. Complete finish grading to elevations and slopes indicated.

3.9 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.10 FIELD QUALITY CONTROL

A. See Section 01 4000 – Quality Requirements, for general requirements for field inspection and testing.

B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

C. Compaction density testing will be performed on compacted fill in accordance with ASTM D 1556 or ASTM D 6938.

D. Results will be evaluated in relation to compaction curve determined by testing un-compacted material in accordance with ASTM D 698 ("standard Proctor").

E. If tests indicate work does not meet specified requirements, remove work, replace and retest.

F. Frequency of Tests:
   1. Conduct at least one test for each strata of soil on which foundations will be placed, to verify required design bearing capacities.

2. Prior to start of fill work at building pad, conduct field density tests of bottom of building pad excavation, at each column footing location, and one density test for each 100 lineal feet of continuous spread footing.
3. Conduct one field density test of top 12 inches of subgrade for every 5,000 square feet of paved area or building slab. Provide additional tests in each compacted fill layer for fills exceeding 30 inches in depth.
4. Conduct at least one field density test for foundation wall backfill at bottom and top lifts, and not less than one set of tests for each 100 lineal feet of backfill.
5. Conduct at least one field density test for each 100 cubic yard of backfill for trenches at bottom, middle, and top lifts, and not less than one set of tests for each 100 linear feet of trench.

3.11 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

3.12 MAINTENANCE

A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerance.

C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

D. Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.13 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.14 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION 31 2300

SECTION 31 2323 – FILL AND BACKFILL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 Sections, Apply to this Section.

1.2 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade, footings, pile caps, slabs-on-grade, paving, site structures, and utilities within the building.

B. Backfilling and compacting for utilities outside the building to utility main connections.

1.3 RELATED REQUIREMENTS

A. Section 31 2200 – Grading

B. Section 31 2300 – Excavation and Fill

C. Section 31 2333 – Trenching for Site Utilities

1.4 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.5 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2019.

B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.

C. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 e2.

D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2015 e1.

E. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012 e1.

F. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.

G. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017.

H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005 – Superseded and Replaced with ASTM D 6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2017a.

I. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); (Withdrawn 2007).

J. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2017 e1.

1.6 SUBMITTALS

A. See Section 00 710 Paragraph 2 Submittals, for administrative requirements and submittal procedures.

B. Samples: 10 lb sample of each type of fill; submit in air-tight containers to testing laboratory.

C. Materials Sources: Submit name of imported materials source.

D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

E. Moisture/Compaction Density Test Reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.

C. Separate differing materials with dividers or stockpile separately to prevent intermixing.

D. Prevent contamination.

E. Protect stockpiles from erosion and deterioration of materials.

F. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. General Fill/Controlled Fill: Imported borrow.
   1. Maximum particle size 2 ½ inch.
   2. Plasticity Index 4 minimum to 15 maximum.
   3. Liquid limit 35 maximum.

B. Structural Fill/Engineered Fill: Imported borrow.
   1. Specified in Section 31 2300 – Excavation and Fill

C. Concrete for Fill: Lean concrete.
   1. Granular Fill - Gravel: Pit run washed stone; free of shale, clay, friable material and debris.
   2. Graded in accordance with ASTM C 136, within the following limits:
   3. 2-inch Sieve: 100 percent passing
   4. 1-inch Sieve: 95 percent passing
   5. 3/4-inch Sieve: 95 to 100 percent passing
   6. 5/8-inch Sieve: 75 to 100 percent passing
   7. 3/8-inch Sieve: 55 to 85 percent passing
   8. No. 4 Sieve: 35 to 60 percent passing
   9. No. 16 Sieve: 15 to 35 percent passing
   10. No. 40 Sieve: 10 to 25 percent passing
   11. No. 200 Sieve: 5 to 10 percent passing

D. Granular Fill – Specified in Section 31 2300 – Excavation and Fill.

E. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
   1. Grade in accordance with ASTM D 2487 Group Symbol SW.

F. Topsoil: See Section 31 2200 – Grading.

2.2 ACCESSORIES

A. Vapor Retarder: 6 mil thick, polyethylene.

2.3 SOURCE QUALITY CONTROL

A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

B. If tests indicate materials do not meet specified requirements, change material and retest.

C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. Verify sub drainage, damp proofing, or waterproofing installation has been inspected.

D. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.2 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 10 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.3 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 6 inches compacted depth.

H. Slope grade away from building minimum not less than 5% for a minimum of 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.

J. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 95 percent of maximum dry density.

K. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

L. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under slabs-on-grade: 95 percent of maximum dry density.
   2. At other locations: 95 percent of maximum dry density.

