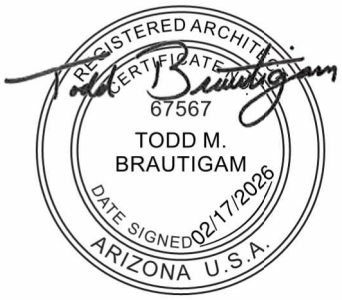
PROJECT MANUAL FOR:

City of Bullhead City

Community Park Restroom

Bullhead City, Arizona



PREPARED BY:

SELBERG ASSOCIATES, INC.
ARCHITECTURE & PLANNING

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SECTION 01 11 00

SUMMARY OF WORK

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. Project: Project consists of a new building located at Trailhead Park in Bullhead City, Arizona. Project includes a low-rise building as described in the Construction Documents.

1.2 DEFINITIONS PERTAINING TO THE CONTRACT DOCUMENTS

A. Furnish: To purchase and deliver.

B. Install: To place into final position and connect.

C. Provide: To furnish and install.

D. Connect: To make the complete necessary utility connection (water, sewer, gas, electricity, etc.) from the building utility to the piece of equipment to allow that piece of equipment to function as intended (e.g., a gas connection for an oven or cooktop).

E. "As shown", "as detailed", "as indicated" or words of similar import mean as indicated on the drawings

F. "As selected", "as approved" or words of similar import mean as selected by, as approved by, or as accepted by the Architect and Owner.

G. "Approved equal", "or equal" shall mean as approved and accepted by the Architect and Owner.

H. "Shall" means mandatory.

I. "As required" means as required by the contract documents.

J. "As necessary" means essential to the completion of the work.

K. "Concealed" means not visible in the finished work.

L. "Exposed" means visible in the finished work.

M. "Days" means calendar days.

N. "Working Days" means work days and does not include legal holidays.

O. Substantial Completion: That stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

1.3 OWNER FURNISHED AND INSTALLED ITEMS

A. General: The terms "Furnish," "Install," and "Connect" shall be as defined in Article 1.2 of this Section.

B. Items furnished and installed by Owner, or by Owner's separate Vendor(s): Refer to Drawings for items to be Owner Furnished and Installed.

C. Contractor's Responsibilities:
1. Contractor shall give Owner written notice, stating date(s) when Owner-Furnished items must be received at the job site to insure Project completion in accordance with established schedule. Such dates shall be shown on the schedule.
2. Contractor is responsible for the coordination and interface of Owner-Furnished and Installed items with Work of this Contract to provide all necessary mechanical and electrical rough-ins, openings, supports, dimensions, etc., as necessary for a complete installation.

1.4 OWNER-FURNISHED, CONTRACTOR INSTALLED ITEMS

A. General: The terms "Furnish," "Install," and "Connect" shall be as defined in Paragraph 1.3 of this Section.

B. Items furnished by Owner and installed by Contractor: Refer to Architectural Drawings and Interior Drawings and Specifications for items to be Owner Furnished for Installation by Contractor.

C. Owner's Responsibilities:
1. Arrange for and deliver Owner reviewed Shop Drawings, Product Data, and Samples, to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for Manufacturers' warranties, inspections and service.

D. Contractor's Responsibilities:
1. Contractor shall provide a written schedule to the Owner, indicating when Owner-furnished items must be received at the job site to insure Project completion in accordance with established schedule. Such dates shall be shown on the schedule.
2. Review Owner-reviewed Shop Drawings, Product data, and Samples
3. Receive and unload products at site; inspect for completeness or damage, jointly with Owner.
4. Handle, store, assemble, install, protect, connect and finish such products, including furnishing lubricants and fluids and procedures necessary to render product serviceable and operative.
5. Contractor is responsible for the coordination and interface of Owner-Furnished items to provide all necessary mechanical and electrical rough-ins, openings, supports, dimensions, etc., as necessary for a complete installation.

1.5 CONTRACTOR USE OF SITE

A. General: Contractor shall have full use of the site within Contract Limit Lines indicated for construction operations during the construction period.
1. Special care shall be taken to secure the site within the Contract Limit Lines to prevent access by the general public.

B. Contractor shall coordinate and allow use of site by Owner or Owner's separate contractors for items identified in Article 1.4 of this Section.

C. Emergency Building Exits During Construction: Comply with Code requirements for exiting requirements during construction. Exit doors and pathways indicated on drawings shall be maintained during the entire course of construction.

1.6 PERMITS, FEES AND NOTICES

A. Plan check fees have been paid by the Owner.

B. The Contractor shall secure and pay for the building permit and for other permits and governmental fees, licenses and inspections necessary for the proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required at the time the bids are received or negotiations concluded. This shall include, but not be limited to:
1. Building Permit from the City of Bullhead City, Arizona.
2. Inspections and Certificates from State Fire Marshal.
3. Other Permits as may be imposed by agencies having authority.
4. Utility connection and servicefees.

C. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on the performance of the Work.

D. It is not the responsibility of the Contractor to make certain that the Contract Documents are in accordance with applicable laws, statutes, building codes and regulations. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify the Architect and Owner in writing, and any necessary changes shall be accomplished by appropriate Modification.

E. If the Contractor performs Work knowing it to be contrary to such laws, ordinances, rules and regulations, including, but not limited to the following, and without such notice to the Architect and Owner, the Contractor shall assume full responsibility therefore and shall bear attributable costs. Work shall comply with the following:

1. Codes, Ordinances, Rules and Regulations, as adopted:
   a. 2018 International Building Code with local amendments
   b. 2018 International Mechanical Code with local amendments
   c. 2018 International Plumbing Code with localamendments
   d. 2018 International Fuel Gas Code
   e. 2018 International Fire Code
   f. 2018 International Code Council Electrical Code Administrative Provisions
   g. 2017 National Electrical Code
   h. 2010 ADAAG Manual

2. Contractor shall maintain current copies of each of the codes listed in 1.6, E, 1. on-site and available for use at the Contractors field office.

1.7 SPECIAL SITE CONDITIONS

A. The Contractor shall be completely responsible for protecting any existing site and street improvements, including utilities indicated to remain and adjacent to new construction from damage and/or injury due to this Work and shall repair at his expense and to the Architect's satisfaction, all areas damaged as a result of his Work.

1.8 ARCHITECTURAL BARRIERS

A. It is the desire of the Owner that the facilities and improvements constructed under this Contract meet or exceed the intent of applicable public law concerning prohibition of discrimination, and that no individual be discriminated against on the basis of disability in the full and equal enjoyment of the goods, services, facilities, privileges, advantages, or accommodations of this completed Project.

B. The designers and drafters of these Documents have intended to incorporate those Owner's intentions into these Documents.

C. It is recognized that there may be products not incorporated into these Documents that may more nearly meet the Owner's desires than those included.

D. The Owner hereby solicits those providing elements of this Project to bid and contract for the Project as required by these Documents, but at the time of submitting Shop Drawings, or sooner when appropriate, and without causing delay in the Project, to also submit proposals for improving the accessibility of the Project to physically or mentally impaired persons.

1.9 REPRODUCTION OF DRAWINGS

A. Contractor shall not alter the size of Drawings when making or ordering reproductions.

B. Only full-size, current Drawings shall be maintained at the Project Site.

1.10 COMMUNICATIONS

A. All communications with the Architect shall be copied to the Owner’s Representative.

B. All communications with the Architect's consultants shall be through the Architect.

1.12 CONTRACTORS USE OF ARCHITECTS DIGITAL DATA

A. Refer to Section 01 33 00 – Submittal Procedures.

END OF SECTION

SECTION 01 12 16

WORK SEQUENCE

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work - Section 01 11 00.

B. Contractor's Use of Premises - Section 01 14 19.

1.02 WORK SEQUENCE

A. Construction work of this contract shall begin on or before a date to be specified in a written Notice to Proceed to the Contractor and issued by the Owner.

B. COMPLETION OF THE WORK

1. Upon receipt of written notice to Proceed work shall continue without interruption until final completion and within the stipulated calendar days defined under Article 9 of the Information to Bidders.

PART 2 - PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

END OF SECTION

SECTION 01 14 19

CONTRACTOR'S

USE OF PREMISES

PART 1 - GENERAL

1.01 REQUIREMENT

A. Contractor use of premises:

1. Confine operations at site to areas permitted by:

a. Permits.

b. Contract Documents.

2. Do not unreasonably encumber Site with materials and equipment.

3. Assume full responsibility for protection and safe keeping of products stored on premises.

4. Do not load structure with weight that will endanger structure.

5. Obtain and pay for use of additional storage or work areas needed for operations.

6. Limit use of Site for Work and storage:

a: Limit outside construction activities to area designated on the drawings.

7. Seal off and fence off areas during construction for security and to prevent dust particles and noise from entering adjacent areas occupied by the Owner. A maximum noise level of NC-35 will be allowed between areas during school hours.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Basis of Award - Instructions to Bidders

B. Summary of Work - Section 01 11 00

1.02 DESCRIPTION

A. Alternates may be accepted by the Owner in accordance with Article 5 of the Instructions to Bidders.

B. The Contractor shall provide an itemized breakdown of all alternates as listed in the Bid Form.

1.03 DESCRIPTION OF ALTERNATES

A. Alternate No. 1: All material and labor for _____.

B. Alternate No. 2: All material and labor for _____.

C. Alternate No. 3: All material and labor for _____.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 26 13

REQUESTS FOR INTERPRETATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Administrative requirements for requests for information / interpretation.

1.2 DEFINITIONS

A. Request For Information / Interpretation (RFI):
1. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as RFI.
2. A properly prepared request for information / interpretation shall include a detailed written statement that indicates the specific Drawings or Specification in need of clarification and the nature of the clarification requested.
   a. Drawings shall be identified by drawing number and location on the drawing sheet.
   b. Specifications shall be identified by Section number, page and paragraph.
3. Requests for Information: Request made by Contractor concerning items not indicated on Drawings or contained in the Project Manual that is necessary to properly perform the Work.
4. Requests for Interpretation: Request made by Contractor in accordance with Owner's Representative's third party obligations to the contract for construction.

B. Improper RFI's:
1. RFI's that are not properly prepared.
2. Improper RFI's will be processed by the Architect at the Architect's standard hourly rate and Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor. The Contractor will be notified by the Architect prior to the processing of improper RFI's.

C. Frivolous RFI's:
1. RFI's that request information that is clearly shown on the Contract Documents.
2. Frivolous RFI's may be returned unanswered or may be processed by the Architect at the Architect's standard hourly rate and Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor. The Contractor will be notified by the Architect prior to the processing of frivolous RFI's.

1.3 CONTRACTOR'S REQUESTS FOR INFORMATION

A. RFI's shall be submitted on Document 00 63 13 included in the Project Manual, or similar form prepared by the Contractor and approved by the Architect prior to use.
1. Forms shall be completely filled in, and if prepared by hand, shall be fully legible.
2. RFI's shall be submitted in numerical order with no breaks in the consecutive numbering.
3. Each page of attachments to RFI's shall bear the RFI number and shall be consecutively numbered in chronological order.

4. RFI's shall be submitted by E-Mail or digital file transfer.
   a. Address for E-Mail will be distributed by the Architect at the Pre-Construction Conference.
   b. An electronic version of Document 00 63 13 will be provided upon request.

B. When the Contractor is unable to determine from the Contract Documents, the material, process or system to be installed, the Architect shall be requested to make a clarification of the indeterminate item.
   1. Whenever possible, such clarification shall be requested at the next appropriate Project Meeting, with the response entered into the meeting minutes. When clarification at the meeting is not possible, either because of the urgency of the need, or the complexity of the item, Contractor shall prepare and submit an RFI to the Architect.
   2. RFI's may not be sent directly to the Architect's Consultants. All RFI's shall be sent directly to the Architect.

C. Contractor shall endeavor to keep the number of RFI's to a minimum. In the event that the process becomes unwieldy, in the opinion of the Architect, because of the number and frequency of RFI's submitted, the Architect may require the Contractor to abandon the process and submit future requests as either submittals, substitutions or requests for change.

D. RFI's shall be originated by the Contractor.
   1. RFI's from subcontractors or material suppliers shall be submitted through, reviewed by, and signed by the Contractor prior to submittal to the Architect.
   2. RFI's from subcontractors or material suppliers sent directly to the Owner's Representative, Architect or the Architect's consultants shall not be accepted and will be returned unanswered.

E. Contractor shall carefully study the Contract Documents to assure that the requested information is not available therein. RFI's which request information available in the Contract Documents will be deemed either "improper" or "frivolous" as noted above.

F. In cases where RFI's are issued to request clarification of coordination issues, for example, pipe and duct routing, clearances, specific locations of work shown diagrammatically, and similar items, the Contractor shall fully lay out a suggested solution using drawings or sketches drawn to scale, and submit same with the RFI. RFI's which fail to include a suggested solution will be returned unanswered with a requirement that the Contractor submit a complete request.

G. RFI's shall not be used for the following purposes:
   1. To request approval of submittals
   2. To request approval of substitutions,
   3. To request changes which are known to entail additional cost or credit. (A Change Order Request form shall be used.)
   4. To request different methods of performing work than those drawn and specified.

H. In the event the Contractor believes that an RFI response by the Architect results in additional cost or time, Contractor shall not proceed with the work indicated by the RFI until a Change Order (or Construction Change Directive, if applicable to the Project) is prepared and approved. RFI's shall not automatically justify a cost increase in the work or a change in the Project schedule.
   1. Answered RFI's shall not be construed as approval to perform extra work.
   2. Unanswered RFI's will be returned with a stamp or notation "Not Reviewed".

I. Contractor shall prepare and maintain a log of RFI'S, and at any time requested by the Architect, Contractor shall furnish copies of the log showing outstanding RFI'S. Contractor shall note unanswered RFI's in the log.

J. Contractor shall allow up to 5 working days review and response time for RFI'S, unless review is required of multiple consultants, then the review and response period shall be 7 working days.
1. The Architect will endeavor to respond to RFI's in a timely manner.
2. RFI shall state requested date/time for response, however, this requested date/time for response is not a guarantee that the RFI will be answered by that date/time if that date/time is too expeditious.
3. Architect may request additional time when deemed necessary.

1.4 ARCHITECT'S RESPONSE TO RFI'S

A. Architect will respond to RFI's as follows:
1. Answers to properly prepared RFI's will be made directly upon the RFI form and will be returned via E-Mail or digital file transfer. Architects response may include supplemental information such as Drawings, Sketches, Supplementary Instructions, Product Data Sheets, Specifications, etc. as deemed necessary tp provide requested information.
2. Improper or Frivolous RFI's
a. Notification of Processing Fee(s).
b. Unanswered RFI's will be returned with a stamp or notation: "Not Reviewed."

B. Architect may opt to retain RFI's for discussion during regularly scheduled project meetings for inclusion of responses in meeting minutes in lieu of responding on a written form.

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

1.1 SCHEDULE OF VALUES

A. With first Application for Payment, submit three (3) copies of completed AIA Document G703 Continuation Sheet indicating the scheduled value of major categories and subcontracts for the Work, for approval of the Architect.

B. For each item, provide a column for listing:
1. Item number
2. Description of Work
3. Scheduled Value
4. Previous Applications
5. Work in Place and Stored Materials under this Application
6. Authorized Change Orders
7. Total Completed and Stored to Date of Application
8. Percentage of Completion
9. Balance to Finish
10. Retainage.

1.2 PAY REQUEST

A. The form of Application for Payment shall be a notarized AIA Document G702, Application and Certification for Payment, supported by approved AIA Document G703, Continuation Sheet. A minimum of three (3) original copies of these forms shall be submitted for each application. Submit additional copies if requested by the Owner or Architect.
1. Present required information in typewritten form or on electronic media printout.
2. Execute certification by signature of authorized officer.
3. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
4. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of Work.

B. With each Application for Payment submit lien releases for the previous payment, substantiation for stored materials, monthly progress reports and updates, and any other pertinent items required by the Owner or Architect and identified during the Pre-Construction Conference.
1. AIA Documents G706, Contractor's Affidavit of Payment of Debts and Claims, G706-A, Contractor's Affidavit of Release of Liens, Documents G707, Consent of Surety Company to Final Payment shall be used.
2. If appropriate, G707-A, Consent of Surety to Reduction in or Partial Release of Retainage shall be used.

C. When acceptable to the Owner, the Contractor may submit for payment on properly stored materials not yet incorporated into the work. Materials stored on the site must be in a secured area and be protected from damage, weather, theft or vandalism. The Contractor shall be responsible for replacing any damaged or missing materials.

D. Materials stored off the job site must be in the supplier's storage area, separated from other materials, and clearly labeled for this particular project. Insurance certificates for the material naming the Owner as an additional insured, loss payee shall be delivered with the pay request.

END OF SECTION

SECTION 01 29 73

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 REQUIREMENT

A. Submit to the Architect a Schedule of Values allocated to the various portions of the work, within ten (10) days after receipt of Notice to Proceed.

B. Upon request of the Architect, support the values with data which will substantiate their correctness.

C. The Schedule of Values, unless objected to by the Architect or Owner, shall be used only as the basis for the Progress Schedule and Contractor's Applications for Payment.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Type the schedule on 8-1/2" x 11" white paper. Identify schedule with the following:

1. Project title and number.

2. Location.

3. Name and address of Contractor.

4. Architect and Owner.

5. Date of Submission.

B. Schedule shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the Index of Specifications of this Project Manual as format for listing component items. Identify each line item with the number and title of the respective major section of the specifications.

D. For each major line item list sub-values of major products or portions under the item.

E. For various portions of the work:

1. Each item shall include a directly proportional amount of the contractor's overhead and profit, mobilization and preparatory costs.

F. The sum of all values listed in the schedule shall equal the total Contract Sum.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

End of Section

SECTION 01 29 76

APPLICATION FOR

PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENT

A. Submit Applications for Payment to Architect in accord with the schedule established by Conditions of the Contract and Agreement between Owner and Contractor.

B. Related requirements specified elsewhere:

1. Progress Payments, Retainages and Final Payment: Conditions of the Contract.

C. Related requirements specified in other sections:

1. Schedule of Values - Section 01 29 73.

2. Closeout Procedures- Section 01 77 00.

1.02 FORMAT AND DATA REQUIRED

A. Submit itemized applications typed on AIA Document G702, Application and Certificate for Payment and continuation sheets G703.

1.03 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

A. Application Form:

1. Fill in required information, including closing date of the submitted application.

2. Fill in summary of dollar values to agree with the respective totals indicated on the continuation sheets.

3. Execute certification with the signature of a responsible officer of the Contractor.

B. Continuation Sheets:

1. Fill in total list of all scheduled component items of Work, with item numbers and the scheduled dollar value for each item.

2. Fill in the dollar value in each column for each scheduled line item when work has been performed or products stored. Round off values to nearest dollar.

3. List each Change Order fully executed prior to the closing date of the submission at the end of the continuation sheets.

4. List by Change Order Number and description as for an original component of work.

C. Certificate for Payment:

1. The Architect shall fill in the required information after reviewing the G702 for completeness and correctness and verifying that the inspector has initialed and dated the G702.

2. The completed Certificate for Payment should include the typed corporation name and representative's signature of both the Architect and Contractor. The date here is to be the date each signature is affixed.

1.04 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. Attach to the G703's a schedule of all material stored on the site, which are included thereon. This schedule should indicate the monthly status of those materials. The first time the materials appear on the schedule, one copy of the invoice, shipping ticket or other substantiating document should be attached to the schedule.

B. For sensitive materials which are not stored on the site for which the Contractor requests payment, the following procedure shall be precisely followed to request such approval. The Contractor shall submit a letter through the Architect to the Owner so that it is received by the Owner no later that the 20th of the month. The letter shall forward one copy of the invoice for the materials, invoice number and amount. The letter shall be signed by a responsible officer of the Contractor stating that the following responsibilities are certified:

1. That this material now stored in our warehouse will be installed on this project;

2. That it is covered by our insurance while so stored.

3. That it will be transported to the site;

4. That it is physically identified as property for this project.

C. Those items for which Owner provides written approval may be included with that month's Application for Payments.

D. Submit updated progress schedule with each application for payment.

1.05 PREPARATION OF APPLICATION FOR FINAL PAYMENT

A. Fill in Application form as specified for progress payments.

B. Use continuation sheet for presenting the final statement of accounting.

1.06 SUBMITTAL PROCEDURE

A. Submit Application for Payment to Architect at the times stipulated in the Agreement.

B. When the Architect finds the application properly completed and correct, he will prepare the Certificate for Payment and transmit them to the Owner for payment.