M. Reshape and re-compact fills subjected to vehicular traffic.

3.4 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Structural Fill under building pad: Use structural fill/engineered fill.
   1. Fill up to subgrade elevations.
   2. Maximum depth per lift: 6 inches, compacted.
   3. Compact to minimum 95 percent of maximum dry density.
   4. Moisture plus 2 percent to minus 2 percent of optimum moisture.

C. Under Interior Slabs-On-Grade: Use base course.
   1. Depth: 4 inches deep.
   2. Compact to 95 percent of maximum dry density.
   3. Cover with granular fill.
   4. Depth: 4 inches.
   5. Compact to 95 percent of maximum dry density.
   6. Moisture plus 2 percent to minus 2 percent of optimum moisture.
   7. Minimum 10 inches Engineered Fill.

D. At Foundation Walls and Footings: Use structural fill/engineered fill.
   1. Fill up to subgrade elevation.
   2. Compact each lift to 95 percent of maximum dry density.
   3. Optimum moisture plus 2 percent to minus 2 percent of optimum moisture.
   4. Do not backfill against unsupported foundation walls.
   5. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

E. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches: Refer to Section 31 2333 – Trenching for Site Utilities.

F. Bedding: Refer to Section 31 2300 – Excavation and Fill, for procedures and Specifications

3.5 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

3.6 FIELD QUALITY CONTROL

A. Perform compaction density testing on compacted fill in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 6938.

B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor") or AASHTO T 180.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

D. Frequency of Tests: See requirements in Section 31 2300 – Excavation and Fill. For Items not listed in Section 31 2300, follow the procedures listed below
   1. Subgrade (Insitu soils) - One (1) soil density every 2500 square feet of prepared building pad (ASTM D 6938) or minimum of 3.
   2. Footings - One (1) soil density every 150 lineal feet of continuous footing area per lift of compacted material (ASTM D 6938).
   3. Engineered Fill/Controlled Fill - One (1) soil density every 2500 square feet of prepared building pad per compacted lift (ASTM D 6938) or minimum of 3.
   4. Foundations for Sidewalks/Concrete Paving - One (1) soil density every 1,000 square feet of compacted material (ASTM D 6938).
   5. Foundations for Curb & Gutter - One (1) soil density every 500 lineal feet of compacted material (ASTM D 6938).
   6. One (1) sieve analysis and plasticity index per material (subgrade, engineered fill, controlled fill) (ASTM C 136 and ASTM D 4318)

   One (1) moisture density determination (proctor) per each type of material (ASTM D 698)

F. Proof roll compacted fill at surfaces that will be under slabs-on-grade and parking areas.

3.7 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 31 2323

SECTION 31 2333 - TRENCHING FOR SITE UTILITIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

1.3 RELATED REQUIREMENTS

A. Section 31 1000 – Site Clearing

B. Section 31 2200 – Grading

C. Section 31 2300 – Excavation and Fill

D. Section 31 2323 – Fill and Backfill

1.4 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2019.

B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 e2.

C. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2015 e1.

D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012 e1.

E. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.

F. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005 – Superseded and Replaced with ASTM D 6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2017a.

G. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); (Withdrawn 2007).

1.5 SUBMITTALS

A. See Section 00 710 Paragraph 2 Submittals, for administrative requirements and submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.

C. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. General Fill/Controlled Fill: Outlined in Section 31 2300 – Excavation and Fill

B. Structural Fill/Engineered Fill: See Section 31 2300 – Excavation and Fill

C. Concrete for Fill: See Section 31 2323 – Fill and Backfill

D. Granular Fill – See Section 31 2300 – Excavation and Fill

2.2 SOURCE QUALITY CONTROL

A. See Section 00 710 Paragraph 14 Materials Testing, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.2 PREPARATION

A. See Section 31 2200 – Grading, for additional requirements.

3.3 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

G. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume. See Section 31 2300 – Excavation and Fill for removal of larger material.

H. Remove excavated material that is unsuitable for re-use from site.

I. Remove excess excavated material from site.

3.4 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.5 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

G. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

H. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

I. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.

J. Reshape and re-compact fills subjected to vehicular traffic.

3.6 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Utility Piping, Conduits, Duct Bank.
   1. At Pipe Culverts: Over Sub Drainage Piping at Foundation Perimeter and Under Slabs:
   2. At French Drains:

3.7 FIELD QUALITY CONTROL

A. See Section 00 710 Paragraph 14 Materials Testing, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 6938.

C. Evaluate results in relation to compaction curve determined by testing un-compacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests:
   1. Water, electrical, communication gas (outside parking or driving areas)
      a. 1 density per 24” depth per 300 linear feet
   2. Water, electrical, communication gas (inside parking or driving areas)
      a. 1 density per 12” depth per 100 linear feet
   3. Sewer
      a. 1 density per 6” depth per 100 linear feet

END OF SECTION 31 2333

SECTION 32 1216 - ASPHALT PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aggregate base course.