C. Number: Five copies of each Application and Certificate.

D. The Contractor and Architect must coordinate the processing of the Application and Certificate so that the properly executed documents are received by the Owner by the first day of the month.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 29 83

TESTING & LABORATORY

SERVICES

PART 1 - GENERAL

1.01 REQUIREMENTS

A. The Contractor will provide the services of an independent Testing Laboratory approved by the Architect to perform specified testing for passing tests.

1. Contractor shall call and cooperate with the laboratory to facilitate the execution of its required services.

B. Related requirements:

1. Certification of Products: The respective sections of the specifications.

2. Test, adjust and balance of equipment: The respective sections of the specifications.

3. Laboratory tests required and standards for testing: the respective sections of the specifications.

C. Where tests are conducted during construction, the Contractor will be provided with two copies of the test. Additional copies will be furnished to the Architect and Owner's representative.

D. Testing laboratory inspection, sampling and testing will be conducted on the following:

1. Earthwork - Section 31 00 00.

2. Concrete Formwork – Section 03 10 00 .

3. Cast-in-Place Concrete - Section 03 30 00.

4. Concrete Reinforcing – Section 03 20 00.

5. Special Inspection – see Contract Drawings.

1.02 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. The Laboratory is not authorized to relieve, revoke, alter or enlarge on requirements of Contract Documents, approve or accept any portion of Work, or perform any duties of the Contractor.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor shall obtain and pay for all testing that may be necessary to qualify materials for use in the work and all other testing required herein. This shall include material quality test mix designs, equipment and plant calibration, sieve analysis, atterberg limits, swell potential, optimum moisture, and other similar tests, required to qualify materials for compliance with the specifications or provide standards for field control tests and all other testing required herein. The contractor shall submit test results to the Architect sufficiently in advance of the work so that approval to proceed is received by the Contractor prior to using the material in the work.

B. Samples of material required for testing shall be furnished by the Contractor.

C. The Contractor is responsible for coordinating with the Inspector and requesting all testing, including field-testing paid for by the Owner.

D. Secure and deliver to the laboratory adequate quantities of representational samples of Materials proposed to be used and which require testing.

E. Provide to the laboratory the preliminary design mix proposed to be used for concrete and other materials mixes, which require control by the testing laboratory.

F. Furnish copies of products test reports as required.

G. Furnish incidental labor and facilities:

1. To provide access to Work to be tested.

2. To obtain and handle samples at the Project site or at the source of the product to be tested, as directed by laboratory personnel.

3. To facilitate inspections and tests.

4. For storage and curing of testing samples.

H. The Contractor shall notify the laboratory and owner representative sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

PART 2 - PRODUCT - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 CONTRACTORS USE OF ARCHITECTS DIGITAL DATA

A. General: Electronic copies of digital files of the Construction Documents (Digital Data) may be made available by Architect for Contractor's use in preparing Submittals. The Architect shall not be obligated to make available nor shall the Contractor be obligated to use such documents in submittal preparation.

1. The use and/or provision of the Digital Data prepared by the Architect and/or its consultants shall not in any way reduce or obviate the Transferee's duty to check and coordinate dimensions, details, member sizes, gauges/thicknesses, quantities of materials, and all other conditions required to facilitate construction of the Project. Confirmation of existing conditions is the sole responsibility of the Transferee.
2. Transfer of digital files from Architect to Contractor shall be subject to the Terms and Conditions of the "Digital Data Letter of Agreement" at time of such transfer.
3. A copy of the Digital Data Letter of Agreement" is included as Appendix "A" to this Section.

1.2 CONSTRUCTION SCHEDULE

A. Submit 3 copies of the Construction Schedule, broken down by Trade or Material, to the Architect for approval prior to the first Pay Request. Schedule shall be by CPM or bar graph type, and shall show proposed starting and completion dates for each Trade and activity for the Work. Submit 3 copies of updated schedule at each Pay Request field review to the Architect.

B. Submit completed construction schedule to Architect no later than 15 calendar days after date of Agreement and update monthly during construction. Submit current schedule with each application for payment.

C. Submit completed material delivery schedule to the Architect no later than 20 calendar days after the date of the Agreement. Identify material critical to the progress of the Project and those for which long lead time in procurement is anticipated. Indicate projected dates for submittal, order and delivery of such material.

1.3 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. Submit the completed schedule of submittals to the Architect no later than 15 calendar days after date of Agreement and update monthly during construction. Submit current schedule with each application for payment.

B. Shop Drawings:

1. Following Contractor's review and approval, submit to the Architect electronic copy (PDF or similar) of each Drawing for review.
2. The Architect will review the electronic copy and attach an electronic stamp to the electronic copy indicating the findings of the review, and will return same to the Contractor via email.
3. Comments, if any, will be noted directly on the transparency using electronic mark-up.

4. The Contractor shall then distribute to the various Trades and to Contractor's job personnel as required.
5. If a submittal is indicated to be corrected and resubmitted, correct and resubmit as outlined above.
6. Fire Alarm System/Fire Sprinklers System Shop Drawings shall be submitted to the state and local Fire Marshal and obtain approval prior to installation. Fire Marshal inspection, test and approval of completed installations shall be obtained prior to acceptance of the systems and Substantial Completion of the Project.

C. Product Data: Following Contractor's review and approval, submit to the Architect four (4) copies of Manufacturer's catalogs and brochures, or PDF format electronic copy of Manufacturer's catalogs and brochures as required by the Specifications. If electronic copy product data are furnished, all files shall be full size PDF only. Electronic copies shall have model numbers, colors, finishes, accessories, etc. identified using electronic mark-up to clearly indicate materials/products being used. Resubmit corrected copies for approval in accordance with original submittal.

D. Samples:
1. Following Contractor's review and approval, submit to the Architect samples of materials in quantities and sizes as required by the Specifications. No electronic copy of samples will be considered for review.
2. Unless otherwise indicated within individual Specification Sections, submit a minimum of four (4) samples of each required material, one each for Architect, Owner, Contractor and Subcontractor.
3. Submittals required other than for selection of color, texture, fabric or finish shall be given to the Architect at a time determined by the Contractor, which will allow for resubmittal and which will not cause and delay in the Work.
4. Corrected samples shall be resubmitted for approval as per the original submittal.

E. Color Selection: Within 30 days of the date of Agreement, submit to the Architect for approval, samples and appropriate information required for the selection of colors, textures, fabric and finishes for the entire Project. Physical samples shall be submitted for color or material selections. Electronic samples will not be reviewed. Final selection of color, textures, fabrics or finishes will not be made until all applicable and related submittals have been provided. If the Contractor fails to provide the required samples and related information within the time period, the Architect shall have the option of selecting colors, textures, fabric, finishes or specific materials from those specified or approved and the Contractor shall be obligated to provide the material selected by the Architect.

F. Submit Shop Drawings, Product Data and Samples for only those items specifically mentioned in the Specifications and or Addenda. Contractor shall be responsible for obtaining Shop Drawings required for the progress of the Work, even though such Shop Drawings may not require the Architect's review.

G. Partial Submittals: Submittals which are partial or contain only a portion of the data required to describe the item or installation will be rejected, unless such partial submittal is coordinated with the Architect prior to submittal, and final approval of all such items will be withheld pending receipt of all required information.

H. Deviations: All deviations from the Contract Documents shall be clearly identified in the submittal. Submittal shall include only items included in the specifications or which have been approved in advance by the Architect in accordance with requirements of Section 01 60 00. Submittals containing items which have not been approved in advance by the Architect will be rejected.

1.4 QUALITY CONTROL SUBMITTALS

A. Equipment Lists: Following Contractor's review and approval, submit to the Architect 6 complete lists of major items of mechanical, plumbing and electrical equipment and materials, within 30 calendar days after date of Agreement. Submit all items at one time. Partial list will not be acceptable. Submittals shall include the Manufacturer's Specifications, weights, space requirements, physical dimensions, rating of equipment and supplemental information requested by the Architect. Submit performance curves for pumps and fans. Where a submittal sheet describes items in addition to that item being submitted, delete such items. Clearly note equipment and materials which deviate from those shown or specified in size, weight, required clearances, and location of access. Modifications to the Work as shown or specified in submittals shall be indicated and shall be provided by the Contractor as a part of the Work.

B. Manufacturer's Instructions: Where Specifications require Work to be furnished, installed or performed in accordance with a specified product Manufacturer’s instructions, distribute copies of such instructions to concerned parties.

1.5 REVIEW PROCESS

A. All Shop Drawings will be reviewed and returned within 7 working days to the Contractor for distribution to the applicable trades. Shop Drawings for major components of the Work (i.e. Structural Steel) shall be returned within 14 working days.

B. Shop Drawings are to be submitted to the Architect in a reasonable sequenced manner as not to overburden the reviewing discipline. If the Architect feels as though the review of the Submittal is not on the critical path of the Project, then the review may exceed indicated review times.

C. If the corrections identified on the Shop Drawings are not corrected and the review of the same Submittal exceeds two (2) reviews, the Contractor will be billed for additional reviews at the current hourly rate charged by the Architect or his Consultants. This process will require that the Contractor be notified of the charges and an additional Service Work Order be signed prior to the review commencing.

END OF SECTION

Attachments to this Section: Appendix “A” to Section 01 33 00: “Digital Data Letter of Agreement”

DIGITAL DATA LETTER AGREEMENT

An Agreement between the Architect and _____(the "Transferee," either Original or Third Party, as the case may be) for Transfer of Digital Data

Architect: Selberg Associates, Inc.
2130 Mesquite Ave. Suite 204
Lake Havasu City, Arizona 86403
Contact: Todd Brautigam, AIA, NCARB

Transferee:
_____
_____
_____

Contract No.:
Project No.: 23084
Project Name: Trailhead Park Restrooms
Location: Bullhead City, Arizona
Date: ------

The Architect will provide the following Digital Data, dated as of the particular transmission, to the Transferee **for information purposes only**:

Digital Data was prepared using the following:

Software: AutoCAD (.dwg), Word

Digital Data to be delivered via the following media: Email or Google Drive

TERMS AND CONDITIONS

1. The Architect and its consultants make no representation as to the compatibility of the Digital Data with any hardware or software. The Transferee shall notify the Architect within five (5) business days of any problems associated with accessing and/or using the Digital Data.

2. The Transferee acknowledges and agrees that the Digital Data can be modified unintentionally or otherwise. The Transferee acknowledges and agrees that the Architect and its consultants may remove all indications of ownership from the Digital Data prior to transmission.

3. All Digital Data shall be considered the property of the Architect and/or its consultants and shall not be used for other Projects, for additions to this Project, or for completion of this Project without the prior written permission of the Architect and/or its consultants. Digital Data shall not be re-transmitted by the Original Transferee to a Third-Party Transferee without prior execution of an agreement identical to this Agreement between the Architect, the Original Transferee, and the Third-Party Transferee. Under no circumstances shall the transmission of the Digital Data be considered a sale of goods or a sale of copyrights.

4. **THE ARCHITECT AND THE ARCHITECT'S CONSULTANTS HEREBY EXPRESSLY DISCLAIM ANY AND ALL WARRANTIES, BOTH EXPRESS AND IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AS WELL AS ANY WARRANTY OF ACCURACY, COMPLETENESS, AND/OR PERMANENCE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.**
Addenda information and/or revisions made to the most current Digital Data after any date of transmission may not have been incorporated into the transmitted Digital Data. The Architect may update the Digital Data and give notice to authorized parties as is consistent with the Architect's professional skill and care and the orderly progress of the Work. In the event of a conflict between the Architect's printed instruments of service (whether sealed or not) and the Digital Data, the printed instruments of service shall govern. The Transferee acknowledges and agrees that the duty to determine the existence of any and all conflicts between the Digital Data and any other information upon which the Transferee relies rests solely upon the Transferee. The Digital Data shall not be considered Contract Documents or Construction Documents as defined by any General Conditions of Contract for Construction.

5. The use and/or provision of the Digital Data prepared by the Architect and/or its consultants shall not in any way reduce or obviate the Transferee's duty to check and coordinate dimensions, details, and quantities of materials as required to facilitate construction of the Project. Confirmation of existing conditions is the sole responsibility of the Transferee.

6. The Transferee agrees to the extent permitted by applicable law, to indemnify, hold harmless, release, and defend the Architect and/or its consultants, their officers, shareholders, employees, and sub-consultants from any and all injuries, claims, demands, expenses, suits, liabilities, losses, damages, costs, disputes, other matters in question, third party claims, pass-through claims, subrogated claims, and/or claim

expenses, including but not limited to, attorneys' fees, expert witness fees, and court costs arising out of or in any way related to or connected with any negligent act and/or omission in the generation, provision, and/or use of the Digital Data by the Transferee and/or any of its subcontractors, suppliers, and/or consultants and waive any and all rights to such claims and causes of action.

7. The Transferee waives damages against the Architect for any and all injuries, claims, losses, expenses, damages, disputes, other matters in question, and/or claim expenses arising out of or relating to this Agreement and/or generation, provision, and/or use of the Digital Data, including, but not limited to, consequential damages and reasonable attorneys' fees and defense costs.

8. The Architect's and/or the Architect's consultants' liability to the Transferee and/or any of its subcontractors, suppliers, and/or consultants for any and all injuries, claims, losses, expenses, damages, disputes, other matters in question, third party claims, pass-through claims, subrogated claims, and/or claim expenses arising out of or relating to this Agreement and/or the Digital Data, including, but not limited to, reasonable attorneys' fees and defense costs, regardless of the nature of the claim or damage, shall not exceed, either individually or in the aggregate, the total amount of $5,000.00. Such causes include, but are not limited to, the Architect's and/or the Architect's consultants' negligence, errors, omissions, strict liability, breach of contract, and/or breach of warranty.

9. Upon information and belief, there are no licensing or copyright fees due to others based on the transmission of the Digital Data, but to the extent that such unknown fees do exist, the Transferee agrees to pay the required fees and hold the Architect and/or its consultants harmless from any associated costs or penalties.

10. Upon execution of this Agreement, the Architect grants to the Transferee a non-exclusive, non-transferable (except as set forth herein) license to use the Digital Data solely and exclusively for purposes of constructing, using, and maintaining the Project, provided that the Transferee substantially performs its obligations, including prompt payment of all sums when due, under this Agreement.

11. Any purchase order number provided by the Transferee is for the Transferee's accounting purposes only. The Transferee acknowledges and agrees that purchase order terms and conditions are null, void, and inapplicable to this Agreement.

12. Payment of the service fee set forth herein is due prior to transmission of the Digital Data.

13. This Agreement constitutes the entire agreement between the parties relative to the Digital Data and shall be governed by the laws of the State of Arizona.

AUTHORIZED ACCEPTANCE

by Architect:
Selberg Associates, Inc.

_____
Signature

_____
Print Name and Title

_____
Date

by Original Transferee:

_____
Signature

_____
Print Name and Title

_____
Date

by Third Party Transferee:

_____
Signature

_____
Print Name and Title

_____
Date

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality Monitoring: Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality. Perform quality control procedures and inspections during installation.

B. Standards: Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

C. Tolerances: Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate. Comply with manufacturers' tolerances.

D. Reference Standards: For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

E. Manufacturer's Field Services: When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to perform the following as applicable, and to initiate instructions when necessary.
   1. Observe site conditions.
   2. Conditions of surfaces and installation.
   3. Quality of workmanship.
   4. Start-up of equipment.
   5. Test, adjust and balance of equipment.

F. Mock-Ups: Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes. Accepted mock-ups shall be a comparison standard for the remaining Work.

G. Removal of Mock-Ups: Where mock-up has been accepted by Architect and no longer needed, remove mock-up and clear area when directed to do so.

PART 2 PRODUCTS - Not applicable to this Section

PART 3 EXECUTION - Not applicable to this Section

END OF SECTION

SECTION 01 42 00

REFERENCES

1.1 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes. Such Reference Standards are made part of the Contract Documents by reference.

B. Conform to reference standard by date of issue current on date of Contract Documents.

C. Obtain copies of standards when required by Contract Documents.

D. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

E. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.2 SCHEDULE OF REFERENCES

A. The following is a partial list of agencies, councils, institutions, associations, and so forth that may be referred to in the Contract Documents. This list is not to be interpreted as being complete.

AA	Aluminum Association	www.aluminum.org
AABC	Associated Air Balance Council	www.aabchq.com
AAMA	American Architectural Manufacturers Association	www.aamanet.org
AASHTO	American Association of State Highway	www.aashto.org
ACI	American Concrete Institute	www.aci-int.org
ADC	Air Diffusion Council	www.flexibleduct.org
AFPA	American Forest and Paper Association	www.afandpa.org
AI	Asphalt Institute	www.asphaltinstitute.org
AIA	American Institute of Architects	www.aia.org
AISC	American Institute of Steel Construction	www.aisc.org
AISI	American Iron and Steel Institute	www.steel.org
AITC	American Institute of Timber Construction	www.aitc-glulam.org
AMCA	Air Movement and Control Association	www.amca.org
ANSI	American National Standards Institute	www.ansi.org
APA	Engineered Wood Association	www.apawood.org

API	American Petroleum Institute	www.api.org
ARI	Air-Conditioning and Refrigeration Institute	www.ari.org
ASHRAE	American Society of Heating, Refrigerating	www.ashrae.org
ASME	American Society of Mechanical Engineers	www.asme.org
ASTM	American Society for Testing and Materials	www.astm.org
AWI	Architectural Woodwork Institute	www.awinet.org
AWPA	American Wood Preservers Association	www.awpa.com
AWS	American Welding Society	www.aws.org
AWWA	American Water Works Association	www.awwa.org
BHMA	Builders Hardware Manufacturer's Association	www.buildershardware.com
BIA	Brick Industry Association	www.brickinfo.org
CDA	Copper Development Association	www.copper.org
CISCA	Ceilings and Interior Systems Construction Association	www.cisca.org
CLFMI	Chain Link Fence Manufacturers Institute	www.chainlinkinfo.org
CRI	The Carpet and Rug Institute	www.carpet-rug.com
CRSI	Concrete Reinforcing Steel Institute	www.crsi.org
CSSB	Cedar Shingle and Shake Bureau	www.cedarbureau.org
DHI	Door and Hardware Institute	www.dhi.org
EJMA	Expansion Joint Manufacturers Association	www.ejma.org
FMG	FM Global	www.allendale.com
GA	Gypsum Association	www.gypsum.org
GANA	Glass Association of North America	www.glasswebsite.com
ICC	International Code Council	http://www.iccsafe.org/
IEEE	Institute of Electrical and Electronics Engineers	www.ieee.org
IGMA	Insulating Glass Manufacturers Alliance	www.igmaonline.org
MBMA	Metal Building Manufacturer's Association	www.mbma.com
MIL	Military Specification	http://dodssp.daps.dla.mil/
ML/SFA	Metal Lath/Steel Framing Association	www.naamm.org

NAAMM	National Association of Architectural	www.naamm.org
NCMA	National Concrete Masonry Association	www.ncma.org
NEBB	National Environmental Balancing Bureau	www.nebb.org
NEMA	National Electrical Manufacturers Association	www.nema.org
NFPA	National Fire Protection Association	www.nfpa.org
NRCA	National Roofing Contractors Association	www.nrca.net
NTMA	National Terrazzo and Mosaic Association	www.ntma.com
PCA	Portland Cement Association	www.cement.org
PCI	Precast/Prestressed Concrete Institute	www.pci.org
PDCA	Painting and Decorating Contractors of America	www.pdca.com
PS	Product Standard U. S. Department of Commerce http://ts.nist.gov/Standards/Conformity/sccg.cfm	
RIS	Redwood Inspection Service	www.redwoodinspection.com
RFCI	Resilient Floor Covering Institute	www.rfci.com
SDI	Steel Deck Institute	www.sdi.org
SDI	Steel Door Institute	www.steeldoor.org
SIGMA	Sealed Insulating Glass Manufacturers Association	Refer to IGMA
SJI	Steel Joist Institute	www.steeljoist.org
SMACNA	Sheet Metal and Air Conditioning	www.smacna.org
SSPC	The Society for Protective Coatings	www.sspc.org
TCA	Tile Council of America, Inc.	www.tileusa.com
UL	Underwriters' Laboratories, Inc.	www.ul.com
WCLIB	West Coast Lumber Inspection Bureau	www.wclib.org
WDMA	Window and Door Manufacturing Association	www.wdma.com
WWPA	Western Wood Products Association	www.wwpa.org

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

PART 1 GENERAL

1.1 TESTING LABORATORY SERVICES

A. Special Inspections and Testing: Owner will employ and pay for the services of an independent testing agency to perform Special Inspections and Testing called for in the Contract Documents and as required by Code or authorities having jurisdiction.

B. Quality Control Testing and Inspections: Contractor shall retain an independent testing laboratory, acceptable to Architect and Owner, to perform quality control testing Work called for in the Contract Documents, and pay cost of services.

C. Contractor shall cooperate with Testing Laboratory personnel and provide access to the Work as required to perform testing or inspections called for in the Construction Documents.

D. Contractor shall furnish samples for such tests and deliver them to the Testing Laboratory in quantities as required by the Contract Documents.

E. Contractor shall provide Testing Laboratory 24 hours minimum notice in advance of Work being performed that requires testing and/or inspection services.

F. The Testing Laboratory(s) shall, within 24 hours of performing a test or inspection, distribute digital copies of reports as follows:
1. Architect
2. Structural Engineer or other Engineering Consultant
3. Contractor
4. Owner
5. Code authorities or authorities having jurisdiction as they may require.

G. All costs for additional inspections and/or retesting required when initial testing indicates Work does not comply with Contract Documents shall be paid for by the Contractor.

H. Refer to individual specification Sections and General Notes on Drawings for specific requirements for Testing and/or Inspections. The following lists are intended as a guide to the Contractor to aid in determining testing requirements for the Project, however, the requirements specified in the Technical Sections shall take precedence over these lists and these lists are not to be interpreted as being complete.

1. Special Inspections and Testing:
   a. Special Inspections and Testing required by the General Structural Notes on the Drawings.
   b. 03 30 00 - Cast-In-Place Concrete: Test cylinders, slump test(s)
   c. 31 00 00 - Earthwork: Test imported fill materials if required, observation of earthwork by Geotechnical Engineer, density and moisture testing of trench backfill, field density tests of under slab fill and backfill.
   d. 31 31 00 – Soil Treatment: Field test termite treatment.

2. Quality Control Testing and Inspections:
   a. 03 30 00 - Cast-In-Place Concrete: Floor flatness, calcium chloride moisture testing.
   b. 07 92 00 – Joint Sealers: Field adhesion testing and stain testing.
   c. Division 9 Flooring Sections: Moisture content of concrete sub-floors.
   d. 31 31 00 – Soil Treatment: Field test termite treatment.

1.2 CONTRACTOR'S QUALITY CONTROL

A. Where Contract Documents require that a particular product be installed and/or applied by an applicator approved by the Manufacturer, it is the Contractor's responsibility to ensure that the subcontractor employed for such work is approved in writing by the Manufacturer of the product. Such subcontractor(s) shall provide evidence of being approved to the Owner and Architect prior to being awarded the Subcontract for the Work.

B. Work shall be executed by persons skilled in the work required and shall conform to the highest methods, standards and accepted practices of the Trade or Trades involved.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 GENERAL

A. Comply with codes and regulations regarding potable drinking water, sanitation, dust control, fire protection, and other temporary controls.

B. Remove temporary office facilities, including construction trailers used for field offices, storage sheds, portable toilet facilities, fences and gates, trash dumpsters,, etc. and other construction of temporary nature from the site as soon as, in the opinion of the Architect, the progress of the work will permit. Recondition and restore to a condition acceptable to the Architect, areas of the site occupied by temporary facilities.

C. Obtain written approval from the Owner a minimum of 72 hours prior to disconnection or shutting off service or utility.

1.2 TEMPORARY ELECTRICITY

A. Provide and pay for power service required from Utility and make arrangements for such service.

B. Provide temporary electric feeder from electrical service at location as directed by the Utility Owner or as indicated on Drawings.

C. Provide adequate distribution equipment including main service disconnect(s), overcurrent protection, branch circuits, wiring and distribution boxes with power outlets as necessary for construction operations. Provide flexible, heavy-duty exterior rated power cords as necessary. Provide separate branch circuits and wiring for temporary lighting.

D. Properly installed permanent convenience receptacles may be utilized during construction after appropriate approvals and permits for temporary use. Do not exceed AMP ratings of breaker serving outlets. Electrical receptacle used during construction shall be left in a new condition without damage at final completion.

1.3 TEMPORARY LIGHTING

A. Provide lighting for construction operations to achieve a minimum lighting level of 2 watts/sq. ft.

B. Provide adequate floodlights, clusters and spot illumination to work areas after dark.

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. Replace all lamps used during the construction period immediately prior to issuance of Certificate of Substantial Completion.

1.4 TEMPORARY HEATING/COOLING AND VENTILATING

A. Provide and pay for heating/cooling devices and heat as required to maintain appropriate and specified conditions for construction operations. Exercise measures to conserve energy.

B. Prior to operation of permanent equipment for temporary heating or cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
1. All ducts shall be vacuumed and all filters shall be replaced immediately prior to issuance of Certificate of Substantial Completion.

C. Maintain minimum/maximum ambient temperature and humidity conditions required by individual specification sections for installation of materials and finishes required to have specific environmental conditions.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.5 COMMUNICATIONS

A. At time of Project mobilization, or before, provide Architect and Owner with Project team directory, including the following:
1. General Contractor's home office.
2. Contractor's superintendant mobile telephone number.
3. Other major subcontractors and Project Team members.

B. Provide superintendant with mobile telephone throughout construction period.

C. Computer and Internet Access: Provide computer with internet access in field office.
1. Provide DSL or Cable modem access with 1.5 Mbps minimum.
2. Computer shall be made available to Owner and Architect for use throughout construction.
3. Provide account/address reserved for projectuse.

1.6 TEMPORARY WATER SERVICE

A. Provide, maintain and pay for suitable quality water service required for construction operations.
1. Provide suitable facilities with drainage to sanitary sewer.
2. Provide backflow prevention, branch piping and water distribution throughout the site with threaded connections for attachment of hoses.

B. Construction debris, mortars, drywall mud, adhesives, paint, or similar items shall not be washed down drains.

1.7 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures.

1.8 TEMPORARY FIRE PROTECTION

A. Provide adequate number of fire extinguishers to protect the Work.

B. Comply with fire insurance and governing regulations.

C. Provide UL labeled ABC all-purpose fire extinguishers adequate in size and number.

D. Provide temporary office and storage areas with fire extinguishers.

1.9 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide barricades and covered walkways as may be required by governing authorities to protect public right-of-ways and public accesses.

C. Provide protection for plant life designated to remain. Replace damaged plant life.

D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.10 FENCING

A. Construction: Commercial grade chain link fence with adequate support to remain in place during storm winds.

B. Provide 6'-0" high fence around construction site, including parking lots, contractor staging areas, landscape areas, retention areas, etc. as necessary to protect Work; equip with vehicular and pedestrian gates with locks.

C. Locate gates for access to work areas, as required. Close and lock after working hours.

1.11 ENVIRONMENT PROTECTION AND CONTROLS

A. Exercise controls to keep noise and dust during construction to a minimum. Traffic or construction areas shall be sprinkled with water or chemicals as required and in accordance with applicable regulatory requirements.

B. Environmental Protection: Conduct construction operations and operate equipment and machinery using methods complying with environmental regulations to avoid or minimize environmental pollution or contamination.
   1. Air Resources: Prevent creation of dust, air pollution, and odors.
   2. Store volatile liquids, including fuels and solvents, in closed containers.
   3. Properly maintain equipment to reduce gaseous pollutant emissions.
   4. Properly dispose of hazardous or contaminated debris in compliance with environmental regulations.
   5. Grade site to drain. Maintain excavations free of water. Provide, operate and maintain pumping equipment as may be necessary to properly dispose of ground water and storm water.
   6. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
   7. Comply with local requirements for storm water pollution prevention.

1.12 EXTERIOR ENCLOSURES

A. Provide temporary weather-tight closure of any exterior openings or penetrations required for Work or as necessary to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.13 PROTECTION OF INSTALLED WORK

A. Protect all installed work as follows. Additionally, provide the special protection features specified in individual specification Sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to avoid damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with plywood sheets and waterproof covering.

E. Prohibit traffic or storage directly on waterproofed or roofed surfaces. If traffic or activity is necessary, provide protection in accordance with material and or system manufacturer's printed instructions.

F. Prohibit traffic from landscaped areas.

1.14 SECURITY

A. Provide security and facilities to protect Work and existing facilities, and Owner's operations from unauthorized entry, vandalism or theft.

B. Provide and pay for security services if necessary for adequate protection.

1.15 SITE ACCESS AND ACCESS ROADS

A. Restrict site access to contracted construction personnel and Project Team Members only.

B. Comply with Contractor Use of Site requirements of Section 01 11 00 – Summary of Work.

C. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.

D. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.

E. Provide and maintain access to fire hydrants, free of obstructions.

F. Provide means of removing mud from vehicle wheels before entering streets.

1.16 PARKING AND STAGING AREAS

A. Provide temporary surface parking areas to accommodate construction personnel. Parking areas shall be graded and surfaced with suitable well-draining, non-dusting granular material.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets.

D. Provide fenced are with secure locking gates for exterior construction staging that may be necessary throughout the construction period.

1.17 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition on a daily basis.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing thespace.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Regularly remove waste materials, debris, and rubbish from site and dispose off-site. Do not allow to accumulate.

1.18 PROJECT IDENTIFICATION

A. General Contractor is limited to one (1) sign located on their construction trailer. Additional signage must be approved by Owner’s Representative. Subcontractors, suppliers, manufacturers, consultants, etc., shall not furnish company information banners unless approved by Owner’s Representative.

B. Project Information Sign: Provide two (2) 16 sq. ft. project signs of exterior grade vinyl to be affixed to project construction fence, printed to Architect's design and colors.
   1. List title of Project, Names of Owner, Architect, and General Contractor.
   2. Erect on site at location established by Architect and Owner.
   3. Allow 7 working days for Architect to provide electronic graphic image.

C. Contractor shall obtain all required City/County approvals and sign permits and pay all fees required for installation of temporary construction signs.

D. No other signs are allowed without Owner's permission except those required by law.

1.19 FIELD OFFICES AND SHEDS

A. Temporary Field Offices (Construction Trailers): Weather-tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture, drawing rack(s), drawing display table(s), chairs.

B. Provide space for project meetings, with table and chairs to accommodate the entire Project Team.

C. Where required by the Architect, provide separate private office, similarly equipped and furnished, for use of Architect.

D. Locate offices (construction trailers) and sheds as approved by Owner.

END OF SECTION

SECTION 01 60 00

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 DELIVERY, STORAGE AND HANDLING

A. Deliver manufactured materials in original packages, containers or bundles, with the seals unbroken, identified by the name and mark of the Manufacturer, the product name, color, number, and so forth.

B. Deliver fabrications in as large assemblies as practicable. Fabrications specified to be shop-primed or shop-finished shall be packaged or crated as required to preserve such priming or finish intact and free from damage.

C. The Contractor shall be responsible for protecting all materials and equipment furnished under the Contract including materials and equipment furnished by the Owner for the Contractor to install and for the materials and equipment furnished and installed by the Owner's separate contractors in the completed or partially completed Work.

D. Store materials in a manner to properly protect them from damage. Materials or equipment damaged by handling, weather, dirt or other cause will not be acceptable and are to be removed from the site. Replace such materials immediately so as not to delay the Work.

E. Store materials so as to cause no obstructions. Store off sidewalks, roadways, and underground services.

F. When a room in the Project is used as a shop or store room, the Contractor shall be responsible for all repairs, patching or cleaning necessary due to such use. Location of such storage space shall be subject to approval of the Architect.

1.2 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Whenever a product is specified by using a proprietary name or the name of a particular Manufacturer or Vendor, the specific item mentioned shall be understood as establishing type, function, dimension, appearance, and quality desired.

B. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Architect to determine that products proposed are equivalent to those named.

C. Prior Approvals:
1. Substitutions will be considered when written request has been submitted to the Architect for approval.
2. Contractor shall request approval of such substitution, in writing, to the Architect using Document 00 43 25 – Substitution Request (During the Bidding Phase) form contained in the Project Manual.
3. Each such request shall include all information requested below for Requests for approval after award of a Contract. If the Owner approves any proposed substitution, such approval shall be set forth in an Addendum.

D. Requests for approval after award of a Contract:
   1. Requests shall be made only under one of the following conditions:
      a. Specified product or material is not available.
      b. Extensive revisions to the Contract Documents are not required.
      c. Proposed changes are consistent with intent of the Contract Documents.
      d. Request is timely and properly submitted.
      e. Specified product or material cannot be provided within the Contract Time.
      f. Request relates to an "or equal" clause.
      g. Proposed substitution offers Owner a substantial advantage in cost, time, or other considerations.
      h. Specified product or material cannot receive regulatory approval.
      i. Specified product or material is incompatible with other materials.
      j. Specified product or material cannot be coordinated with other materials.
      k. Specified product or material manufacturer cannot provide the specified warranty.
   2. Requests shall be submitted to the Architect a minimum of 10 working days prior to date Contractor is required to place an order for the product.
   3. Contractor shall request approval of such substitution, in writing, to the Architect using Section 00 63 25 – Substitution Request (After the Bidding Phase) form contained in the Project Manual.
   4. The request shall specifically state the reason that the product is unavailable with evidence to substantiate the reason.
   5. Requests made directly to Architect by suppliers, subcontractors and distributors that are not from the Contractor will not be accepted by the Architect or Owner.
   6. Architect will approve or reject substitution in writing.
   7. Substitutions will not be considered if they are indicated or implied on Shop Drawings.

E. Contractor shall submit descriptive brochures, drawings, samples and other data as is necessary to provide direct comparison to the specified materials after reviewing and determining that product meets specified requirements. Submittals shall be well marked and identified as to types and kind of the items being submitted for approval. Lack of sufficient information will be cause for rejection. Reference to catalogs will not be acceptable unless catalog is submitted with approval request and the specific product or material and its components are clearly identified.

F. In submitting a substitution, the Contractor makes the following representations:
   1. Proposed substitution has been fully investigated and determined to be equal or superior to specified product or material.
   2. The same warranty will be furnished for proposed substitution as for specified product or material.
   3. The same maintenance service and source of replacement parts, as applicable, is available.
   4. Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
   5. Cost data included on the substitution request is complete. Claims for additional costs related to accepted substitution and its impact on other portions of the Work which may subsequently become apparent are waived.
   6. Proposed substitution does not affect dimensions and functional clearances.

7. Payment for costs for additional services of Architect caused by the substitution shall be paid by Contractor. The Contractor will be billed for additional services at the current hourly rate charged by the Architect. The Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor.
8. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

END OF SECTION

SECTION 01 66 00

STORAGE AND PROTECTION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Provide secure storage and protection for products to be incorporated into the work, and maintenance and protection for products after installation and until completion of the Work.

1.02 STORAGE

A. Store products immediately on delivery, and protect until installed in the work.

1. Store in accord with manufacturer's instructions, with seals and labels intact and legible.

B. Store products subject to damage by elements in substantial weathertight enclosures.

1. Maintain temperatures within ranges required by manufacturer's instructions.

2. Provide humidity control for sensitive products, as required by manufacturer's instructions.

3. Store unpacked products on shelves, in bins or in neat piles, accessible for inspection.

C. Exterior Storage:

1. Provide substantial platforms, blocking or skids to support fabricated products above ground, prevent soiling and staining.

a. Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.

2. Store loose granular materials on solid surfaces such as paved areas, or provide plywood or sheet materials to prevent mixing with foreign matter.

a. Provide surface drainage to prevent flow or pounding of rainwater.

b. Prevent mixing of refuse or chemically injurious materials or liquids.

c. Arrange storage in manner to provided easy access for

inspection.

1.03 MAINTENANCE OF STORAGE

A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. State of storage facilities is adequate to provide required conditions.

2. Required environmental conditions are maintained on continuing basis.

3. Surfaces of products exposed to elements are not adversely affected.

a. Any weathering of products, coatings and finishes is acceptable under requirements of Contract Documents.

1.04 PROTECTION AFTER INSTALLATION

A. Provide protection of installed products to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of Work.

B. Control traffic to prevent damage to equipment and surfaces.

C. Provide coverings to protect finished surfaces from damage.

1. Cover projections, wall corners, and jambs, sills and soffits of openings in areas used for traffic and for passage of products in subsequent work.

2. Protect finished floors and stairs for dirt and damage.

a. In areas subject to foot traffic, secure heavy paper, sheet goods, or other materials in place.

b. For movement of heavy products, lay planking or similar material in place.

c. For storage of products, lay tight wood sheeting in place.

1.05 WATERPROOFED AND ROOFING SURFACES

A. Prohibit use of surfaces for traffic of any kind and for storage of any products.

B. When some activity must take place in order to carry out the Contract, obtain recommendations of installer for protection of surface.

1. Install recommended protection; remove on completion of that activity.

2. Restrict use of adjacent unprotected areas.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

End of Section

SECTION 01 70 00

EXECUTION AND CLOSEOUT

REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cutting and patching.

B. Substantial Completion: The following are prerequisites to substantial completion. Provide the following.
1. Punch list prepared by Contractor and subcontractors as applicable.
2. Supporting documentation.
3. Warranties.
4. Certifications.
5. Occupancy permit.
6. Start-up and testing of building systems.
7. Change over of locks.
8. Meter readings.
9. Commissioning documentation.

C. Final Acceptance: Provide the following prerequisites to final acceptance.
1. Final payment request with supporting affidavits.
2. Completed punch list.

D. As-Built Drawings: Provide a marked-up set of drawings including changes, which occurred during construction.

E. Project Closeout: Provide the following during project closeout.
1. Submission of record documents.
2. Submission of maintenance manuals.
3. Training and turnover to Owner's personnel.
4. Final cleaning and touch-up.
5. Removal of temporary facilities.

PART 2 PRODUCTS - Not applicable to this Section

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

A. Cutting and Patching: Provide cutting and patching work to properly complete the work of the project, complying with project requirements for:
1. Structural work.
2. Mechanical/electrical systems.
3. Visual requirements, including detailing and tolerances.
4. Operational and safety limitations.
5. Fire resistance ratings.
6. Inspection, preparation, and performance.
7. Cleaning.

B. Means and Methods: Do not cut and patch in a manner that would result in a failure of the work to perform as intended, decrease energy performance, increase maintenance, decrease

operational life, or decrease safety performance.

C. Inspection: Inspect conditions prior to work to identify scope and type of work required. Protect adjacent work. Notify Owner of work requiring interruption to building services or Owner's operations.

D. Performance of Operations: Perform work with workmen skilled in the trades involved. Prepare sample area of each type of work for approval.

E. Cutting: Use cutting tools, not chopping tools. Make neat holes. Minimize damage to adjacent work. Inspect for concealed utilities and structure before cutting.

F. Patching: Make patches, seams, and joints durable and inconspicuous. Comply with tolerances for new work.

G. Cleaning: Clean work area and areas affected by cutting and patching operations.

END OF SECTION

SECTION 01 73 00

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 EXAMINATION AND COORDINATION OF WORK

A. Verification of Conditions: Examine and verify surfaces, sub surfaces, condition and serviceability of previous work to receive subsequent work and report detrimental conditions in writing to the Architect.

B. Commencement of work acknowledges acceptance and serviceability of previous work.

C. Coordination: Coordinate with other work which affects, connects with, or will be concealed by subsequent work.
   1. Work within concealed ceiling and plenum spaces shall be coordinated with all other work within these spaces to assure a coordinated assembly.
   2. Coordinate location and layout of mechanical, electrical and other systems located within suspended ceilings.
   3. Utilize Revit Model to create fully coordinated model and Shop Drawings of Project infrastructure. Perform clash detection analysis and report conflicts to Architect.
   4. Notify Architect immediately if conflicts are found.
   5. Adjust work in place in concealed ceiling spaces as required to allow installation of other work which cannot be adjusted.

D. Any remedial work required to be performed on previously placed work after new work has commenced shall be by and at the expense of the Contractor and/or sub-contractor having commenced the new work.

1.2 TOLERANCES

A. Certain tolerances are listed in the various specification sections and on the Drawings. In addition, other tolerance limits are set forth below. These tolerances are the maximum variation allowed on the Project.

B. Each of the Contractors shall review the tolerance limits established for their work as they relate to the other work on the Project. Should the tolerance limits established for their work be in conflict with those limits established for other adjoining work, the Architect and Owner shall be notified before proceeding.

C. It is the intention of the Contract Documents that, assuming work in place is within the tolerance limits established, or has been accepted by following contractor(s), subsequent work shall be adjusted as required.

D. Tolerances:
   1. Concrete: 1/8 inch plus or minus in any 10 feet and 3/4 inch total overall in any direction.
   2. Masonry: 1/8 inch plus or minus in any 10 feet and 1/4 inch total overall in any direction.
   3. Structural Steel: 1/8 inch plus or minus in 60 feet and 1/2 inch total overall in any direction.
   4. Miscellaneous Metal: 1/8 inch plus or minus in 20 feet and 1/4 inch total overall in any direction.