B. Bituminous concrete paving.

1.2 SUBMITTALS

A. See Section 01 3300 – Submittal Procedures, for administrative requirements and submittal procedures.

B. Mix Design: Submit proposed mix design of each class of mix for review prior to commencement of work.

C. Certificates: Submit two copies of material certificates signed by the material producer and Contractor, certifying that each material item complies with specified requirements.
   1. If requested, submit independent testing laboratory reports on aggregates and asphalt for sieve analysis, wear abrasion and other specified characteristics.

D. Project Record Documents: Maintain record of time and date of placement, temperature and weather conditions at time of placement.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with applicable requirements of New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction, 2019 Edition; Section 423.

B. Obtain materials from same source throughout.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Transport mixtures from mixing plant in trucks with tight, clean, non-sticking compartments. Provide covers to protect from weather and to prevent loss of heat when ambient temperature is below 50 degrees F.

1.6 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.
   1. Exception: Ambient temperature must be above 50 degrees F for the final asphalt wearing surface.
B. Place bitumen mixture when temperature is not more than 15 degrees F below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate Materials - General: Comply with regionally-sourced and recycled content product requirements specified in Section 01 6000 – Product Requirements.

B. Asphalt Cement Materials: In accordance with New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction, 2019 Edition.

C. Aggregate for Base Course: In accordance with New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction, 2019 Edition; Section 303, Table 303.2.1.1.

D. Mineral Aggregate: In accordance with New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction, 2019 Edition; SP IV requirements, Table 423.2.2.1:1.

2.2 ASPHALT PAVING MIXES AND MIX DESIGN

A. Use dry material to avoid foaming. Mix uniformly.

B. Perform mix design using HMA Superpave Mix Design method in accordance with New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction, 2019 Edition, Table 423.2.8.1.

C. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.3 ACCESSORIES

A. Herbicide: Chemical root inhibitor.

B. Pavement Marking Paint: Specified in Section 32 1723.13.

2.4 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction, 2019 Edition.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.2 PREPARATION - BASE SOILS

A. Coordinate compaction of soil base with Section 31 2300 – Excavation and Fill.

B. Proof roll areas to be paved with pneumatic tired equipment with a minimum vehicle weight of 25 tons. Where soft areas occur, remove loose materials and replace with base course aggregate compacted to level of subgrade.

C. Verify accuracy of site grading will result in minimum specified base course and asphalt thicknesses. Identify necessary refinements and modifications which may be necessary for proper drainage.

D. Apply herbicide at rate recommended by manufacturer; full coverage over paved areas. Remove surface vegetation within three days prior to application. Limit application of herbicide only to pavement areas.

3.3 PREPARATION - BASE COURSE

A. Place and compact base course as specified.

3.4 PREPARATION – PAVEMENT

A. Coat surfaces of manhole and catch basin frames, and similar items, with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.5 PLACING ASPHALT PAVEMENT

A. Install Work in accordance with New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction, 2019 Edition.

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Do not locate seams on vehicle wheel lines parallel to the direction of traffic.

D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.6 PAVEMENT PATCHING

A. Cut and fill with fresh, hot asphaltic concrete. Remove deficient areas for full depth of surface and base course.

B. Cut sides vertically, perpendicular and parallel to direction of traffic for extent of failure.

C. Compact and finish as specified.

D. Patch test holes full depth of section and finish flush with adjoining work.

E. Where patching is required in rights-of-way or on public property, patch as required by local jurisdiction, but not less than minimum requirements of this Section.

3.7 INSTALLATION – ACCESSORIES

A. Pavement Marking Paint: Apply according to Section 32 1723.13.

3.8 TOLERANCES

A. Flatness: Maximum variation of 1/8 inch measured with 10 foot straight edge.

B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch.

3.9 FIELD QUALITY CONTROL

A. See Section 01 4000 – Quality Requirements, for general requirements for quality control.

B. Include tests for compaction and thickness of entire pavement section and each course as installation progresses.

C. Testing organization will take samples and perform tests in accordance with New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction, 2019 Edition.

3.10 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 7 days or until surface temperature is less than 140 degrees F.

END OF SECTION 32 1216

SECTION 32 1313 - CONCRETE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete sidewalks, stair steps, gutters, parking areas, and similar site elements.

1.2 RELATED SECTIONS

A. Section 03 3000 – Cast-in-Place Concrete

B. Section 31 2300 – Excavation and Fill

1.3 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International. Reapproved 2009.

B. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International. 2016.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International. Reapproved 2009.

D. ACI 305R – Guide to Hot Weather Concreting; American Concrete Institute International. 2010.

E. ACI 306R – Guide to Cold Weather Concreting; American Concrete Institute International. 2016.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement. 2016.

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

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

I. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens. 2018.

J. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete. 2018.

K. ASTM C150/C150M - Standard Specification for Portland Cement. 2019a.

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

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

N. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete. 2011.

O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete. 2017.

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

Q. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types). 2018.

R. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction. 2018.

1.4 SUBMITTALS

A. See Section 01 3300 – Submittal Procedures, for administrative requirements and submittal procedures.

B. Product Data: Provide data on joint filler, admixtures, and curing compound.

C. Mix Designs: Submit proposed mix design for each class of concrete specified. Include proportions of ingredients, aggregate analysis, cement brand and type, slump, water/cement ratio, and strength test reports for 7 and 28 day strengths.
   1. Prepare in accordance with ACI 301.
   2. Provide specific aggregate analysis for recycled aggregates proposed for use in concrete mixes.
   3. Fly-Ash Content Submittal: If any fly ash or ground granulated blast furnace slag is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of Portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.

PART 2 PRODUCTS

2.1 PAVING ASSEMBLIES

A. Comply with applicable requirements of New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridge Construction, 2019 Edition; Section 450.
   1. Proof rolling and Base Course for Concrete Paving: See Section 00 220 – Information Available to Bidders: Specified in Geotechnical Report.

2.2 MATERIALS - GENERAL

A. Formwork, Reinforcing, and Concrete Materials - General: Comply with applicable recycled content and sustainably harvested wood product requirements specified in Section 01 6000 – Product Requirements.

2.3 FORM MATERIALS

A. Form Materials: Conform to ACI 301.

B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
   1. Thickness: 1/2 inch.

2.4 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) yield strength; deformed billet steel bars; unfinished.

B. Steel Welded Wire Reinforcement: Plain type, ASTM A1064/A1064M; in flat sheets; unfinished.

2.5 CONCRETE MATERIALS

A. Obtain cementitious materials from same source throughout.

B. Cement: ASTM C150/C150M, Air Entraining - Type IIA or Type V - Sulfate-Resistant, Portland type, gray color.

C. Fine and Coarse Mix Aggregates: ASTM C33/C33M.

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

E. Water: Clean, and not detrimental to concrete.

F. Air-Entraining Admixtures: ASTM C260/C260M.

G. Chemical Admixtures: ASTM C494/C494M, Type A - Water Reducing.
   1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.6 ACCESSORIES

A. Curing Compound: ASTM C309, Type 2 (white pigmented), Class A.

B. Joint Sealer: Specified in Section 07 9200.

2.7 CONCRETE MIX DESIGN

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

B. 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.

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

D. Concrete Properties:
   1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 3,000 psi.
   2. Minimum Modulus of Rupture at Third Point Loading: 650 psi.
   3. Fly Ash Content: Maximum 20 percent of cementitious materials by weight.
   4. Cement Content: Minimum 6 sacks per cubic yard.
   5. Water-Cement Ratio: Maximum 45 percent by weight.
   6. Total Air Content: 5 to 7 percent, determined in accordance with ASTM C173/C173M.
   7. Maximum Slump: 4 inches.
   8. Maximum Aggregate Size: 1-1/2 inch.

2.8 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.2 SUBBASE

A. See Section 312300 for construction of base course for work of this Section.

3.3 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

3.4 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

A. Place reinforcement as indicated.

B. Interrupt reinforcement at expansion joints.

3.6 COLD AND HOT WEATHER CONCRETING

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

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

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.7 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Do not place concrete when base surface is wet.

C. Ensure reinforcement, inserts, embedded parts, formed joints and similar items are not disturbed during concrete placement.

D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

E. Place concrete to pattern indicated.

3.8 JOINTS

A. Place 1/2 inch wide expansion joints at 30 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
   1. Form joints with joint filler extending from bottom of pavement to within 3/4 inch of finished surface.
   2. Secure to resist movement by wet concrete.

B. Provide tooled joints.
   1. At spacing and layout indicated on Drawings.

3.9 FINISHING

A. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge; 1/4 inch radius.

B. Vehicular Paving: Light broom, texture perpendicular to direction of travel.

C. Curbs and Gutters: Light broom, texture parallel to pavement direction.

D. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.10 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
B. Maximum Variation From True Position: 1/4 inch.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 – Quality Requirements.
   1. Provide free access to concrete operations at project site and cooperate with appointed firm.
   2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
   3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

B. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure five concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
   1. Test one cylinder at 7 days, three at 28 days, and hold one for further testing, if necessary.
   2. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
   3. Perform one slump and air content test for each set of test cylinders taken.