5. Ornamental Metal: 1/8 inch total overall in any direction.
6. Drywall: 1/16 inch plus or minus in any 12 feet and 1/8 inch total overall in any direction.
7. Acoustic Tile: 1/8 inch maximum variation overall in any direction.
8. Granite and Marble: 1/16 inch maximum variation overall in any direction.
9. Millwork: 1/16 inch Maximum overall in any direction.
10. Ceramic Tile: 1/16 inch maximum overall in any direction.

E. All materials such as Stone tile and veneers, acoustic tile, lay-in acoustical panel and decorative ceilings, ceramic tile, VCT, wood flooring, and so forth, are to meet flush with adjacent pieces of the same material.

1.3 APPROVED APPLICATORS

A. Where specific instructions in the Specifications require that a particular product and/or material be applied and/or installed by an "approved applicator" it shall be the Contractor's responsibility to insure that any subcontractor or sub-subcontractor used for such Work is in fact currently certified by the particular Manufacturer for this type of installation or application.

1.4 APPROVED MANUFACTURERS

A. Each Section includes a list of Manufacturers whose equipment is acceptable as to manufacture, subject to conformance with the Contract Documents. Careful checking must be completed by the Contractor and the manufacturer or equipment supplier to verify that the equipment will meet all capacities, requirements, space allocations and is suitable for the intended purpose specified.

1.5 REFERENCE DATA

A. Reference data made available to the Contractor is for the Contractor's information only, and neither the Owner nor the Architect assume any responsibility for the Contractor's conclusions.

B. The Contractor shall establish and maintain all building and construction grades, lines, levels, and bench marks. This Work shall be performed by a licensed Civil Engineer or Surveyor under the employ of the Contractor, who shall certify to the Owner that he has performed this service.

C. The Contractor shall not remove any fixed property line markers, monuments or data.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cutting, fitting and patching, including attendant excavation and backfill required to complete Work, and for:
   1. Making several parts fit together properly.
   2. Uncovering portions of Work to provide for installation of ill-timed Work.
   3. Removing and replacing defective and non-conforming Work.
   4. Removing samples of installed Work required for testing, as directed by Architect.
   5. Providing routine penetrations of non-structural surfaces for installation of piping electrical conduit, and similar items.

1.2 SUBMITTALS

A. In advance of executing any cutting or alterations, submit written request to Architect requesting consent to proceed with cutting which affects:
   1. Work of Owner or other trades.
   2. Structural value or integrity of any element of Project.
   3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
   4. Efficiency, operational life, maintenance or safety of operational elements.
   5. Visual qualities of sight-exposedelements.

B. Include in request:
   1. Identification of Project.
   2. Description of affected Work.
   3. Necessity for cutting, alteration or excavation.
   4. Effect of Work of Owner or other trades, or structural or weatherproof integrity of Project.
   5. Description of proposed Work:
      a. Scope of cutting, patching, alteration, or excavation.
      b. Trades which will execute Work.
      c. Products proposed to be used.
      d. Extent of refinishing to be done.
   6. Alternatives to cutting and patching.
   7. Cost proposal, when applicable.
   8. Written permission of trades whose Work will be affected.

C. Submit written notice to Architect designating time work will be uncovered and when work will be performed to provide for observation when necessary.

1.3 PAYMENT FOR COSTS

A. Payment for cutting and patching caused by ill-timed or defective work or work not conforming to Contract Documents, including costs for additional services of Architect and Engineer shall be paid by Contractor. The Contractor will be billed for additional services at the current hourly rate charged by the Architect. The Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor.

B. Payment for work done on written instructions of Architect, other than defective or nonconforming work, will be paid by Owner on approval of a written Change Order. Provide written cost proposal prior to proceeding with cutting and patching instructed by Architect for other than defective or nonconforming work. All work shall be approved by Architect and Owner prior to commencement.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide for replacement of Work removed. Comply with Contract Documents for type of Work standards and Specification requirements for each specific product involved.

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of Work, including elements subject to movement or damage during cutting and patching, and excavating and backfilling. After uncovering Work, inspect conditions affecting installation of new products and verify procedures with Architect.

B. Report unsatisfactory or questionable conditions in writing to Architect/Engineer. Do not proceed with Work until further instructions are received.

3.2 PREPARATION

A. Provide shoring, bracing and supports as necessary to maintain structural integrity of work. Design of shoring, bracing and supports is the responsibility of the Contractor and shall be performed by an Engineer registered in the State of Arizona.

B. Provide devices and methods to protect other portions of Work from damage, including elements which may be exposed by cutting and patching Work. Maintain excavations free from water.

3.3 ERECTION, INSTALLATION AND APPLICATION

A. Performance:
1. Execute fitting and adjustment of products to provide finished installation to comply with and match specified tolerances and finishes.
2. Execute cutting and demolition by methods which prevent damage to other Work to provide proper surfaces to receive installation of repairs and new Work.
3. Execute excavating and backfilling by methods which prevent damage to other Work and settlement as specified in Section 31 00 00 - Earthwork.

B. Employ original installer or fabricator to perform cutting and patching for:
1. Weather-exposed surfaces and moisture-resistant elements such as roofing, sheet metal, sealants and waterproofing.
2. Sight-exposed finished surfaces.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes as shown on Drawings and as specified.

D. Fit Work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces. Conform to fire code requirements for penetrations and maintain integrity of fire walls and ceilings.

E. Restore Work which has been cut or removed. Install new products to provide completed Work in accordance with requirements of Contract Documents and as required to match surrounding areas and surfaces.

F. Refinish entire surfaces as necessary to provide an even, matching finish as follows:
1. Painted Walls or Ceilings: To nearest intersection with another finish or corner.
2. Where applied finishes occur (i.e wallcovering, tile, wood paneling): To nearest intersection of finish without damage to adjacent material. Where match of pattern, grain, texture, or similar finish cannot be made, refinish area to intersection with other finish or internal corner.
3. Manufactured or shop fabricated materials: Replace entire affected surface or entire component.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 FINAL CLEANING

A. Perform the following special cleaning for trades at completion of Work. Employ experienced workmen or professional cleaners for the final cleaning:
   1. Remove marks, stains, fingerprints, soil and dirt from paint, stain and wall covering.
   2. Remove spots, soil, paint and mastic from tile work and wash same.
   3. Clean fixtures, equipment and piping; remove stains, paint, dirt and dust.
   4. Remove temporary floor protections; clean and polish floors.
   5. Clean concrete walks and slabs of plaster or cement droppings, paint and other objectionable materials to present a neat, clean appearance.
   6. Clean exterior and interior metal surfaces, including doors and windows and their frames.
   7. Remove oil, stains, dust, dirt, paint and the like from items required to have a polished finish; polish and leave without fingermarks or other blemishes.
   8. Wash interior and exterior glazing, inside and outside.
   9. Polish mirrors.

B. Make building(s) ready for occupancy in every respect. Lay heavy building paper in main circulation areas to protect the floors until final inspection and acceptance.

C. Existing improvements, inside or outside the property which are disturbed, damaged or destroyed by the Work under the Contract shall be restored to their original condition unless as part of the Work, improvements were required.

1.2 PROJECT RECORD DOCUMENTS

A. As the work progresses, the Contractor shall maintain a complete and accurate record of changes or deviations from the Contract Documents and Submittals, indicating the Work as actually installed. Document information by daily corrections and/or additions in the appropriate locations on a record set of prints of the Construction Documents and Submittals and a copy of the Specifications which shall be maintained by the Contractor solely for the purpose of this documentation. Keep this record set of Construction Documents and Submittals at the Project site for review by the Owner and Architect.

B. Information contained in the Record Documents shall include, but not be limited to:
   1. Modifications made by Addenda, Bulletins, Change Orders, Construction Change Directives and Architect's Supplemental Instructions.
   2. Location of site underground pipes, conduits, ducts, cables and similar work, dimensioned horizontally to permanent points of reference and located vertically by indicating depth of burial and invert elevations. Dimensions shall be accurate within 2 inches.
   3. Location of building plumbing piping, sprinkler piping, control valves, shut-off valves, heating and air conditioning equipment, mechanical piping, ductwork, major conduit runs, power, control and alarm wiring, etc., dimensioned horizontally to permanent points of reference. Dimensions shall be accurate within 2 inches. By notation, describe the vertical location of the item such as "below slab," "above ceiling," etc.
   4. Modifications made to accommodate field conditions.

5. Location and function of mechanical and electrical control devices and shut-off valves.
6. Panel schedules showing final circuiting of electrical fixtures and equipment.

B. The Architect will provide the Contractor with a black-line bond paper set of drawings, of the complete original bidding documents, at Contractor's expense. Seals and signatures of Registrants shall be completely removed and/or permanently obscured. Contractor shall provide the following on the Drawings:
1. Changes in the Contract Documents, secured with prior approval of the Architect, recorded in a neat readable manner, in black ink, by a competent drafter. Deletions shall be made by erasure or other indication clearly indicating information deleted. Record information in adequate size lettering and notations to be legible at half size reproduction.
2. Prior to application for final payment, transfer all changes, information and notations made to the record prints to the reproducible set.

C. Upon Substantial Completion of the Work, deliver the complete set of Record Documents including prints, black-line bond paper set, Shop Drawings and annotated Specifications to the Architect for approval.

D. Permit Record Set, as approved by all governing agencies shall be kept in secure location by the Contractor.

1.3 OWNERS MANUAL

A. Owner's Manual: Prior to final payment, provide 1 electronic copy and Three (3) hard-back, loose-leaf binders, suitably typed, indexed and labeled, containing the following:
1. Subcontractors and major suppliers list with companies names, addresses, email addresses and telephone numbers.
2. Warranties and certifications.
3. Affidavit from general and subcontractors on use of asbestos free materials.
4. Maintenance/operation instructions.
5. Parts list.
6. List of Extra Materials delivered to Owner; signed for by Owner's representative.
7. Other items required by the Specifications.
8. Provide electronic copy on DVD, memory key or similar current electronic media in common acceptable format such as PDF.

1.4 OPERATION AND MAINTENANCE DATA

A. Submittals: Submit two (2) draft copies of Operation and Maintenance Manuals for systems and equipment, including electrical and control items, and parts lists, a minimum of 14 days prior to requesting inspection for Substantial Completion, or scheduled Substantial Completion Date, whichever is earlier. Furnish separate copies for each Division.
1. Architect will review Manuals for general scope and content and return one copy of draft manuals with required action.

B. Operating instructions shall include complete operating sequence, control diagrams, description of method of operating machinery, machine serial numbers, factory order numbers, parts, tests, instruction books, suppliers phone numbers, addresses, email addresses, and individual equipment guarantees. Parts lists shall be complete in every respect, showing parts and part numbers for ready reference.

C. Maintenance instructions shall include a written list of required and suggested maintenance for mechanical, plumbing, electrical or other equipment or features in the project. Each item shall contain a brief description of the maintenance required as well as the recommended time frame or period for the maintenance. Include lists of filter sizes for air handling equipment, indicated "washable" or "disposable" and for which unit the filter is for.

D. Provide operating and maintenance instructions on DVD, memory key or similar current electronic media in common acceptable format such as PDF, either prepared by the Contractor or where available, manufacturers prepared operations and maintenance videos and/or instructions for each specific equipment item or system.

E. Assemble maintenance manual and operating instructions in hard back loose leaf binders. Suitably label and index material for ready reference.

F. Upon substantial completion of the Project Work, submit one copy of the Operation and Maintenance Manual and Parts Lists to the Architect for approval. Upon receipt of Notice of Approval, deliver the additional copy to the Owner. Include DVD, memory key or similar current electronic media copies of materials in electronic format.

1.5 SPARE PARTS AND MAINTENANCEMATERIALS

A. Deliver spare parts, tools, extra stocks of material and similar physical items required by individual specification sections to the Owner with a copy of the transmittal to the Architect. Obtain signed receipts from the Owner for all items.

B. Change over construction locks to permanent keying system. Deliver required number of keys to the Owner with a copy of the transmittal to the Architect. Obtain receipts from the Owner for delivered items.

1.6 ELECTRONIC COPIES OF IMAGE DOCUMENTS

A. Upon completion, provide CD, DVD, memory key or other current electronic media containing image copies in JPEG, PDF or other common appropriate electronic format of all record and maintenance documents.

1.7 WARRANTIES

A. Submit warranties required by individual specification Sections in duplicate, assembled in durable binders with a Table of Contents and a digital copy of same on DVD, memory key or other current electronic media.

B. The date of commencement of warranties shall be the date of Substantial Completion except as may be modified by AIA Document G-704, Certificate of Substantial Completion, or by other written agreement with the Owner.

END OF SECTION

SECTION 02 41 13

SELECTIVE DEMOLITION

PART 1: GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Temporary Facilities and Controls-Section 01 50 00.
B. Electrical - Division 26.

1.2 WORK INCLUDED

A. Protecting of utilities, structures, sidewalks, roads, drives, buildings, lawns, trees, shrubs, and landscape work adjacent to or to remain on the site.
B. Miscellaneous excavating and backfilling as required.
C. Remove certain portions of site improvements.
D. All demolition and dismantling required to complete the alteration work at the existing structures and the construction of the new addition.
    1. Demolition of existing interior walls, and associated materials; cutting and patching.
        a. Do not disrupt or remove any of the existing gypsum drywall ceilings without the explicit consent of the architect and/or owner.
    2. Cutting of openings, pockets, chases or depressions, etc., as required for alteration work.
    3. All items of work indicated to be removed by other trades shall be coordinated with specific trade involved before proceeding with the demolition.
E. The owner will remove any materials or equipment which he desires.

1.3 PROTECTION

A. Provide and maintain suitable barricades, shelters, lights and danger signals during the progress of the work. They shall meet the requirements of State and/or local building codes. Assume full responsibility of barriers to completion of contract and remove same.

B. Take reasonable and adequate precautions to protect the Owner's property from damage during demolition work, moving of debris, restore any damage to the Owner's property due to the afore mentioned work or replace in a manner satisfactory to the Architect.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 CONDUCT OF WORK

A. Remove all work carefully and only to the extent required for the final work. Remove all loose or damaged materials caused by demolition, or noted, or specified to be removed.

B. Conduct all operations with a minimum of noise.

C. Erect dustproof partition where demolition work is in progress and as directed. Such partitions shall remain in place until their removal as directed.

D. Carefully remove any materials and equipment noted or specified to be reused or salvaged and handle with care to minimize damage.

E. Where openings are to be cut in existing structure, cut such openings with care, where materials are to be removed, remove such items with care to minimize damage to adjacent materials.

F. Neatly cut depressions, chases and the like with carborundum saws.

G. The use of pneumatic or electric hammers for demolition and cutting purposes within the existing building will not be permitted, without prior approval of the Owner.

H. After the demolition work in any area is completed, clean all floors, walls and ceilings, etc., before any new construction is started.

I. Where patching is required, patch all areas using the same materials and finish as adjacent surfaces and patch in such a manner that the repaired area is in visual harmony with the surrounding areas.

J. Properly repair any adjoining surfaces to original condition that are damaged by the Contractor.

3.2 DISPOSAL

A. Remove all materials or debris resulting from demolition operations from the site promptly. No accumulation of debris will be permitted.

END OF SECTION

SECTION 03 10 00

CONCRETE

FORMWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Formwork for cast-in-place concrete, including, but not limited to:
   1. Waterstops.
   2. Installation of embedded items.
   3. Shoring, Bracing and Anchorage, including openings for other Work
   4. Form Accessories
   5. Form Stripping.

1.2 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.3 SUBMITTALS

A. Shop Drawings: Show form construction including jointing and other items that affect exposed concrete visually. The Architect's review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is the Contractor's responsibility. Submit Drawings showing dimensions, materials, bracing, tie- hole layouts for exposed tie holes, and arrangement of joints.

B. Product Data: Provide data on accessory materials and installation requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347R - Guide to Formwork for Concrete.

1.5 QUALIFICATIONS

A. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Arizona.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site to prevent deterioration and damage.

B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.7 COORDINATION

A. Coordinate this Section with other Sections of Work which require attachment of components to formwork.

B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Architect's Structural Engineer before proceeding.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Forms for Concealed Concrete: Plywood, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit. For use in below grade concrete or concrete covered by another finish. Not for use where finished concrete is exposed to view.
   1. Plywood, Douglas Fir species; APA grade-trademarked; BB Plyform, Class 1, Exterior Grade as per PS1.
   2. Lumber: Spruce, Pine or Fir species; construction grade, with grade stamp clearly visible.
   3. Plywood shall have mill applied release agent and edge seal.

B. Forms for Exposed Concrete: Plywood, MDO, tempered concrete-form-grade hardboard, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surface. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system where shown on Drawings. For use in exposed to view concrete that is not covered by another finish.
   1. MDO (medium density overlay), class 1 or better, with mill applied release agent and edge seal.
   2. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C of B-B High Density Overlaid Concrete Form," Class I, Exterior grade or better.
   3. Tempered concrete-form-grade hardboard, with applied release agent and edge seal.
   4. MDO, plywood, and hardboard forms shall have mill applied release agent and edge-sealed.

C. Forms for Cylindrical Columns and Supports. Metal, glass-fiber-reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

D. PVC Sleeves: ASTM D1758, PVC 1120 compound, Schedule 40.

E. Polystyrene Void Forms: Rigid extruded polystyrene meeting ASTM C578, Type VI with 40 psi compressive strength.

2.2 FORMWORK ACCESSORIES

A. Form Ties: Removable or snap-off type, free of defects that could leave holes larger than one inch in concrete surface.

B. Form Release Agent: Commercial formulation, 100 percent biodegradable, zero VOC, vegetable base, colorless, which will not stain concrete, or impair natural bonding or color characteristics of subsequent treatments and coatings applied to concrete surfaces.
   1. Do not use petroleum-based agents. Paraffin and waxes shall not be used when a concrete finish is required.

C. Corners: Chamfered wood strip type or vinyl bead; 3/4 inch x 3/4 inch size; maximum possible lengths.

D. Flashing Reglets: Galvanized steel 22 gauge thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

F. Waterstops: Provide one of the following:

1. Polyvinyl chloride or rubber, flat or dumbbell type, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; width as shown on Drawings. Comply with Corps of Engineers CRD-C572 for PVC and CRD-C513 for rubber.
2. Self-Expanding Waterstop Strips: self-expanding waterstop strips of reinforced sodium bentonite or other hydrophylic material.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Volclay Waterstop RX; Colloid Environmental Technologies Co.
      2) Hydrotite; Greenstreak.
      3) Mirastop; Mirafi Moisture Protection, Div. Of Royal Ten Cate (USA), Inc.
      4) Superstop; Progress Unlimited.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.2 EARTH FORMS

A. Earth Forms:

1. Earth forms are only allowed when and where approved by the Structural Engineer.
2. Hand trim sides and bottom of earth forms. Remove loose soil in pour cavity prior to placing concrete.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Arrange formwork for exposed concrete in an orderly and symmetrical manner to produce smooth concrete finish indicated. Arrange form ties in exposed locations in consistent even rows and spacing acceptable to Architect.

C. Provide bracing to ensure stability of formwork. Shore or strengthen formwork

subject to overstressing by construction loads.

D. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping.

E. Align joints and make watertight. Keep form joints to a minimum.

F. Obtain approval from Architect before framing openings in structural members which are not indicated on Drawings.

G. Provide chamfer strips on external corners where exposed in the finished Work.

H. PVC Sleeves: Set PVC sleeves in proper alignment and position. End of sleeves shall be flush with finished concrete surface.

I. Use polystyrene to form void spaces where indicated on Drawings.

3.4 APPLICATION - FORM RELEASE AGENT

A. Coat contact surfaces of forms with a form coating compound before reinforcement steel, anchoring devices, or embedded items are placed. Thin form-coating compounds with thinning agent and apply as specified in manufacturer's instructions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed.

B. Do not apply form release agent where concrete surfaces will receive applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate Work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Install accessories in accordance with Manufacturer's instructions, straight, level and plumb. Ensure items are not disturbed during concrete placement.

E. Waterstops: Install waterstops as specified in Section 03 30 00.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 JOINTS

A. Comply with requirements of Section 03 30 00.

3.7 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.8 FORMWORK TOLERANCES

A. Design and construct formwork in accordance with ACI 301.

B. Construct formwork as required to produce concrete members of size, shape, configuration, alignment, elevation and position indicated on Drawings within tolerance limits of ACI 301.

C. Surface Irregularities: Construct and maintain formwork to produce concrete having the following formed finish Class and permitted abrupt or gradual irregularities as designated by ACI 347-01.
1. All vertical and horizontal exterior exposed surfaces: Class A, 1/8 inch.
2. Other surfaces prominently exposed to public view: Class A, 1/8 inch.
3. Concealed surfaces where covered by another finish: Class C, 1/2 inch, except abrupt irregularities shall be limited to 1/4 inch.

3.9 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that Work is in accordance with formwork design, and that support, fastenings, wedges, ties and items are secure.

B. Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.10 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads. Forms shall be removed in accordance with the requirements of the General Structural Notes.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Forms for vertical elements such as walls, columns, and pilasters shall not be removed or disturbed for at least 7 days from the date of last placement.

E. Forms for slabs, girders, beams and the like and retaining walls shall not be

removed or disturbed for at least 14 days from date of last placement. It may be required that such forms be left in place longer than the above specified period. The length of time they shall remain in place will depend on the system of forming and shoring, and shall be in accordance with the requirements of the General Structural Notes.

F. Formwork for stem walls and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage.

G. Cure exposed concrete in accordance with Section 03 30 00 whenever the formwork is removed during the curing period.

3.11 REMOVAL STRENGTH

A. When formwork removal is based on the concrete reaching its specified 28 day strength (or a specified percentage thereof), the concrete shall be presumed to have strength when either of the following conditions has been met:

1. When test cylinders, field cured under the most unfavorable conditions prevailing for any portion of the concrete represented, have reached the required strength.

2. When the concrete has been cured for the same length of time as the age, at test, of laboratory cured cylinders which reach the required strength. The length of time concrete has been cured in the field shall be determined by the cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the air in contact with the concrete is above 50 degrees F. and the concrete has been damp or thoroughly sealed from evaporation and loss of moisture.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Concrete reinforcement as shown on the Drawings and as specified.

B. Related Sections:
1. Section 03 10 00 – Concrete Formwork.
2. Section 03 30 00 – Cast-in-Place Concrete.

1.2 QUALITY ASSURANCE

A. Comply with the Following:
1. ACI 301-10 – Specifications for Structural Concrete, Chapter 5, except where more exacting requirements are specified.
2. ACI 315-99 – Details and Detailing of Concrete Reinforcement.
3. ACI 318-11 – Building Code Requirements for Structural Concrete.
4. Concrete Reinforcing Steel Institute (CRSI), Design Handbook, 2008 Edition.

B. Comply with requirements in AWS-D12.1, except where more exacting requirements are specified in the Contract Documents.

1.3 SUBMITTALS

A. Shop Drawings: Submit Drawings showing bending and placing of reinforcing. Comply with ACI 315 requirements including diagrammatic elevations of walls at a scale sufficiently large to show clearly the position and erection marks of marginal bars and their dowels and splices and bar arrangement for more than one layer of reinforcing steel in concrete sections.

B. Certificates: Submit certified mill test reports for review prior to fabrication.

1.4 DELIVERY, STORAGE AND HANDLING

A. Shipping: Deliver reinforcement to the Project site bundled, tagged and marked to facilitate sorting and placing. Tags shall indicate bar sizes, lengths, grade and other information corresponding to markings shown on placement diagrams.

B. Storage and Protection: Store reinforcement at the site off the ground and in a manner to prevent damage to the materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel: New billet-steel, deformed bars conforming to ASTM A615, Grade 60, with a minimum yield of 60 ksi for all bars, except stirrups, ties and indicated field bent bars and all bars No. 4 and smaller in slabs-on-grade may be ASTM A615, Grade 40, with a minimum yield of 40 ksi. Grade 60 bars indicated to be welded shall be ASTM A706.

B. Welded Wire Fabric: ASTM A185 using bright steel wire meeting the requirements of ASTM A82. Provide in flat sheets only. Gauges and dimensions as noted on the Drawings.

C. Chairs: Galvanized steel or plastic tipped, wire bar type, and precast concrete block type meeting requirements of CRSI Manual of Standard Practice.

D. Tie Wire: ASTM A82, 16 gauge or heavier, black annealed.

E. Welding Rods: E-70 Series for A615 Grade 40 (ASTM A615M, Grade 300) reinforcing, and E-90 Series for A706 reinforcing; low hydrogen conforming to AWS A-5.1.

F. Fiber Reinforcing is specified in Section 03 30 00.

2.2 FABRICATION

A. Do not fabricate reinforcing steel until shop drawings are reviewed and approved.

B. Fabricate reinforcing steel in accordance with fabricating tolerances of ACI 315.

C. Shop fabricate bars as far as is practical. Bend bars cold. Make bends for stirrups and ties around pins having diameters at least 2 times the thickness of the bars; for other bars 1 inch diameter and smaller, 6 times the thickness; for larger bars 8 times the thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Determine weldability of reinforcing steel by laboratory chemical analysis of steel. Only steel conforming to chemical requirements specified in AWS D12.1 may be welded.

3.2 PLACING REINFORCEMENT

A. General:
1. Place in accordance with ACI 318-11, CRSI Code of Standard Practice for “Placing Reinforcing Bars,” and as shown on Drawings.
2. Clean reinforcing steel of loose rust and mill scale, earth, ice, and other deleterious materials which reduce or destroy bond with concrete.
3. Accurately place reinforcement and securely tie at intersections with 16 gauge black annealed wire.
4. Maintain reinforcing in proper position by chairs, bar supports or other approved devices.
5. Bars in footings shall be supported on precast concrete blocks.
6. The bending or field cutting of bars around openings or sleeves will not be permitted.
7. At slab-on-grade where base course fill materials will not support chair lags, provide supports with sand plates or precast concrete blocks.

B. Tension and compression laps shall be in accordance with the lap schedule on the structural Drawings. All splice locations are subject to approval by the Structural Engineer.

C. Concrete protection of reinforcing shall be in accordance with General Structural Notes on Drawings.

D. Clear distance between bars shall be not less than 1-1/2 times the maximum size of coarse aggregate unless noted otherwise.

E. Corner Reinforcing: Provide corner bars of same size and spacing as horizontal reinforcing steel. Lap with horizontal reinforcing 30 bar diameters or 18 inches minimum length.

F. Reinforcing at Construction/Control Joints: Continue reinforcing steel through construction joints unless noted otherwise. Discontinue reinforcing steel 2 inches from preformed construction joints in slabs-on-grade. Cut alternate longitudinal bars at weakened plane control joints in walls.

G. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items. If bars are moved more than one bar diameter or enough to exceed code tolerances, resulting arrangement of bars shall be subject to review of Architect.

H. Bars with kinks or bends not indicated shall not be used. Reinforcement shall not be bent or be straightened in a manner that will weaken the material, or be bent after being partially embedded in hardened concrete.

I. Wire mesh in slabs: Laps in welded wire fabric shall be made so that the overlap, measured between outermost cross wires of each fabric sheet, is not less than the spacing of cross wires plus 2 inches.

3.3 CLEANING

A. During the course of the Work and on completion, remove excess materials, equipment and debris and dispose of off premises. Leave Work in clean condition.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Cast-in-place concrete including, but not limited to, the following:
   1. Building footings, foundations and slabs on grade including finishing, surface repair and curing, as indicated on Drawings.
   2. Underslab vapor barrier for slabs-on-grade.
   3. Site structures including, but not limited to, footings and foundations for site walls, enclosures, site lighting supports, electrical and mechanical equipment support pads, and other site furnishing and equipment requiring cast-in-place concrete items.
   4. Other items as indicated.

B. Related Sections:
   1. Section 03 10 00 – Concrete Formwork
   2. Section 03 20 00 – Concrete Reinforcement
   3. Section 31 00 00 – Earthwork, for preparation of subgrades, including granular base course underslab fill material for slabs-on-grade.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements: Interior slabs on grade scheduled to receive applied floor finishes (VCT, carpet, etc.) shall be tested as specified herein under Field Quality Control Calcium chloride test requirements. Moisture vapor from the floor must be less than 3 pounds per 1,000 square feet per 24 hours.

1.3 SUBMITTALS

A. Mix Design: Submit mix design for each class of concrete in accordance with ACI-310, Section 4.
   1. Submit with mix design results of laboratory tests performed within previous 6 months indicating aggregates from proposed source comply with requirements of ASTM C33 or C330 as applicable.
   2. Submit written reports of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been approved.
   3. Lightweight concrete: Submit data showing that the mix meets requirements regarding shrinkage, split cylinder strength, and modulus of elasticity.
   4. Submit the proposed area of use for each mix design submitted (footings, stemwalls, slabs, walls, columns, etc.).
   5. Review of mix designs by Architect and/or Engineer shall in no way

relieve the Contractor of responsibility for the performance of the concrete.

B. Product Data: Submit manufacturer's product data with application and installation instructions for accessory products, proprietary materials and admixtures.

C. Test Reports: Submit copies of test reports for concrete compressive strength, air content, temperature and slump. Submit copies of granular base course test reports.

D. Shop Drawings: Submit shop drawing showing proposed location of construction joints, expansion/contraction joints and control joints and obtain approval of same from Architect prior to construction.

E. Samples of materials, including names, sources and descriptions, of the following:
1. Color finishes.
2. Vapor Barrier.
3. 4 inch long samples of expansion/contraction joint and control joint

1.4 QUALITY ASSURANCE

A. Standards: Meet the requirements of the following:
1. ACI 301-10 – Specifications for Structural Concrete.
2. ACI 306.1-90 Standard Specification for Cold Weather Concreting
3. ACI 318-11 – Building Code Requirements for Structural Concrete.
4. Standard for measuring, mixing and delivery of ready mixed concrete shall be ASTM C94, except that time in mixer after water has been added at batch plant is limited to 1-1/2 hours.
5. Job-mixed concrete shall be subject to Architect's review of design, mixing and handling procedures.

B. Field Samples:
1. Provide on-site sample(s) of exposed flatwork concrete with integral color or other decorative concrete finishes specified in Section 03 35 33, showing texture and color before proceeding with finish to be used on this Project.
2. Sample(s) shall be minimum 4'-0" square and have at least one longitudinal and one transverse joint.
3. Construct sample panels in ample time to allow for finishing and curing before requesting Architect to review.
4. Construct where directed by Architect and prepare successive sample panels as required until finish acceptable to Architect is produced.
5. Since sample panels will constitute a basis of acceptance or rejection of the completed Work, do not remove sample panels until authorized in writing by the Architect. Dispose of sample panels in a legal manner when authorized.

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

D. Pre-Installation Conference:
   1. Contractor shall conduct a meeting at Project site to review proposed mix designs and discuss required methods and procedures to achieve required concrete construction.
   2. Contractor shall distribute meeting agenda to all attendees a minimum of 7 days prior to the scheduled date meeting.
   3. Attendees: Responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:
      a. Contractor's superintendent.
      b. Laboratory responsible for concrete design mix.
      c. Laboratory responsible for field quality control.
      d. Concrete subcontractor.
      e. Ready-mix concrete producer.
      f. Admixture manufacturer(s).
      g. Concrete placement equipment manufacturer(s).
   4. Meeting minutes will be taken by the Contractor for distribution to all attendees within 5 days of meeting. Contractor shall also distribute copy of meeting minutes to Owner, Structural Engineer, and Architect.
   5. Minutes shall include statement by concrete subcontractor indicating proposed mix design, placement, finishing and curing procedures can produce the concrete quality required by these specifications.

E. Static Coefficient of Friction: Sealed concrete floors shall have a tested coefficient of friction of 0.71 minimum dry, 0.6 minimum wet for level surfaces and treads of stairs and
0.8 minimum wet or dry for ramp surfaces when tested in accordance with ASTM D2047 / UL410.

1.5 PROJECT CONDITIONS

A. Rain protection: Do not place concrete during rain unless adequate protection has been provided.

B. Cold weather protection: Protect concrete work from physical damage or reduced strength caused by frost, freezing or low temperatures. Comply with ACI 306.1.

C. Hot weather protection: When hot weather conditions exist that would impair quality and strength of concrete, reduce delivery time of ready mix concrete, lower the temperature of materials, or add retarder to ensure that the concrete is plastic. Retempering with water is not allowed. Comply with ACI 305R and 305.1-06.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150, Type V where in contact with earth, Type II elsewhere, alkali content not to exceed 0.6 percent. Use one brand and type of cement throughout Project unless otherwise specified.

B. Aggregates:
1. Regular Weight Structural Concrete: Clean, coarse aggregate and gravel, free from foreign matter, conforming to ASTM C33. Aggregate shall be graded from coarse to fine in accordance with ASTM C33, Size 67.
2. Aggregate for lightweight structural concrete: ASTM C330 except use only shale, slate or clay prepared in a rotary kiln. Test results from an acceptable testing laboratory shall show compliance with the performance requirements of this Specification. Soundness shall have a maximum 15 percent loss when tested in accordance with ASTM C88. Absorption shall have a maximum 15 percent when tested in accordance with ASTM C127.

D. Admixtures:
1. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures. Provide one of the following:
   a. AEA-92 and Air 40, Euclid Chemical Co. www.euclidchemical.com
   b. Sika AER, Sika Corp. www.sikaconstruction.com
   c. Master Builders MB-VR or MB-AE, BASFAdmixtures www.basf- admixtures.com
2. Water-Reducing Admixture: ASTM C494, Type A, and containing not more than 0.05 percent chloride ions. Provide one of the following:
   a. Eucon NW or Eucon WR 91, Euclid Chemical Co.
   b. Master Builders Pozzolith 322N, BASF Admixtures
   c. Plastocrete 160, Sika Chemical Corp.
3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or Type G and containing not more than 0.05 percent chloride ions. Provide one of the following:
   a. Eucon 37/Eucon 1037, or Plastol Series, Euclid Chemical Co.
   b. Daracem 100 or ADVA Flow, W.R. Grace & Co.
   c. Master Builders Rheobuild 1000 or Glenium 3030, BASF Admixtures.
4. High-Range, Water-Reducing, and Retarding (Superplasticizer): ASTM C 494, Type G. Provide one of the following:
   a. Eucon 537, Euclid Chemical Company
   b. Daracem 100, W.R. Grace & Co.
   c. Master Builders Rheobuild 916, BASF Admixtures
5. Non-Chloride, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Provide one of the following:
   a. Accelguard 80, 90 or NCA, Euclid Chemical Co.
6. Water-Reducing, Retarding Admixture: ASTM C494, Type D, and contain not more than 0.05 percent chloride ions. Provide one of the following:
   a. Eucon NR or Eucon Retarder 100, Euclid Chemical Co.
   b. Master Builders Pozzolith Retarder, BASF Admixtures.
   c. Plastiment, Sika Chemical Co.
7. Fly ash admixture: In accordance with Section 03 05 05.
8. Use set-retarding admixtures during hot weather only when approved by Architect.
9. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.

E. Fiber Reinforcement (Fill for stair treads, landings, and as otherwise indicated): Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, Section 4.1.3, not less than 3/4 inch long.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Tuf-Strand SF, Euclid Chemical Co. www.euclidchemical.com
      b. Fibermesh 650, Propex Concrete Systems www.fibermesh.com
      c. Forta, Forta Corp. www.forta-ferro.com
      d. Grace Fibers, W.R. Grace & Co. www.na.gracecontruction.com

F. Water: Potable.

G. Coloring Agent:
   1. ASTM C979.
   2. Approved Manufacturers:
      a. Bayer Corporation, Bayferrox Pigment.
      b. Frank Davis Company
      c. L.M. Scofield Company
      d. Solomon Grind-Chem Service, Inc.
   3. Color(s): As selected by Architect.
   4. Color weight shall not exceed 10 percent of the weight of the cement.

2.2 ACCESSORIES

A. Bonding Agents and Repair Products:
   1. Interior Only (PVA): L&M Construction Chemicals EVERWELD www.lmcc.com; EucoWeld, Euclid Chemical Company www.euclidchemical.com; US Spec Bondcoat PVA www.usspec.com; or Larsens' Weld Crete www.larsenproducts.com
   2. Interior Only for Bonding Existing Concrete to Fresh Concrete (Epoxy): Sikadur 32, Hi-Mod, Sika www.sikausa.com; Euco 452 Series, Euclid Chemical Company www.euclidchemical.com; Maxi-Bond 2500, US Spec www.usspec.com; or Rezi- Weld, W.R. Meadows www.wrmeadows.com.
   3. Exterior and Interior Bonding Admixture (acrylic latex): SBR Latex or Flexcon Euclid Chemical Company www.euclidchemical.com; Intralok, W.R. Meadows www.wrmeadows.com; Acylcoat, US Spec www.usspec.com; or Dayton Bond J40, Dayton Superior www.daytonsuperior.com.
   4. Polymer Repair Compounds: Polymer and microsilica modified cementitious based compounds.
      a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
      b. Horizontal Locations:
         1) Sikatop 121 or 122, Sika Chemical www.sikausa.com
         2) Thin Top Supreme, Concrete Top Supreme, Euclid Chemical Company www.euclidchemical.com
         3) TP Mortar, US Spec www.usspec.com
      c. Vertical or Overhead Locations:
         1) Sikatop 123, Sika Chemical
         2) V/O Patch, US Spec
         3) Verticoat, Verticoat Supreme, Concrete Top Supreme,

Euclid Chemical Company.

5. Underlayment Topping: Free-flowing, self-leveling, pumpable cementitious base compound.
   a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
      1) Ardex K-15, Ardex Inc.
      2) Flo-Top or Super Flo-Top, Euclid Chemical Company
      3) Self-Leveling Underlayment, US Spec
      4) Underlayment 110, BASF
6. Repair Topping: Latex modified, sandless cementitious mortar topping with bond strength meeting or exceeding requirements of ASTM C1059.
   a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
      1) Thin Top Supreme, Euclid Chemical Company
      2) TP Mortar, US Spec
      3) As approved by Architect.

B. Non-Shrink Grout:
1. Premixed or prepackaged, non-metallic, non-gaseous, bleed free compound; non-shrink when tested in accordance with ASTM C 1107, Grade B at a fluid (flow cone) consistency of 20 to 30 seconds.
2. Attain minimum compressive strength of 7,000 psi in 28 days at above fluid consistency.
3. Fluid grouts: Remain workable, flow through flow cone after 20 minutes with slight agitation, in temperatures from 40 to 70 degrees F.
   a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
      1) Suregrip High Performance, Dayton Superior, www.daytonsuperior.com
      2) Sikagrout 212, Sika www.sikausa.com
      3) Master Builders (Masterflow 713) www.masterbuilders.com
      4) W.R. Meadows No. 588 Grout www.wrmeadows.com
      5) L&M Construction Chemicals (DURAGROUT) www.lmcc.com
      6) US Spec "GP Grout" www.usspec.com
      7) Euclid N-S Grout www.euclidchemical.com.
4. High Flow Fluid Grouts: High flow grout shall achieve 95 percent contact when placed under an 18 inch x 36 inch base plate, remain workable, and flow through cone after 60 minutes in temperature from 70 to 90 degrees F.
   a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
      1) Hi-Flo Grout, Euclid Chemical Company www.euclidchemical.com
      2) US Spec "MP Grout" www.usspec.com
      3) Chemrex Masterflow 928, BASF www.chemrex.com

C. Liquid Curing and Sealing Compound:
1. Verify that specified curing compound is compatible with the floor finish material(s) and adhesive(s) that will be applied to floor surface prior to delivery of curing compound to jobsite. If it is determined that the curing compound is not compatible with the floor finish material(s) and adhesive(s) that will be applied to floor surface, Contractor shall

immediately notify Architect.

2. Clear Curing and Sealing Compound (Voc Compliant, 350 g/l): Liquid type membrane-forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class A, 25% solids content minimum. Moisture loss shall be not more than 0.40 Kg/m^2 when applied at 300 sq. ft./gal. Manufacturer's certification is required. Subject to project requirements provide one of the following products:
   a. Chemrex Kure 1315, BASF Construction Chemicals www.chemrex.com.
   b. Lumiseal WB, L&M Construction Chemicals www.lmcc.com
   c. Radiance UV-25, US Spec www.usspec.com
   d. Super Diamond Clear VOX, Euclid Chemical Company www.euclidchemical.com
   e. VOCCOMP-30, W.R. Meadows www.wrmeadows.com
3. Dissipating Hydrocarbon Resin Curing Compound: ASTM C309, VOC compliant, 350 g/l, for use on slabs receiving subsequent applied finishes and where noted on Drawings. Subject to compliance with requirements, provide one of the following:
   a. Kurez DR VOX or Kurez W VOX, Euclid Chemical Company www.euclidchemical.com
   b. Maxcure Resin Clear HS, US Spec www.usspec.com

D. Epoxy Anchoring Adhesive: 2-component, high modulus, 100 percent solids epoxy gel adhesive complying with ASTM C881.
   1. Acceptable Products: Subject to compliance with requirements, provide one of the following:
      a. Hilti HIT-RE 500-SD www.hilti.com
      b. Simpson Strong-Tie Co. Set-XP www.simpsonanchors.com .

E. Preformed Construction Joint: Standard design plastikey rigid plastic, tongue and groove key joint; 3-1/2 inch vertical dimension for 4 inch slabs, or thickness as required by slab depth. For use only in slabs not exposed to vehicular traffic.

F. Preformed Control Joint: Rigid plastic or metal strip with removable top section.

G. Preformed Expansion Joint Filler: Asphalt saturated fiberboard, 1/2 inch thick, meeting the requirements of ASTM D 1751.

H. Sealer: VOC compliant, acrylic copolymer type.
   1. Antimicrobial Penetrating Concrete Sealer (Slabs Surfaces Under Access Flooring): Provide the following at all recessed slab areas where access flooring will be installed Penetrating concrete sealer and/or densifier which includes an antimicrobial additive or property, or has a naturally antimicrobial PH level. Acceptable products include, but are not limited to the following:
      a. Norganix Biosecurity Concrete Sealant www.norganix.com
      b. BoneDry Penetrating Concrete Sealer www.bonedryproducts.com
      c. Xtreme Hard Densifier www.xtremeharddensifier.com
      d. Other antimicrobial penetrating concrete sealer as approved by Architect.
   2. Interior (Not for use at access floor areas): ASTM C1315, Class A. Subject to requirements, Provide one of the following:
      a. VOCOMP-30, W. R. Meadows.

b. Euclid Super Aqua Cure VOX, Euclid Chemical Company.
c. Dress & Seal WB #30, L&M Construction Chemicals.
d. J-19, Dayton Superior.

3. Exterior: ASTM C1315, Class A. Provide one of the following:
a. Euclid Super Diamond Clear VOX, Euclid Chemical Company.
b. Lumiseal WB, L&M Construction Chemicals.
c. VOCOMP-30, W. R. Meadows.
d. Radiance UV-25, US Spec.

I. Liquid Sealer Densifier: High performance, deeply penetrating concrete densifier; odorless, colorless, VOC compliant, non-yellowing siliconate based solution designed to harden, dustproof and protect concrete floors subjected to heavy vehicular traffic and to resist black rubber tire marks on concrete surfaces. The compound must contain a minimum solids content of 20 percent of which 50 percent is siliconate. Subject to project requirements provide one of the following products:

1. Ashford Formula, Curecrete Chemical Company, Inc. www.ashfordformula.com
2. Diamond Hard, Euclid Chemical Company www.euclidchemical.com .
3. SealHard, L&M Construction Chemicals www.lmcc.com
4. Liquihard, W. R. Meadows www.wrmeadows.com
5. J-17 Surehard, Dayton-Superior www.daytonsuprerior.com
6. Industraseal, US Spec www.usspec.com"

J. Leveling Agent: Sonneborn Sonoflow, Euclid Flo-Top, Ardex K-15, L&M Construction Chemicals Levelex, US Spec "Self-Leveling Underlayment, or Dayton-Superior Levelayer 1 are acceptable products.

K. Vapor Barrier: ASTM E1745, Meets or exceeds Class A, manufactured from prime virgin resins and complying with the following:

1. Permeance Rating:
a. New Material: Less than 0.01 perms ($gr/ft^2/hr/in\text{-}Hg$) when tested in accordance to ASTM E96 or ASTM F1249.
b. After Mandatory Conditioning: Less than 0.01 perms ($gr/ft^2/hr/in\text{-}Hg$) when tested in accordance with ASTM E154, Sections 8, 11, 12 and 13.
2. Minimum Thickness: 15 mils in accordance with ACI 302.2R-06.
3. Puncture Resistance: Minimum 2200 grams when tested in accordance with ASTM D1709.
4. Tensile Strength: Minimum 45.0 lbf/in when tested in accordance with ASTM D882.
5. Acceptable Products:
a. Stego Wrap (15 mil) vapor Barrier, Stego Industries, L.L.C., (877) 464- 7834 www.stegoindustries.com
b. Vaporguard, Reef Industries www.reefindustries.com
6. Accessories:
a. Seam Tape and Mastic: Provide manufacturer's recommended seam tape and vapor proofing mastic with WVTR of 0.3 perms or lower when tested in accordance with ASTM E96.
b. Pipe Boots: Construct boots from vapor barrier material, pressure sensitive tape and/or mastic in accordance with manufacturer's instructions.
c. Termination Bars: As recommended by manufacturer for terminating vapor barrier on vertical foundation walls.

L. Concrete Accessories: Gateway Engineering Company, Dayton-Superior Corporation, or Burke Concrete Accessories.

M. Evaporation Retarder:
1. Type: Monomolecular film, compatible with subsequent coatings and floor finishes.
2. Acceptable Manufacturer and Products: L&M Construction Chemicals (E-Con), Master Builders (Confilm), Sika (Sika Film), W.R. Meadows (Evapre), US Spec (Monofilm ER), or Dayton Superior (Surefilm J-74).”

N. Felt: Asphalt-saturated organic felt, weighing 30 pounds per 100 square feet, meeting the requirements of ASTM D226.

2.3 MIXES

A. Design of Mixes: Prepare design mixes for each type and strength of concrete by either laboratory trial mixture or field experience methods as specified in ACI 301, Section 4. If trial mixture method is used, employ an independent testing facility, acceptable to Architect, for preparing and reporting proposed mix designs.

B. Selection of proportions for normal weight concrete: ACI 301.

C. Mix and deliver ready-mixed concrete in accordance with requirements of ASTM C94, Option A.
1. Not more than 90 minutes shall elapse from time water is introduced into the concrete mixture until completion of placement.
2. Do not add water to mix that has stiffened to increase its workability.
3. At no time shall concrete mix exceed a bulb thermometer reading of 90 degrees
F. or over.
4. Use ice or other method as reviewed by Architect, to keep concrete below 90 degrees F. temperature.

D. All concrete must contain the specified water-reducing admixture or the specified high- range water-reducing admixture (superplasticizer). All thin concrete slabs, less than 8 inches in thickness placed at air temperatures below 50 degrees F shall contain the specified non-corrosive, non-chloride accelerator. All concrete slabs placed at air temperatures above 90 degrees F may require the use of a water reducing retarding admixtures.

E. All concrete required to be air entrained shall contain an approved air entraining admixture. All pumped concrete, concrete for industrial slabs, synthetic fiber concrete, architectural concrete, self-consolidating concrete, concrete required to be watertight or concrete with a water/cement ratio below 0.50 shall contain the specified high-range water-reducing admixture (superplasticizer).

F. Durability Requirements - Water/Cementitious Ratio:
1. All concrete subject to freezing and thawing shall have a maximum water/cementitious ratio of 0.50 (4000 psi at 28 days or more).

2. Water-cement ratio for concrete used for interior slab on grade construction: 0.40 to 0.45.
3. All concrete required to be watertight shall have a water/cement ratio of 0.45 (4500 psi at 28 days or more).

G. Air Entraining Admixture:
1. All concrete exposed to freezing and thawing and/or required to be watertight shall have an air content of 4.5 to 7.5 percent in accordance with ACI 212.3R.
2. All interior, slabs subject to vehicular abrasion, shall have a maximum air content of 3 percent.
3. Structural lightweight concrete may have entrained air content up to a maximum of 10 percent.
4. Air content in fire rated slabs shall comply with the requirements in the specified UL Listing.

H. Compressive strength (28 day): As shown on Structural Drawings.

I. Slump; for consolidation by vibration: As shown on Structural Drawings.

J. Mix coloring agent for integrally colored decorative concrete in strict compliance with the Manufacturer's printed instructions.

K. Lightweight concrete:
1. Structural lightweight concrete shall have a measured equilibrium density not exceeding 115 lbs. per cubic foot when tested in accordance with ASTM C567.
2. Splitting tensile strength, when tested in accordance with ASTM C 496, shall be the minimum as follows for given compressive strength:
a. 4,000 psi, fct equals 425 psi;
b. 5,000 psi, fct equals 475 psi.
3. Modulus of elasticity shall be a minimum of 2,400,000 lbs. per square inch.
4. Drying shrinkage, when tested in accordance with ASTM C330, shall be a maximum 0.06 percent at age 1 year or 0.035 percent at 28 days.
5. Base cement factor and water-cement ratio on degree of saturation and absorption characteristics of the lightweight aggregates stockpiled for use.
6. Shrinkage reducing admixture or a shrinkage compensating admixture may be used to control drying shrinkage if acceptable to the Architect.
7. Substitute natural sand for lightweight fines.

L. Fiber Reinforcement: Add at manufacturer’s recommended rate but not less than 3.0 lbs./cu. Yd..

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel. Set screeds accurately. Embedded items shall be accurately aligned and adequately supported. Verify installation of mechanical,

plumbing, and electrical items to be embedded in concrete. Correct any unsatisfactory condition before proceeding further.

3.2 PREPARATION

A. Prior to placing concrete:
1. Clean equipment involved.
2. Remove debris and foreign material from the forms.
3. Remove concrete laitance from reinforcing steel.
4. Wet wood forms and masonry units in contact with concrete, unless otherwise prepared.
5. Clean and roughen surfaces of previously placed concrete.
6. Remove excess water before placing concrete.

B. No wood other than built-in bucks or nailing blocks will be permitted to remain permanently inside the forms.

C. Coordinate the necessary Trades as required to provide the sleeves, bolts, anchors, holes, etc., to be built in.

D. Place vapor retarder over subbase immediately prior to placing of floor slab.
1. At locations indicated on Drawings, Install vapor retarder in accordance with ASTM E1643-11 and manufacturer's printed instructions.
2. Unroll vapor barrier/retarder with the longest dimension parallel with the direction of the pour.
3. Lap vapor barrier/retarder over footings or seal to foundation walls.
4. Vapor barrier/retarder shall be continuous over entire floor area and turned up a minimum of 2 inches at perimeter walls and penetrations and sealed with termination bar.
5. Overlap joints 6 inches and seal with manufacturer’s tape.
6. Seal all penetrations (including pipes) per manufacturer’s instructions.
7. No penetration of the vapor barrier/retarder is allowed except for reinforcing steel, structural members and permanent utilities.
8. Repair damaged areas by cutting patches of vapor barrier/retarder, overlapping damaged area 6 inches and taping all four sides with tape.
9. Vapor barrier/retarder installation shall be approved by the vapor barrier manufacturer prior to concrete placement.

3.2 PLACING OF CONCRETE

A. Concrete Work shall be performed in accordance with ACI-301 except as amended by this Section.

B. Convey concrete from the mixer to place of final deposit by methods which will prevent segregation of aggregate or loss of material. Place concrete at such a rate that concrete is at all times plastic and to insure a practically continuous flow of concrete. Concrete not in place 1-1/2 hours after water has been added at batch plant may be rejected by Architect.

C. Place concrete continuously in layers not deeper than 24 inches. Concrete shall not be placed against concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints.

D. Place concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not use vibrators to transport concrete. Do not deposit concrete that has partially hardened or been retempered.

E. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface. Do not disturb slab surfaces prior to beginning finishing operations.

F. Do not place concrete during rain unless adequate protection has been provided.

G. Thoroughly compact concrete by suitable means during the placing, and work around the reinforcement and embedded items into the corners of the forms.
   1. Use vibrators to aid in the placement of the concrete, operated by experienced personnel and supplemented by hand-spading, rodding or tamping.
   2. Keep at least one spare operating vibrator on the job at all times during the concrete operations.
   3. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

H. Self-Consolidation concrete does not require vibration.

I. Set reinforcing dowels connecting new concrete construction to existing with epoxy anchoring adhesive as indicated on Structural Drawings.

3.3 CONSTRUCTION, CONTROL, EXPANSION, AND CONTRACTION JOINTS

A. Preformed Construction Joint for Slabs on Grade: Provide as required to facilitate construction in accordance with reviewed shop drawings. Secure with galvanized steel stakes, 1/8 inch thick by 1-1/8 inches wide with 1/2 inch deep rib and tapered point. Splice adjoining joints with 24 gage steel, galvanized splice plates.

B. For slabs-on-grade, no concrete pour shall be longer than 100 feet or more than

4,000 square feet in area, unless early entry saw-cutting techniques are utilized for placement of joints in the slab while the concrete is still in a green state and prior to the slab developing expansion/contraction cracking at random location. Provide shear keys as detailed.

C. Isolation Joints in Slabs on Grade: Construct isolation joints in interior slabs using 30 lb. felt. Provide isolation joints at points of contact between slabs on grade and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated. Construct isolation joints on exterior slabs abutting vertical surfaces with 1/2 inch thick expansion joint material.

D. Control Joints in Slabs-on-Grade: Place expansion and contraction joints where required to ensure that undesirable thermal and shrinkage cracking of slabs is minimized.

1. See Drawings for locations of expansion and contraction joints in slabs-on-grade and in topping pours.
2. If drawings do not indicate locations, verify with Architect prior to placement of slabs-on-grade and topping pours.
3. Preformed Strip: Insert premolded rigid plastic, or metal strip into fresh concrete. Cut groove for strip using 10-foot long straight edge cutting tool. Depths of strip shall be one fourth of slab thickness. Press strip into groove such that top of strip is level with the concrete surface. Pull off removable top section, if any, prior to troweling.
4. Saw Cut: Contractor may saw cut control joints instead of using preformed strips. Saw cut joints shall be 1/8 inch wide. Saw cut depth should equal 1/3 of slab depth. Cut joints after concrete has hardened sufficiently to prevent raveling; usually 4 to 12 hours after slab has been cast and finished. Use diamond or silicone-carbide blades.
5. Utilize early entry saw-cutting techniques using specialized equipment and procedures in accordance with the manufacturer of the saw-cutting equipment to saw-cut all joints in interior and exterior slabs within 2 hours of final finishing of the floor slabs while the concrete is still in its early green state.
    a. Acceptable Equipment: Soff-Cut International, Inc., Corona, CA 1-800- 776-3328 www.soffcut.com
6. At exterior slabs-on-grade provide a 1/2 inch wide expansion joint wherever slabs abut vertical construction elements whether indicated or not.

E. Additional reinforcing may be required at some construction, expansion/contraction and control joints, and shall be supplied and installed at no additional cost.

F. Reinforcing shall be continuous through construction joints of reinforced slabs, unless otherwise indicated on Drawings. Placement schedule shall be submitted for approval.

G. Construction Joints in Elevated Slabs and Beams: Construction joints in Elevated Slabs, Beams, Grade Beams, and other flexural members shall only be made as shown in the contract drawings or as approved by the Engineer of Record. Joints shall be constructed in accordance with ACI 318 Section 6.4 with provisions made for the transfer of shear and other forces. Reinforcement shall be

continuous through these joints unless noted otherwise.

H. Construction Joints in Walls, Foundations, and Slabs on Grade: Provide keyways at least 1-1/2 inches deep in vertical construction joints in walls and construction joints in slabs on grade and foundations. Discontinue every other horizontal bar through slab on grade construction joints unless noted otherwise.

I. Control Joints in Walls: Create weakened planes in cantilevered retaining walls at 25 feet on center. Use preformed strips, placed vertically, full height in each face of wall. Depth of strips shall be one inch.

J. Provide support of formed construction joint materials by means that does not puncture or otherwise damage under floor vapor retarder at interior floor slabs on grade.

3.4 WATERSTOPS

A. Waterstops: Install waterstops continuous in construction joints and joints between footings and walls and other locations as indicated at all below grade soil bearing concrete construction (recessed slab areas for access flooring, etc.), or where exposed to weather, moisture, or other construction joints that have the potential to allow water infiltration into the building, and other locations as indicated on Drawings.

1. PVC or Rubber Dumbbell Type Waterstops: Install without displacing reinforcement. Provide temporary supports as required to retain joint in proper position while concrete is being placed on both side of the joint. Heat seal joints watertight per Manufacturer's specifications.
2. Self-Expanding Waterstop Strips: Install according to Manufacturer's printed instructions. Bond or mechanically fasten as standard per Manufacturer and firmly press into place. Install in longest lengths practicable. Tightly butt adjacent lengths.

3.5 FINISHING VERTICAL (FORMED) SURFACES

A. Formed surface finishes:

1. Pits, tunnels, mechanical rooms and concealed surfaces: Remove fins, patch tie holes.
2. Interior and exterior exposed surfaces: Remove fins, patch tie holes, stone joint marks, out-of-plane surfaces and other projections to produce uniform, smooth, dense concrete having the following formed finish Class and permitted abrupt or gradual irregularities as designated by ACI 347-04:
   a. Vertical and horizontal exterior exposed surfaces: Class A Smooth Finish, 1/8 inch, except abrupt irregularities shall be removed.
   b. Other surfaces prominently exposed to public view: Class A Smooth Finish, 1/8 inch, except abrupt irregularities shall be removed.
   c. Concealed surfaces where covered by another finish: Class C, 1/2 inch, except abrupt irregularities shall be limited to 1/4 inch.

3.6 FINISHING HORIZONTAL SURFACES

A. At tops of foundation walls and grade beams finish with a texture matching adjacent formed surfaces unless otherwise indicated.

B. Flatwork: Rake concrete into place, screed and compact with a light tamp, except do not tamp topping and slabs not on grade. Screed with sawing motion and float surface to bring fines to the top.

C. Mix and apply evaporation retarder in accordance with manufacturer's printed instructions immediately after floating. In extreme drying conditions, apply additional material as needed. Apply lightly on hard to trowel floor areas.

D. When concrete has hardened sufficiently so that excess fines will not be brought to the surface, trowel slab with a steel trowel to a smooth surface free of pinholes and other imperfections. A mechanical trowel with rotating steel blades, approved by Architect, shall be used for this operation.

E. After the surface has hardened sufficiently to ring under a trowel, trowel again with a steel trowel to a hard, burnished surface free of blemishes.

F. Concrete slabs scheduled to receive ceramic tile or similar finishes shall have a screeded finish but true and even to plane with no sharp projections or ridges.

G. Use a small radius edger on edges of exposed Work. Use a deep cutting, scoring tool or sawcutting to provide scoring for control joints as indicated unless otherwise noted or directed.

H. Concrete Flatwork (Slab) Finishes:
   1. Interior concrete flatwork to receive smooth steel trowel finish, unless otherwise indicated on Drawings.
   2. Interior Decorative Concrete Finishes: As specified in Section 03 35 33.
   3. Exterior Flatwork: As follows, unless otherwise indicated on Drawings:
      a. Light to medium broom finish concrete.
      b. Integrally colored concrete with broom finishes as indicated on Drawings or as required to match existing.

I. Finish floors shall meet requirements of ACI 302.1R for a Flat (3/16 in 10'-0") Classification. Floors scheduled to receive thin-set tile applications shall meet Very Flat (1/8 inch in 10'-0") Classification.

3.7 SLABS

A. Saw cut or score contraction joint pattern indicated on Drawings. Use thick blade or scoring tool. Early entry saw shall be used immediately after final finishing and to a depth of 1-1/4 inches. A conventional saw or scoring tool shall cut 1/4 of the depth of slab thickness.

B. Slope to drains to drains as indicated on Drawings, but not less than 1/4 inch per foot nominal across entire room or area to be drained.

3.8 SPECIAL FINISHES

A. General:
1. Obtain cement and aggregates from a single source for specialty concrete finishes to provide uniformity in appearance and color.
2. Place concrete containing the high range water reducing admixture at a maximum slump. Flow or pump concrete into place, screed, strike-off and float. Do not tamp.

B. Integral Colored Concrete
1. Provide cement, aggregate, and pigment as required to produce consistent colors matching approved mock-up using the materials specified.
2. Plant-Mixed Concrete: Schedule delivery of concrete to provide consistent mix times from batching until discharge.
3. Concrete Paving: Schedule placement to minimize exposure to wind and hot sun before curing materials are applied. Avoid placing concrete if rain, snow or frost is forecast within 24 hours. Protect fresh concrete from moisture and freezing.
4. Floors and Paving
   a. Broomed Finish: Do not dampen brooms.
   b. Trowel Finish: Do not over-trowel or start troweling late.
5. Patching Concrete
   a. Fill holes and defects in concrete surface within 48 hours of form removal.
   b. Use the same patching materials and techniques that were approved on mock-up.
   c. Make patches with a stiff mortar made with materials from the same sources as the concrete. Adjust mortar mix proportions so dry patch matches dry adjacent concrete. Add white cement to mortar mix if necessary to lighten it.
6. Curing
   a. Maintain concrete between 65 and 85 F degrees during curing.
   b. Cure concrete using curing compound; apply curing compound in accordance with manufacturer's instructions.
7. Minor variations in appearance of colored concrete, which are similar to natural variations in color and appearance of unpigmented concrete, are acceptable.

C. Decorative Concrete Finishes: As specified in Section 03 35 33.

3.9 REPAIR OF SURFACE DEFECTS

A. Modify or replace concrete not conforming to required lines, detail and elevations. Grind high spots and fill low areas as required to provide finished floor tolerances as required for application of finish floor materials.

B. Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects. Do not patch, repair or replace exposed architectural concrete except upon express direction of Architect.