C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over pavement for 7 days minimum after finishing.

END OF SECTION 32 1313

SECTION 32 1373 - PAVEMENT JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within Portland cement concrete pavement.
2. Joints between Portland cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 32 Section "Concrete Pavement" for constructing joints in concrete paving.
2. Division 7 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 REFERENCE STANDARDS

A. ASTM D5249 - Standard Specification for Backer Material for Use with Cold and Hot-Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints. 2010 (Reapproved 2016).

B. ASTM C1193-Standard Guide for Use of Joint Sealants. 2016.

1.4 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- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

D. Product Test Reports: From a qualified testing agency indicating joint sealants comply with requirements, based on comprehensive testing of current product formulations.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 PRODUCTS

2.1 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 for this characteristic.

2.2 COLD-APPLIED JOINT SEALANTS

A. Available Products: Subject to compliance with requirements, provide one of the following or equal:

1. Type NS Silicone Sealant for Concrete:
   a. Roadsaver Silicone-SL; Crafco Inc.
   b. 888; Dow Corning.
2. Type SL Silicone Sealant for Concrete and Asphalt:
   a. 890-SL; Dow Corning.
3. Multi-component Low-Modulus Sealant for Concrete and Asphalt:
   a. SOF-SEAL; W.R. Meadows, Inc.

2.3 HOT-APPLIED JOINT SEALANTS

A. Available Products: Subject to compliance with requirements, provide one of the following or equal:

1. Elastomeric Sealant for Concrete:
   a. Superseal 444/777; Crafco, Inc.

b. Poly-Jet 3406; W.R. Meadows, Inc.

2. Sealant for Concrete and Asphalt:
   a. Roadsaver 221; Crafco Inc.
   b. Product #9005; Koch Materials Company.
   c. Product #9030; Koch Materials Company.
   d. Sealtight Hi-Spec; W.R. Meadows, Inc.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depths, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depths 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 pre-construction joint- sealant-substrate tests and field tests.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on pre-construction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

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 by proven techniques to 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 silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 32 1373

SECTION 32 1723.13 - PAINTED PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Parking lot markings, including parking bays, crosswalks, arrows, and handicapped symbols.

1.2 REFERENCE STANDARDS

A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.

B. FHWA MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways; U.S. Department of Transportation, Federal Highway Administration; http://mutcd.fhwa.dot.gov.

1.3 SUBMITTALS

A. See Section 01 3300 – Submittal Procedures, for administrative requirements and 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. Installation methods.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons accompanied by batch certificate.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.5 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MATERIALS

A. Line and Zone Marking Paint: MPI No. 97 Latex Traffic Marking Paint; color(s) as specified.
   1. Drive Lanes: Yellow.
   2. Parking Lots: White.
   3. Handicapped Symbols: Blue and white.

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.

3.2 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean surfaces thoroughly prior to installation.
   1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.

D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

E. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

3.3 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F or more than 95 degrees F.

C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

D. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the Drawings true, sharp edges and ends.
   1. Apply paint in one coat only.
   2. Wet Film Thickness: 0.015 inch, minimum.
   3. Length Tolerance: Plus or minus 2 inches.
   4. Width Tolerance: Plus or minus 1/8 inch.

G. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on Drawings.
   1. Mark the International Handicapped Symbol at indicated parking spaces.
   2. Hand application by pneumatic spray is acceptable.

H. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.4 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Replace removed markings at no additional cost to Owner.

END OF SECTION 32 1723.13

SECTION 33 1000 – WATER DISTRIBUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Pipe and fittings for site water lines including domestic water lines and fire water lines.

B. Valves, Fire hydrants, and Domestic water hydrants.

1.3 RELATED REQUIREMENTS

A. Section 31 2300 – Excavation and Fill

B. Section 31 2323 – Fill and Backfill: Bedding and backfilling.

C. Section 31 2333 – Trenching for Site Utilities

D. Section 33 1300 – Disinfection of Water Utility Distribution: Disinfection of site service utility water piping.

E. Section 03 3000 – Cast -in-Place Concrete: Concrete for thrust restraints.

F. Section 09 9000 – Paints and Coatings

1.4 REFERENCES

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2018.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; The American Society of Mechanical Engineers; 2018.

C. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2016.

D. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015e1.

E. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2017.

F. ASTM D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl

Chloride) (PVC) Pipe and Fittings; 2015.

G. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter; 2015.

H. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 1998 (Reapproved 2011).

I. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011.

J. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2018 (ANSI/AWWA C105/A21.5).

K. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2017 (ANSI/AWWA C111/A21.11).

L. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2002, and Errata 2017 (ANSI/AWWA C151/A21.51).

M. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association; 2019.

N. AWWA C502 - Dry Barrel Fire Hydrants; American Water Works Association; 2018 (ANSI/AWWA C502/C502a).

O. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association; 2015.

P. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; 2017 (ANSI/AWWA C508).

Q. AWWA C600 - Installation of Ductile-Iron Water Mains and their Appurtenances; American Water Works Association; 2017 (ANSI/AWWA C600).

R. AWWA C606 - Grooved and Shouldered Joints; American Water Works Association; 2015.

S. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 60 In. (100 mm through 1500 mm), for Water Distribution; American Water Works Association; 2016 (ANSI/AWWA C900/C900a).

T. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service; American Water Works Association; 2017.

U. UL 246 - Hydrants for Fire-Protection Service; Underwriters Laboratories Inc.; 2011.

1.5 SUBMITTALS

A. See Section 01 3300 – Submittal Procedures, for administrative requirements and submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with utility company requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.1 WATER PIPE

A. Ductile Iron Pipe: AWWA C151:
   1. Fittings: Ductile iron, standard thickness.
   2. Joints: AWWA C111, rubber gasket with rods.
   3. Jackets: AWWA C105 polyethylene jacket.

B. Copper Tubing: ASTM B 88, Type K, annealed:
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection or AWS A5.8, BCuP silver braze.

C. PVC Pipe: ASTM D 1785, Schedule 40.
   1. Fittings: ASTM D 2466, PVC.
   2. Joints: ASTM D 2855, solvent weld.

D. PVC Pipe: AWWA C900 Class 100:
   1. Fittings: AWWA C111, cast iron.
   2. Joints: ASTM D 3139 compression gasket ring.

E. Polyethylene Pipe: ASTM D 3035, for 45 psig pressure rating:
   1. Fittings: AWWA C901, molded or fabricated.
   2. Joints: Compression.

F. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.

2.2 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves Up To 3 Inches:
   1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.
   2. Substitutions: See Section 01 6000 – Product Requirements.

C. Gate Valves 3 Inches and Over:
   1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, flanged ends, control rod, post indicator, valve key, and extension box.
   2. Substitutions: See Section 01 6000 – Product Requirements.

D. Ball Valves Up To 2 Inches:
   1. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet with electrical ground connector, with control rod, valve key, and extension box.
   2. Substitutions: See Section 01 6000 – Product Requirements.

E. Swing Check Valves From 2 Inches to 24 Inches:
   1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
   2. Substitutions: See Section 01 6000 – Product Requirements.

F. Butterfly Valves From 2 Inches to 24 Inches:
   1. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten position lever handle.
   2. Substitutions: See Section 01 6000 – Product Requirements.

2.3 HYDRANTS

A. Hydrants: AWWA C502, UL 246, dry barrel type.
   1. Inside dimension: 7 inches minimum, with minimum 5 inches diameter valve seat opening.
   2. Minimum net water area of barrel not less than 190 percent of valve opening.
   3. 6 inch bell or mechanical joint inlet connection with accessories, gland bolts, and gaskets.
   4. Substitutions: See Section 01 6000 – Product Requirements.

B. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.

C. Hose and Streamer Connection: Match sizes with utility company, two hose nozzles, one pumper nozzle.

D. Finish: Primer and two coats of enamel in color required by utility company.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 2323 – Fill and Backfill.

B. Cover: As specified in Section 31 2323 – Fill and Backfill.

2.5 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03 3000.

B. Manhole and Cover: Refer to Section 31 2323 – Fill and Backfill.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.3 TRENCHING

A. See the sections on excavation and fill for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide 2 sq ft thrust restraint bearing on subsoil.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.4 INSTALLATION - PIPE

A. Maintain separation of water main from sewer piping in accordance with New Mexico APWA code.

B. Group piping with other site piping work whenever practical.

C. Establish elevations of buried piping to ensure not less than 1.5 ft of cover.

D. Install pipe to indicated elevation to within tolerance of 5/8 inches.

E. Install ductile iron piping and fittings to AWWA C600.

F. Install grooved and shouldered pipe joints to AWWA C606.

G. Route pipe in straight line.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Install access fittings to permit disinfection of water system performed under Section 33 1300 – Disinfection of Water Utility Distribution.

J. Slope water pipe and position drains at low points.

K. Install trace wire 6 inches above top of pipe; coordinate with Section 31 2323 – Fill and Backfill.

3.5 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.