C. After forms are removed, fill tie rod holes, correct honeycomb spots, remove fins

and clean and finish damaged surfaces. Wipe off excess mortar and rub to match adjoining surfaces.

D. When excessive honeycombing is revealed, remove the defective material immediately after stripping forms to a depth of 3/4 inch to 1 inch. Cut edge of area perpendicular to surface to avoid feathered edges. Repair using the following method or submit method of repair and patching material to Architect and Structural Engineer for approval.

1. Saturate with water for several inches beyond cutout and brush-in a grout consisting of equal parts Portland cement and sand. Follow immediately with the patching mortar. Leave the patch slightly higher than the surrounding surface. After an hour or two, finish flush with the adjoining surface. Wipe and rub patch to match adjoining surfaces. Keep patches moist for 7 days.
2. Patching mortar shall consist of the same materials and proportions as the original concrete except that the coarse aggregate shall be omitted. When color match is required, adjust mixture to produce a finished color to match the adjoining concrete surfaces.

E. Cracks caused by expansion, shrinkage and the like that occur in natural color concrete up through final acceptance of building shall be carefully repaired by epoxy injection or other method approved by the Architect.

3.10 CURING

A. Protect freshly deposited concrete from premature drying and maintain without drying at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete.

B. Curing Methods: Cure concrete surfaces receiving finish materials, including, but not limited to; cementitious toppings, paint, and flooring, using one of the following two methods immediately after finishing operations. Consideration shall be given to the construction schedule impact and the compatibility of finish materials with the concrete when selecting a method.

1. Keep concrete continuously moist for at least 7 days using polyethylene film, liquid membrane forming curing compound, or other acceptable covering. Interior floor slabs on grade shall be continuously moist cured for a minimum of 7 days in accordance with ACI standards.
2. Liquid curing compounds shall not be acceptable unless it has been demonstrated that curing compound can satisfactorily serve as a base for finish materials or removed, resulting in a satisfactory base for adhesion of finish materials.
3. Where approved for use, apply liquid curing compound in accordance with the Manufacturer's printed instructions.
4. Refer to Structural Drawings for other acceptable curing procedures.

C. Prevent rapid drying of the concrete at the end of the curing period.

D. During the curing period, protect the concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibrations. Protect finished concrete surfaces from damage caused by construction

equipment, materials or methods.

3.11 UNDERLAYMENT OR REPAIR TOPPING

A. Apply underlayment or repair topping to correct unsatisfactory floor surface due to undue settlement or failure to meet tolerance requirements.

B. Slab surface preparation and placing procedures shall be approved by the underlayment and/or repair topping manufacturer and Architect prior to start of installation.

C. Installation: Install underlayment and/or repair topping materials in accordance with Manufacturer's published instructions and recommendations.

3.12 FLOOR SEALER

A. At areas indicated on Drawings, provide 2 coats of sealer.

B. Provide antimicrobial penetrating concrete sealer at all slab and side wall surfaces of recessed slab areas to receive access flooring.

C. Surface must be clean, dry and free of loose dirt, oil, wax, curing and parting compounds and other foreign matter.

D. Apply each coat in accordance with Manufacturer's printed instructions.

3.13 LIQUID SEALER DENSIFIER

A. Where indicated on Drawings, provide one coat of liquid sealer densifier.

B. Clean and prepare concrete floors to receive liquid sealer densifier in accordance with manufacturer's printed instructions.

C. Concrete slabs to receive liquid sealer densifier shall be properly cured in accordance with recommendations of the liquid sealer densifier manufacturer's recommendations.

D. Application shall be made in strict accordance with manufacturer's printed instructions and just prior to completion of construction.
   1. Spray, squeegee or roll-on liquid sealer densifier to clean, dry concrete surface.
   2. Scrub liquid into concrete surface with a mechanical scrubber.
   3. Keep surface wet with sealer densifier during the application process.
   4. When product thickens, but not more than 60 minutes after initial application, squeegee or vacuum surface to remove all excess liquid.

E. Apply each coat in strict accordance with Manufacturer's instructions.

3.14 FIELD QUALITY CONTROL

A. Tests: Inspection and testing of concrete mix will be performed by a testing laboratory in accordance with Section 01 45 00.

1. Provide free access to Work and cooperate with appointed firm.
2. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
3. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C 94.
4. Air Content: ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
5. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
6. Compression Test Specimen: ASTM C31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
7. Compressive-Strength Tests: ASTM C39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
8. Take one additional test cylinder during cold weather concreting, and cure on job site under same conditions as concrete it represents.
9. Slump: ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed. .
10. Concrete which does not meet the compressive strength requirement at 28 days will be rejected and removed from the Project, and disposed of in a legal manner.

B. Calcium chloride test requirements:
1. Two weeks before installation of the ceramic tile, VCT, vinyl, wood, carpet, epoxy flooring and/or other finish flooring systems over the interior concrete slabs, provide calcium chloride test to determine the level of water vapor transmission in the slab.
2. Conduct testing in accordance with ASTM F1869 or ASTM E1907 (quantitative anhydrous calcium chloride test).
3. Conduct calcium chloride tests after HVAC system has been in continuous use for 36 hours with a minimum ambient temperature of 72 degrees F. Water vapor transmission levels are directly affected by ambient room temperature and readings conducted without a sustained ambient temperature is NOT acceptable.
4. Document test results and provide copy to Architect with a marked up floor finish plan showing test results.
5. Provide a written clarification on status of HVAC system before and during the test and the length of time the ambient air temperature was maintained before the tests.

3.15 PROTECTION

A. Protect finished surfaces from stains or abrasions. Protect surfaces or edges by leaving forms in place or by providing temporary covers. Protect concrete from rain, flowing water or mechanical injury.

B. Protect floor slabs from the droppings of plaster, paint, dirt, and other marring by covering with polyethylene plastic sheet, or other acceptable floor protection covering, well lapped and sealed.

1. Where concrete slabs are scheduled to be the finished floor surface, or where slab is treated with a special concrete finish serving as the finished floor surface, provide a continuous covering of 1/2 inch particle board, joints tightly butted and cut to sizes tight to wall construction, over entire floor area over polyethylene plastic sheet, or other acceptable floor protection sheeting. Maintain covering (polyethylene and particleboard) in good condition until danger of damage is past.

3.16 CLEANING

A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises.

END OF
SECTION

SECTION 04 05 15

MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Mortar and masonry grout used in concrete unit masonry construction as shown on Drawings and as specified.

B. Related Sections:
1. Section 04 73 00 – Stone Veneer, for masonry veneer mortar used for setting stone veneer.

1.2 SUBMITTALS

A. Mix Designs:
1. Submit mix designs and samples to the Architect for review prior to delivering materials to the site or commencing the Work.
a. Mortar Mix Design: Furnish in accordance with ASTM C270.
b. Grout Mix Design: Furnished by either the grout supplier or an independent testing laboratory. Submit comprehensive strength data with mix design submittals when pozzolans are used.
2. Submit written colored mortar proportions for each color of mortar to be supplied for review by the Architect.

B. Samples: Submit mortar channels for color selection.

C. Product Data: If alternative mortar materials are to be provided, submit current instructions stating the actual quantities and mixing instructions for alternative mortar materials to conform to specified requirements.
1. Submit test report data substantiating compliance with specified performance requirements.
2. Submit current ICC Evaluation Report.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Cementitious materials shall be stored off the ground, under cover and shall be kept dry.

B. Preblended Mortar Mix Delivery System: The use of dry preblended mortar silos and bulk bags shall be acceptable. Bulk bags and silos shall be sealed to prohibit contamination of the ingredients and to keep the materials dry until mixed.

1.4 PROJECT/SITE CONDITIONS

A. Environmental Requirements:
1. Hot Weather Requirements: Wet mortar board before loading and cover mortar to retard drying when not being used.

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2. Cold Weather Requirements: In accordance with "Recommended Practices and Guide Specifications for Cold Weather Masonry Construction" by IMIAC; provide adequate equipment for heating the mortar and grout materials, when air temperature is below 40 degrees F.. Temperatures of the separate materials, including water, shall not exceed 140 degrees F. when placed in the mixer. When air temperature is below 32 degrees F., maintain mortar temperature on boards above freezing.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mortar:

1. Cement: Type II Portland cement conforming to ASTM C150. Provide Type V cement where CMU walls will be exposed to soil (if any).
2. Aggregate: Clean, sharp and well graded and free from injurious amounts of dust, lumps, shale, alkali, surface coatings and organic matter, conforming to ASTM C144, except that no less than 3 percent nor more than 10 percent shall pass a No. 100 sieve.
3. Hydrated Lime: ASTM C207, Type S or N.
4. Water: Clean and potable.
5. Admixtures:
   a. Chemical: The use of accelerator admixtures, water reducing plasticizers and other chemical admixtures shall not be allowed.
   b. Mineral: In accordance with Section 03 05 05.
   c. Alternative Plasticizer: Pozzolanic formulation consisting of a combination of hydroxy aluminum silicates and diatomite:
      1) Alternative Plasticizer Manufacturer: Engaged in producing materials with a satisfactory performance record for at least 5 years.
      2) Mortar mix design shall be in accordance with ICC Evaluation Report, in accordance with the mortar type specified elsewhere in this specification.
      3) Provide alternative plasticizer in accordance with manufacturer's printed instructions, including specific mixing instruction.
      4) No other admixtures shall be used in conjunction with the alternative plasticizer unless approved in writing by the alternative plasticizer manufacturer.
      5) Packing and Shipping: Mortar admixture(s) shall be delivered to the job site in manufacturer's original containers with seals unbroken and labeled with manufacturer's batch number.
6. Mortar Color:
   a. Color shall match color of masonry unit(s), as selected and approved by Architect.
   b. Provide lime proof, inorganic compounds which shall not exceed 15% by weight of the cement, unless otherwise directed by Manufacturer.
   c. Carbon black shall not exceed 3% by weight of the cement.
   d. Factory blend color for full color saturation of mortar joint and factory package for unitized jobsite mixing at a ratio of one unit of color per sack of cementitious material, (portland cement, lime, or masonry cement).

B. Grout:
1. Cement: Type II Portland cement conforming to ASTM C150.
2. Aggregate: ASTM C404 and as follows:
a. Sand: Size No. 1 for fine aggregate.
b. Pea Gravel: Size No. 8 for coarse aggregate.
3. Water: Clean and potable.

2.2 MIXES

A. Mortar: ASTM C 270, Type S or N.
1. Measurement: Accurately measure materials by ASTM C270 by the Property Method per Table 2.
2. Mix cementitious materials and aggregates 3 to 5 minutes in a mechanical mixer. Small amounts of mortar may be mixed by hand. Adjust consistency of the mortar depending on the absorptive quality of the units being laid, and to the satisfaction of the mason.
3. If mortar begins to stiffen, it may be retempered by adding water within a basin formed by the mortar, and remixing.
4. Use within 2-1/2 hours of initial mixing and no mortar shall be used after it has begun to set or after it has become harsh or non-plastic.
5. Mix color in a specific and exacting ratio in accordance with the Architect's reviewed submittals.
6. Water-Repellent Admixture: In accordance with Section 04 05 26.
7. Preblended Mortar Mix: Provide mortar as specified herein, except that dry ingredients may be preblended and bulk packaged for delivery to a jobsite silo (which loads into batch mixer) or bagged for hand loading into mixer. Moisture shall be extracted from sands. Digital printouts displaying the proportions of each batch shall be submitted to the Architect upon request. Mixing shall be accomplished by mechanical mixer in accordance with instructions provided by Preblended Mortar Mix Distributor.

B. Grout:
1. Job-Site Mixed: In accordance with ASTM C476.
2. Transit-Mixed:
a. Designed by the supplier or an independent testing laboratory with a minimum compressive strength of 2000 psi (140mPa) in 28 days, unless higher strength is required by the Structural Drawings and Notes.
b. Slump: As indicated on Structural Drawings.
c. Use within 1-1/2 hours of initial mixing and use no grout after it has begun to set or after it has become harsh or non-plastic.
d. Course grout may be used in cavity walls with a horizontal dimension of 2 inches or more, and in hollow cell construction 4 inches or more in both horizontal directions.

PART 3 EXECUTION

3.1 INSTALLATION

A. Colored Mortar: Consistency of appearance shall be maintained throughout the Project.

B. Temperature: Mortar and grout shall have a temperature between 50 degrees F. and 90 degrees F. while being used.

C. Grout may be poured by hand bucket, concrete hopper or through a grout pump. Grout spaces shall not be wet down prior to pouring grout.

3.2 FIELD QUALITY CONTROL

A. General: Tests and inspections as necessary to verify quality and strength of mortar and grout. Laboratory tests shall conform to applicable ASTM standards and tests.

B. Tests:
1. Frequency: As determined by the Architect based upon total time for construction of masonry with not less than two tests per each level of masonry construction, foundation to roof or floors.
2. Testing Laboratory: Inspection and testing of mortar and grout will be performed by a testing laboratory in accordance with Section 01 45 00. The testing laboratory, in addition to meeting requirements of ASTM E329, must be an approved laboratory competent to perform cement physical testing.
3. Distribution of Results of Tests: Within 24 hours of results of tests, copies of the results shall be submitted to the Architect, Contractor, masonry contractor, and the grout supplier if applicable.

C. Mortar:
1. Property Specification (ASTM C270): Testing in accordance with ASTM C 780.
2. For determining hardened mortar properties, prepare 3 test specimens for each test age and property. A strength test shall be the average of the strengths of the specimens tested at the age specified. Specimens shall be tested at 7 and 28 days.

D. Grout:
1. Testing per ASTM C1019.
2. Three test specimens shall constitute one sample. A strength test shall be the average of the strengths of the specimen tested at the age specified.
3. Specimens shall be tested at 7 and 28 days.
4. The compression strength will be considered satisfactory if the average of three consecutive tests of the grout is equal to or greater than the specified strength and no individual strength test falls below the specified strength by more than 500 psi.

3.3 CLEANING

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises.

END OF SECTION

SECTION 04 73 00

MANUFACTURED MASONRY VENEER

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Portland cement based manufactured [stone] [and] [brick] veneer and trim.

B. Related Sections:
1. **06 10 00-Rough Carpentry**
2. **07 60 00 and Sheet Metal.**
3. **07 92 00 Sealants.**
4. **09 24 00–Stucco**

1.02 REFERENCES

A. American National Standards Institute (ANSI):
1. ANSI A118.4 Specifications for Latex-Portland Cement Mortar.

B. American Society for Testing and Materials (ASTM):
1. ASTM C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
2. ASTM C 67 Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
3. ASTM C 144 Standard Specification for Aggregate for Masonry Mortar.
4. ASTM C 177 Standard Test Method for Steady-State Head Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
5. ASTM C 207 Standard Specification for Hydrated Lime for Masonry Purposes.
6. ASTM C 270 Standard Specification for Mortar for Unit Masonry.
7. ASTM C 482 Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.
8. ASTM C 567 Standard Test Method for Determining Density of Structural Lightweight Concrete.
9. ASTM C 847 Standard Specification for Metal Lath.
10. ASTM C 932 – Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering.
11. ASTM C 979 Standard Specification for Pigments for Integrally Colored Concrete.
12. ASTM C 1032 Standard Specification for Woven Wire Plaster Base.
13. ASTM C 1059 – Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.
14. ASTM D 226 Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
15. ASTM C1063 –Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster
16. ASTM C1329 Standard specification for Portland cement
17. ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

18. ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
19. ASTM E2556/E2556M – Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for MechanicalAttachment

C. Other Standards:
1. UBC Standard No. 14-1, Kraft Waterproof Building Paper
2. ICC AC38 Acceptance Criteria for Water Resistive Barriers
3. UU-B-790 Building Paper, Vegetable Based, Kraft , waterproofed, water repellent and fireproof

D. International Code Council (ICC):
1. ESR Report.

E. Underwriter's Laboratory (UL): Building Materials Directory.

F. US Department of Housing and Urban Development (HUD): Material Release Numbers 910Fs.

1.03 SUBMITTALS

A. Reference Section 01 33 00 Procedures; submit following items:
1. Product Data.
2. Samples:
a. Standard sample board consisting of small-scale pieces of veneer units showing full range of textures and colors.
b. Full range of mortar colors.
3. Verification Samples: Following initial sample selection submit "laid-up" sample board using the selected stone and mortar materials and showing the full range of colors expected in the finished Work; minimum sample size: 3 by 3 feet (1 by 1 m).
4. Quality Assurance/Control Submittals:
a. Qualifications:
1) Proof of manufacturer qualifications.
2) Proof of installer qualifications.
b. Regulatory Requirements: Evaluation reports.
c. Veneer manufacturer's installation instructions.
d. Installation instructions for other materials.

B. Closeout Submittals: Reference Section 01 78 00 Submittals; submit following items:
1. Maintenance Instructions.
2. Special Warranties.

1.04 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer Qualifications: Eldorado Stone,LLC.
2. Installer Qualifications: Experienced mason familiar with installation procedures and related local, state and federal codes masonry.

B. Certifications:
1. ICC Evaluation Service Evaluation Report ESR-1215.

2. **ICC ESR-1215, Florida Building Code Supplement**
3. **ASTM C1670**
4. **LARR – Research Report RR25589**
5. **HUD Material Release Number 910F**
6. **UL Classification listing in Building Materials Directory: UL 546T (F8002).**

C. Field Sample:

COMPLETE FOLLOWING SUBPARAGRAPH TO INCLUDE DESIRED DETAILS SUCH AS CORNERS, TRIM, MORTAR JOINTS AND JOINT DETAILS ABUTTING OTHER MATERIALS.

1. Prepare 4 by 4 foot sample at a location on the structure as selected by the Architect. Use approved selection sample materials and colors.
2. Obtain Architect's approval.
3. Protect and retain sample as a basis for approval of completed manufactured stone work. Approved sample may be incorporated into completed work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Reference Section 01 66 00 Storage and Handling Requirements.

B. Follow manufacturer's instructions.

1.06 PROJECT/SITE CONDITIONS

A. Environmental Requirements: When air temperature is 40 degrees F (4.5 degrees C) or below, consult local building code for Cold-Weather Constructionrequirements.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard warranty coverage against defects in materials when installed in accordance with manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Eldorado Stone, LLC

San Marcos,CA 92069

Tel: (800) 925-1491
1370 Grand Ave., Bldg. B
Fax: (760) 736-3840
E-Mail:
customerservice@westlake.net
Website:
www.eldoradostone.com

B. Product: Stone Veneer

C. Substitutions: None Allowed.

2.02 MATERIALS

A. Stone Veneer:

1. Profile: River Rock. Include matching corner pieces.
   a. Color: Colorado

SELECT DESIRED STONE ACCENTS FROM THE ELDORADO STONE WEBSITE PRODUCTS DROP DOWN MENU; CLICK ON "STONE ACCENTS." INSERT DESIRED ACCENTS BELOW AND INSERT TEXTURE IF REQUIRED. VERIFY THAT DIMENSIONS, IF REQUIRED, ARE SHOWN ON THE DRAWINGS.

2. Stone Accents:_____.

   a. Color:
   b. Texture:_____.

B. Veneer Unit properties: Precast veneer units consisting of portland cement, lightweight aggregates, and mineral oxide pigments.

1. Compressive Strength: ASTM C 192 and ASTM C 39, 5 sample average: greater than 1,800 psi (12.4MPa).
2. Shear Bond: ASTM C 482: 50 psi (345kPa), minimum.
3. Freeze-Thaw Test: ASTM C 67: Less than 3 percent weight loss and no disintegration.
4. Thermal Resistance: ASTM C 177: 0.473 at 1.387 inches thick
5. Weight per square foot: 2012 IBC and 2012 IRC, ASTM C1670, 15 pounds, saturated.

C. Weather Barrier: ASTM D 226, Type 1, No. 15, non-perforated asphalt-saturated felt paper]

D. Reinforcing: [ASTM C 847, 2.5lb/yd^2 (1.4kg/m^2) galvanized expanded metal lath] complying with code agency requirements for the type of substrate over which stone veneer is installed.

E. Mortar:

1. Cement: Portland cement complying with ASTM C 1329.
2. Lime: ASTM C 207.
3. Sand: ASTM C 144, natural or manufactured sand.
4. **Color Pigment: ASTM C 979, mineral oxide pigments.**
5. Water: Potable.
6. Pre-Packaged Latex-Portland Cement Mortar: ANSI A118.4.