D. Set hydrants to grade, with nozzles at least 20 inches above ground.

E. Locate control valve 4 inches away from hydrant.

F. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inches washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

G. Paint hydrants in accordance with Section 09 9000 – Painting and Coatings.

3.6 SERVICE CONNECTIONS

A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.

B. Provide sleeve in retaining wall for service main. Support with reinforced concrete bridge. Calk enlarged sleeve watertight.

C. Anchor service main to interior surface of foundation wall.

D. Provide 18 gage galvanized sheet metal sleeve surrounding service main to 6 inches above floor and 6 feet minimum below grade. Size for 2 inches minimum of glass fiber insulation stuffing.

3.7 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000 – Quality Requirements.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION 33 1000

SECTION 33 1300 – DISINFECTION OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section includes disinfection of potable water distribution and transmission; and testing and reporting results.

1.2 RELATED REQUIREMENTS

A. American Waterworks Association Standards:
   1. AWWA B300 – Hypochlorites
   2. AWWA B301 – Liquid Chlorine
   3. AWWA C651 – Disinfection Water Mains
   4. AWWA C652 – Disinfection of Water Storage Facilities
   5. AWWA C655 – Field Dechlorination

B. New Mexico Administrative Code (NMAC) – Title 20, Chapter 7, Part 10:
   1. Section 201: Application for Public Water System Project Approval.
   2. Section 400: General Operating Requirements.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Requirements: Comply with applicable state requirements.

1.4 SUBMITTALS

A. Disinfection Plan: Submit two (2) copies as follows:
   1. Prior to filling water system with water, submit Disinfection Plan to Engineer for review and comment. Plan shall describe the following proposed actions:
      a. How pipes and tanks will be filled with source water. Coordinate availability of water with Owner.
      b. Identify the sequence of filling system, chlorinating water, pressure testing and flushing system. Follow procedures specified in the referenced AWWA disinfection standards. Reference which AWWA method of chlorination will be followed.
      c. If system will be disinfected, tested and flushed in segments, identify where and in what sequence the segments will be isolated and tested. Be aware that elevation differences may require breaking up a pipeline into segments with no more than approximately 50 psi (115 vertical feet) pressure difference within the segment.
      d. Identify points in the system where water will be introduced, chlorine added (or swabbed), initial and residual chlorine concentrations measured, flushing water blown off, final chlorine residuals measured after flushing, and bacteriological sample points.
      e. Identify method of measuring chlorine residual in the field.
      f. Identify the bacteriological test lab that will be used, test method, and sampling, chain of custody, and transportation procedures.
      g. Describe how highly chlorinated flush water will be properly disposed.

B. Test Reports: Submit two (2) copies as follows:
   1. Disinfection report, include:
      a. Date issued
      b. Project name and location
      c. Treatment contractor's name, address, and phone number
      d. Type and form of disinfectant used
      e. Time and date of disinfectant injection start
      f. Time and date of disinfectant injection completion
      g. Test locations
      h. Initial and 24-hour disinfectant residuals in ppm for each outlet tested
      i. Time and date of flushing start
      j. Time and date of flushing completion
      k. Disinfectant residual after flushing in ppm for each outlet tested
   2. Bacteriological report, include:
      a. Date issued
      b. Project name and location
      c. Laboratory's name, certification number, address, and phone number
      d. Time and date of water sample collection
      e. Name of person collecting samples
      f. Test locations
      g. Time and date of laboratory test start
      h. Coliform bacteria test results for each outlet tested
      i. Certification that water conforms or fails to conform to bacterial standards of Federal Safe Drinking Water Act.
      j. Microbiologist's signature

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protect against damage and contamination.

B. Maintain caution labels on hazardous materials.

C. Maintain storage room dry and with temperatures as uniform as possible between 60 degrees F (15.6 degrees C) and 80 degrees F (26.7 degrees C).

1.6 PROTECTION

A. Provide necessary signs, barricades, and notices to prevent any person from accidentally consuming water or disturbing system being treated.

PART 2 PRODUCTS

2.1 MATERIALS

A. Disinfectant:
   1. Free chlorine; liquid, powder, tablet or gas: Per AWWA B300.

PART 3 EXECUTION

3.1 INSPECTION

A. Prior to starting Work verify that domestic water system is completed and cleaned.

B. Do not start Work until conditions are satisfactory.

3.2 SYSTEM TREATMENT

A. Water Distribution and Transmission System: Per AWWA C651. Including disinfecting existing systems after repair.

B. Water Storage Reservoir: Per AWWA C652.

C. New Building Water System: Per local or State Plumbing Code.

D. Field Dechlorination: Per AWWA C655.

3.3 BACTERIOLOGICAL TEST

A. Take samples where and when as required by referenced standards or codes.

B. Analyze water samples in accordance with "Standard Methods for the Examination of Water and Wastewater", latest edition, published by American Water Works Association.

C. Analyze water samples as otherwise required or allowed by referenced standards or codes.

D. Employ the services of an independent test laboratory certified by the New Mexico Environment Department Drinking Water Bureau to perform all bacteriological testing.

E. Payment for bacteriological testing for all other domestic water systems is considered incidental Work to the Contract Documents' bid items.

3.4 DISPOSAL OF HEAVILY CHLORINATED WATER

A. Test heavily chlorinated water for chlorine residual in accordance with App A of the AWWA C651.

B. Chlorine residual of water being disposed of, shall be neutralized in accordance with AWWA C655 – Field Dechlorination to meet residual acceptable for domestic use.

C. Dispose of water flushed from water main, after neutralization to designated receiving drainage. Coordinate with Engineer.

3.5 FAILURE OF DISINFECTION AND/OR BACTERIOLOGICAL TESTS

A. If test results do not comply with criteria required by referenced standards or codes, system shall undergo redisinfection in accordance with Section 5.2 of the AWWA C651.

END OF SECTION 33 1300

SECTION 33 3100 - SANITARY SEWER PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 Sections, Apply to this Section.

1.2 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, and accessories

B. Connection of building sanitary drainage system to municipal sewers

C. Testing for installed sanitary sewer drainage pipe

1.3 RELATED REQUIREMENTS

A. Section 31 2333 – Trenching for Site Utilities

1.4 REFERENCE STANDARDS

A. ASTM D 2321 – Standard Practice For Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2018

B. ASTM F 679 – Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe Fittings; 2016

C. ASTM F 477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014

D. ASTM D 3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016

E. ASTM F 1417 – Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air; 2011a (Reapproved 2019)

1.5 SUBMITTALS

A. See Section 00 710 Paragraph 2 Submittals, for administrative requirements and submittal procedures.

B. Product Data: Provide data indicating pipe, pipe accessories.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Project Record Documents:

1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.

2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Sewer Service" in large letters.

B. Testing: All testing of PVC sewer pipe fittings and joints hall be performed in accordance with ASTM F 477, ASTM D 3034, and ASTM F 679 latest revisions.

C. Certifications: Manufacturer shall furnish certifications as follows:

1. That the materials used in the manufacture of the pipe and the elastomeric gaskets conform and tested to ASTM D 3034, ASTM F 477, and ASTM F 679, latest revisions

2. Date of manufacture of pipe

2.2 CLEANOUT MANHOLE

A. Lid and Frame: Cast iron construction, hinged lid.

1. Lid Design: Open checkerboard grill.

2. Nominal Lid and Frame Size: 26-inches.

B. Acceptable Products:

1. Substitutions: See Section 00 710 Paragraph 13 Substitute Materials or Equipment.

C. Shaft Construction and Concentric Cone Top Section: Reinforced precast Concrete pipe sections, lipped male/female dry joints, cast steel ladder rungs into shaft sections at 12-inches; nominal shaft diameter of 36-inches.

D. Base Pad: Cement Concrete, levelled top surface to receive concrete shaft sections, sleeved to receive sanitary sewer pipe sections.

2.3 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 31 2333 – Trenching for Site Utilities

B. Pipe Cover Material: As specified in Section 31 2333 – Trenching for Site Utilities

PART 3 EXECUTION

3.1 TRENCHING

A. See Section 31 2333 – Trenching for Site Utilities for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.2 INSTALLATION – PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.

1. Plastic Pipe: Comply with ASTM D 2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8-inch in 10 feet.

D. Connect to building sanitary sewer outlet, through installed sleeves.

E. Install trace wire 6-inches above top of pipe; coordinate with Section 31 2333 – Trenching for Site Utilities, unless otherwise noted in the Construction Drawings

3.3 INSTALLATION – CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.4 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 00 710 Paragraph 14 Materials Testing.

B. Visual Inspection: The Engineer, Owner, or their representative will make the necessary visual inspections to verify the quality of workmanship. Such inspections shall include: examination of manholes, “lamping” or “flashing” sewer lines, and observation of cleanup, pavement replacement, etc.

C. Leakage Test: The Contractor shall provide suitable equipment for making low air pressure test and measuring infiltration. Low pressure test shall be made between adjacent manholes for the first sections of laid sanitary sewer. Upon completion of the pipe section, desired water tightness shall be confirmed.

   1. Procedures for leakage testing are to conform to the standards specified in ASTM F 1417.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.5 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 3100