F. Bonding Agent: Exterior integral bonding agent meeting [ASTM C 932] [ASTM C 1059 Type II]

G. Water Repellent: Water based silane or siloxane masonry water repellent

2.03 MORTAR MIXES

A. Standard Installation (Grouted Joints):

1. Mix mortar in accordance with ASTM C 270,
2. Polymer modified mortar complying with ANSI A118.4
   a. **Add color pigment in grout joint mortar in accordance with pigment manufacturer's instructions not to exceed 10% by weight of cement.**

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates upon which work will be installed.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

C. Commencement of work by installer is acceptance of substrate.

3.02 PREPARATION

A. Protection: Protect adjacent work from contact with mortar.

B. Surface Preparation: Prepare substrate in accordance with manufacturer's installation instructions for the type of substrate being covered.

3.03 INSTALLATION

A. Install and clean stone in accordance with manufacturer's installation instructions for Standard Installation (Grouted Joint) or Jointless/Dry-Stacked installation as specified above.

B. Apply repellent in accordance with repellent manufacturer's application instructions.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Manufacturer's Field Service Representative shall make one periodic site visits review of on-going installation process but is not responsible for any errors or omissions that are not observed or are previously completed.

3.05 CLEANING

A. Reference Section 01 74 00 and Waste Management.

B. Remove protective coverings from adjacent work.

C. Cleaning Veneer Units:
1. Wash with soft bristle brush and water/granulated detergent solution
2. Rinse immediately with clean water

D. Removing Effloresence:
1. Allow veneer to dry thoroughly
2. Scrub with soft bristle brush and clean water
3. Rinse immediately with clean water; allow to dry
4. If efflorescence is still visible, contact ES Customer Service for assistance

END OF SECTION[1]

1 This specification was prepared specifically for Eldorado Stone Corporation by ASC Specification Consultants. Comments or suggestions for improvement should be addressed to Eldorado Stone via the contact information on page one.

Revised: APRIL 12, 2022

SECTION 06 10 00 ROUGH

CARPENTRY

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Formwork - Section 03 10 00.

B. Gypsum Drywall Systems - Section 09 29 00.

D. Painting - Section 09 91 00.

1.02 QUALITY ASSURANCE

A. Lumber Grading Rules and Wood Species to be in conformance with PS 20.

B. Grading rules of following associations apply to materials furnished under this section:

1. West Coast Lumber Inspection Bureau (WCLIB).

2. Western Wood Products Association (WWPA).

C. Plywood Grading Rules:

1. Softwood Plywood - Construction and Industrial PS 1.

D. Grade Marks:

1. Identify lumber and plywood by official grade mark.

a. Grade stamp to contain symbol of grading agency certified by Board of Review. American Lumber Standards Committee, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which graded where applicable,

b. S-Dry: Maximum 19% moisture content.

2. Softwood Plywood: Conforming to PS 1.

E. Reference Standards:

1. Federal Specifications (FS):

a. FF-B-561C, Bolts (SCREW), Lag.

b. FF-B-575C, Bolts, Hexagon and Square.

c. FF-B584E, Bolts, Finned Neck; Key Head; Machine; Ribbed Neck; Square Neck, Tee Head.

d. FF-N-105B (3), Nails, Wire, Brads, and staples.

e. FF-N-836D (1), Nut, Square, Hexagon, Cap, slotted, Castellated, Clinch Knurled, and Welding.

2. Product Standards (PS) (Latest editions):

a. PS 1, Construction and Industrial Plywood.

b. PS 20, American Softwood Lumber Standard.

c. PS 56, Structural Glued Laminated Timber.

3. Western Wood Products Association (WWPA).

a. Standard Grading Rules for Western Lumber.

1.03 DELIVERY, STORAGE AND HANDLING

A. Immediately upon delivery to job site, place materials in area protected from weather.

B. Store materials a minimum of 6 inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate side ventilation.

C. Do not store materials in wet or damp portions of the project.

D. Protect sheet materials from corners breaking and damaging surfaces while unloading.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber

1. Dimensions:

a. Specified lumber dimensions are nominal.

b. Actual dimensions to conform to PS 20.

2. Surfacing: Surface four sides (S4S), unless specified otherwise.

3. Framing lumber, Douglas Fir - Larch unless specified otherwise:

a. Light framing:

(1) General framing: Standard grade.

(2) Plates, blocking, bracing and nailers: Utility grade.

(3) Bracing, blocking, bulkheading and general utility purposes: Stud grade.

b. Studs:

(1) Load bearing: Construction grade.

(2) Non-load bearing: Stud grade.

c. Structural light framing, No. 2.

d. Structural joists and planks No. 2.

B. Plywood:

1. Roof sheathing:

a. Grade: CDX.

b. Identification Index: 32/l6.

2. Wall sheathing:

a. Grade: CDX.

b. Identification Index: 24/0.

C. Rough Hardware:

1. Bolts

a. FS FF-B-575

b. FS FF-B-584.

2. Nuts: FS FF-N-836.

3. Lag screws and bolts: FS FF-B-561.

4. Nails and staples: FS FF-N-105.

5. Joist hangers: Minimum 18 gauge painted steel.

6. Metal Cross-bridging: 16 gauge painted or zinc-coated steel:

a. Nailable type with two holes in each end.

b. Compression type with prongs at each end.

7. Bar or strap anchors: ASTM A525 zinc coated steel, 12 gauge minimum.

8. Ply-clips: Extruded 6063-T6 aluminum alloy.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that surfaces to receive rough carpentry materials are prepared to required grades and dimensions.

3.02 INSTALLATION

A. Comply with Conventional Light-Frame Construction Design Provisions, International Building Code, Section 2320.

3.03 PROTECTION

A. Protect sheathing with waterproof covering until roofing has been installed.

End of
Section

SECTION 06 17 53

SHOP FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.01 SCOPE

A. Provide all labor, materials, equipment and supervision for the complete installation of all open web wood chord and steel web joists as shown on the Contract Drawings and as specified herein.

1.02 GENERAL REQUIREMENTS

A. The truss joists shall be custom designed to fit the dimensions and loads indicated on the plans. All designs shall be in accordance with allowable values assigned by the building code approval.

B. Complete design calculation showing internal layout, member forces and stress control points shall be furnished for each truss joist design. The design is to be under the supervision of and stamped by a Registered Professional Engineer.

C. Drawings shall be furnished by the manufacturer showing placement in the building as well as the loads the joists are designed to support. These drawings shall be furnished for approval prior to fabrication. One copy of these shall be given to the building panel fabricator prior to fabrication of building panels. See section 13600, item B.l.d. Also refer to section 01200.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The trusses shall be factory manufactured with tubular steel webs, true pin connections and structural wood chords such as manufactured by Truss Joist Corporation.

B. Structural wood chord members shall be of machine stress rated lumber of approved grade and kiln dried to a maximum moisture content of 19%. All end joints shall be finger joints conforming to details approved by the Uniform Building Code.

C. Steel web members shall be accurately die stamped from electrically welded, cold rolled galvanized steel tubing having a minimum yield strength of 45,000 psi.

D. Connecting pins and bearing details shall be of material and size as required by design.

E. The truss joists shall be manufactured in a plant approved for fabrication by the building code and the Contracting Officer.

PART 3 - EXECUTION

3.01 ERECTION AND INSTALLATION

A. The truss joists shall be stored in a vertical position and protected from weather. They shall be handled with care so as to prevent damage.

B. The truss joists shall be erected and installed in accordance with the Contract Drawings, and approved truss joist drawings and installation suggestions. Temporary construction loads, which cause member stresses beyond design limits, are not permitted. Put a nail in all holes provided in clips, anchors, fasteners, etc.

C. Erection bracing in addition to specified bridging is to be provided to keep the truss joists straight and plumb as required to assure adequate lateral support for the individual truss joist and entire system until the sheathing material has been applied.

D. Accessory items such as web stiffeners, pre-notched plates, blocking, bridging, cross bracing, shear panels, etc., shall be installed accurately per instruction as erection proceeds.

E. Contractor shall not permit cutting or drilling of the wooden chords or flanges. Do not remove steel pins or webs even temporarily from open web truss joists. Do not drive nails larger in diameter than 16d into a chord or flange member. Do not make field repairs to damaged truss joists without approval from the supplier.

F. The nailing pattern for attachment of plywood sub-flooring material shall be staggered to assure nailing to each member chord (TJM & TJH Series). Nail size and spacing shall be:

1. 3/4" plywood, 48/24 -use 10d deformed shank, 6" o.c. edges; 10" o.c., intermediates.

2. 1-1/8" plywood, 2-4-1, use 10d deformed shank, 6" o.c., edges; 10" o.c., intermediates.

G. Use nailing details above unless otherwise specified on the Contract Drawings.

END OF SECTION

SECTION 06 19 00

WOOD TRUSSES

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Submittal Procedure – Section 01 33 00.

B. Rough Carpentry – Section 06 10 00.

1.02 SUBMITTALS

A. Truss designs and shop drawings shall be submitted to the Architect for approval prior to the fabrication of any components. Trusses shall be accompanied by an independent quality control agency certificate.

1.03 DESCRIPTION OF WORK

A. Furnish all materials, equipment and labor necessary for the prefabrication, delivery and permanent setting of the wood trusses in the building. Also include all the miscellaneous parts, including bridging, temporary and permanent bracing, and all related items of hardware, metal hangers, anchors and special metal shapes necessary for the proper prefabrication erection, assembly, supporting and anchoring of the wood trusses.

B. Alternate truss systems will be considered if design and submittals are executed in accordance with the following requirements.

1.04 QUALITY ASSURANCE

A. Trusses shall be designed for the loading indicated on the structural Contract Drawings. The full intensity of the appropriately reduced live load applied only to a portion of the length of the truss shall be considered if it produces a more unfavorable effect than the same intensity applied over the full length of the truss. Trusses shall be designed and fabricated by an Architect approved plant.

B. Truss designs shall bear the name and seal of a Professional Engineer licensed in the State of Arizona.

C. Truss designs shall include the following information:

1. Pitch, span, dimensions and spacing of trusses.

2. Truss bearing sizes and locations.

3. Design loading of truss members and allowable stress increase.

4. Axial forces in each truss member.

5. Nominal sizes and location of connector placed at all joints.

6. Size, species and stress of grade of lumber for all truss members.

7. Camber.

8. Permanent lateral bracing as required by design to reduce buckling length of individual truss members only.

9. Handling and erection recommendations.

D. Reference Specifications: The design and fabrication criteria of all wood trusses shall meet with the following, the same as if those specifications and all their references were set out in full herein.

1. "National Design Specifications for Stress-Grade Lumber and Its Fastenings" by the National Forest Products Association (NFPA) (latest revision).

2. "Timber Construction Standards" by the American Institute of Timber Construction (AITC) (latest revision).

3. "Design Specifications for Light Metal Plate Connected Wood Trusses" by the Truss Plate Institute (latest revision).

PART 2 - PRODUCTS:

2.01 LUMBER

A. All lumber used for truss members shall conform to the published stress ratings for the species and grades as set out in the official grading rules of the appropriate lumber association, or as listed in the reference specifications. Wherever this Specification or notes on the Contract Drawings or truss engineering design calls for lumber which exceeds the minimum set forth therein, the Specifications, Contract Drawings and/or truss engineering designs shall be applicable, and information stated or shown in one be applicable the same as if in all of them.

B. At the time of fabrication, the moisture content of all lumber shall be within the proper limits, as stated in the reference specifications. All lumber shall conform to the species and fully recognized nominal sizes shown on the Contract Drawings or truss engineering designs. All members shall be cut from lumber which bears the proper grade-mark stamps of a recognized grading association or licensed lumber inspection agency. No lumber shall be used which does not appear to conform to the proper dimensions and/or grades.

2.02 CONNECTORS

A. Where steel connector plates are used, truss connector plates shall be manufactured from ASTM A-466-72, Grade A, prime commercial quality galvanized sheet steel of no less than 20 gauge thickness, which has a minimum yield of 33,000 psi and a minimum ultimate tensile strength of 45,000 psi.

B. The corrosion-resistant coating shall be ASTM-A525, "Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements", Coating Designation G90 or G60, or ASTM A-591, "Standard Specification for Electrolytic Zinc-Coated Steel Sheets", Coating Class C, or such treatment as will give equivalent corrosion protection.

C. This protective coating may be applied to the sheet steel before the connector plates are stamped out; it is not necessary to re-coat the connectors after the stamping operation. The connectors shall have a series of nail-like projections, which are designed to separate the fibers of the wood into which they are pressed in accordance with accepted nailing practices.

D. Where field assembly of truss sub-components is necessary, the connections shall be in accordance with the details shown on the truss design drawings, approved by the Architect.

PART 3 - EXECUTION

3.01 FABRICATION

A. All trusses and other roof structural components shall be fabricated in a properly equipped manufacturing facility of a permanent nature. They shall be manufactured by experienced workmen using precision cutting and truss fabricating equipment, under the direct supervision of a qualified foreman. All trusses shall be fabricated under strict rules of inspection and quality control as required by the Uniform Building Code and open to the inspection of the architect or his representative at all times.

B. All truss members shall be accurately cut to length, angle and be true to line to assure tight joints for finished trusses.

C. All truss members and connector plates shall be properly placed in special jigs and the members tightly clamped in place, remaining in that position until the connector plates have been pressed into the lumber simultaneously on both sides of the joints.

3.02 INSTALLATION

A. Fabricated trusses and sub-components shall be so handled and stored that they are not subject to damage. If the trusses are to be stockpiled prior to erection, sufficient bearing points and/or bracing shall be provided to prevent excessive lateral bending or tipping over.

B. Framing anchors and/or truss hangers shall be provided by the Contractor in accordance with the Contract Drawings.

C. Field erection of the trusses, including items such as proper handling, safety precautions, temporary bracing to prevent toppling or dominoing of the trusses during erection, and any other safeguards or procedures consistent with good workmanship and good building erection practices, shall be the responsibility of the Contractor.

D. During the entire construction period, all trades shall provide means for adequate

distribution of concentrated loads so that the carrying capacity of any one truss and/or component is not exceeded.

E. Proper erection bracing shall be installed to hold the trusses true and plumb in safe condition until permanent truss bracing and bridging can be solidly nailed in place to form a structurally sound roof framing system. All erection bracing and components shall be permanently fastened before the application of any loads.

F. To ensure the overall rigidity of the roof system the permanent structural cross-bracing shall be in accordance with the Shop Drawings.

G. 19% moisture content during storage, during installation, and after erection.

End of Section

SECTION 07 10 00

BUILDING PAPER

PART 1 - GENERAL

1.01 SUMMARY

A. This section contains the building paper system, including sealing joints and protrusions through the building paper, with accessories as required for complete installation.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's literature for each type of building paper.

B. Samples: Submit samples of each type of building paper. Submit quality assurance/control submittals either as test reports or manufacturer's certificates indicating materials complying with the specified requirements.

1.03 WARRANTY

A. The building paper manufacturer shall warrant the material meeting the specification herein and that it is tested to ensure conformance to the physical properties listed.

B. The manufacturer is not responsible for damage caused by improper use or handling during and after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. The building paper shall be as manufactured by Fortifiber Corporation, 419 W Plumb Lane, Reno, NV, 89509, (800)-773-4777 or approved equal.

2.02 MATERIALS

A. Vapor permeable weather-resistant barrier made of single ply asphalt saturated kraft, Grade D, breather type sheathing paper.

1. Type: Jumbo Tex® (Standard).

2. Reference Standard: Federal Specification UU-B-790a, Type 1, Grade D, Style 2.

3. Moisture Vapor Transmission: 35 grams minimum (ASTM F 1249).

4. Water Resistance: 20 minutes (standard) (ASTM D 779).

5. Tensile Strength: MD – 70 lb./in, CD – 29 lb./in (ASTM D 828).

B. Accessories: Provide products recommended by the building paper manufacturer for complete installation.

C. Adhesives: Types as recommended by the building paper manufacturer for specific materials and application indicated.

D. Joint Sealers: Pressure sensitive tape or mastic as recommended by the building paper manufacturer for specific material and application indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure items which pass through the building paper are properly and rigidly installed, substrate is free of projections and irregularities which may be detrimental to the proper installation of building paper.

3.02 INSTALLATION

A. Apply the building paper in accordance with the manufacturer's recommendations, laid smoothly without folds or bunches of material.

1. Seam Overlap: As recommended by the building paper manufacturer for specific building paper material and application indicated.

2. Sealing: Seal edges and items projecting through vapor retarders and vapor barriers.

B. Inspect and repair the building paper prior to application of finish material over building paper; tape tears, perforations and similar damage.

END OF
SECTION

SECTION 07 21 00

BUILDING INSULATION

PART 01: GENERAL

1.1 SUMMARY

A. Section includes the following:
1. Batt/Blanket thermal building insulation for exterior walls, soffits and other locations as indicated.
2. Rigid mineral wool board insulation for application at underside of parking garage slabs at occupied spaces above finish ceilings.
3. Fire-saving insulation.
4. Rigid polyisocyanurate board insulation for inside face of foundation walls at access floor locations.

1.2 SUBMITTALS

A. Product Data: Submit Manufacturer's data, installation instructions, limitations and recommendations. Include certification and test data substantiating R-Values and combustibility of each type of insulation.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to applicable code for fire resistance ratings and surface burning characteristics.

B. Provide certificate of compliance acceptable to authorities having jurisdiction indicating conformance to fire-resistance requirements.

C. Fire saving insulation and assemblies for closure of various voids with fire saving insulation shall comply with 2012 IBC Chapter 7 requirements.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage: Deliver materials to job in Manufacturer's original unopened packaging. Adequately protect against damage while stored at the site. Deliver so that stocks of materials on the site will permit uninterrupted progress of the Work.

B. Materials shall be properly identified on each package with the Manufacturer's name and R value.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Furnish products of one of the following Manufacturers, except as approved otherwise by the Architect, subject to compliance with Specification requirements:
1. Batt and Semi-Rigid Board Insulation:
a. Johns-Manville www.jm.com
b. Owens-Corning Fiberglas Corp. www.owenscorning.com
c. Certainteed www.certainteed.com
d. Knauf Insulation www.knaufinsulation.com
2. Fire Safing Insulation:
a. Thermafiber, Inc. www.thermafiber.com
b. Roxul Inc. www.roxul.com
3. Rigid Board Insulation Sheathing and Accessories:
a. The Dow Chemical Co. http://building.dow.com/en-us

B. Materials designated for a specific application shall be the products of one Manufacturer.

2.2 MATERIALS

A. Batt Insulation: ASTM C665, FS25, Type III (reflective membrane faced), Class A, Category 1 (membrane is a vapor barrier) faced glass fiber batts.
   1. Facing: Foil-scrim-craft, or foil-scrim-polyethylene vapor-retarder membrane on one face.
   2. Surface-Burning Characteristics: Class A - maximum flame-spread and smoke- developed indices of 25 and 50, respectively.
   3. Thickness: Provide minimum thickness as indicated on Drawings for various locations, or minimum thickness to provide the resistance values indicated on Drawings, for various locations.
   4. Batts shall be a single thickness to meet the required R value, multiple layers of batts will not be accepted.

B. Rigid Mineral Wool Board Insulation: Glass Mineral Wool thermal insulation complying with ASTM C612, Type 1A or 1B; insulation exclusive of facing non-combustible when tested in accordance with ASTM E136.
   1. R-value: R-4.3 per inch when tested in accordance with ASTM C518.
   2. Size: Maximum sizes available, to avoid jointing to greatest extent possible.
   3. Density: 2.25 lb./cu. ft. minimum.
   4. Facing: Foil-scrim-kraft (FSK) vapor retarder faced.
      a. Surface Burning Characteristics: Maximum flame spread of 25, maximum smoke developed of 50, when tested in accordance with ASTM E84.
   5. Free of Formaldehyde: Insulation is manufactured with bio-based binder and no formaldehyde.

C. Fire Safing Insulation: ASTM C24, E119 and E136, with 4 pcf density. Thickness shall be as required by the Manufacturer to provide a fire rating equal to that of the assembly of which it is a part. Where smoke stop protection also is required, install firestopping sealant complying with Section 07 84 00 as needed to meet UL Standard 1479 and ASTM E814 procedure.

D. Rigid Polyisocyanurate Board Insulation Sheathing: Non-structural, rigid board insulation consisting of a glass-fiber-infused polyisocyanurate foam core laminated between 1.0 mil smooth, reflective aluminum facers on both sides, complying with the following:
   1. ASTM C1289 Type 1, Class 2.
   2. Compressive Strength (ASTM D1621): 25 psi, minimum.
   3. Thermal Resistance (ASTM C518): R-6.5 per 1 inch of thickness.
   4. Flexural Strength (ASTM C203): Minimum 40 psi.
   5. Water Absorption (ASTM C209): Maximum.1.0 percent by volume.
   6. Water Vapor Permeance (ASTM E96): 0.3 perms maximum.
   7. Maximum Use Temperature: 250 degrees F.
   8. Edges: Shiplap.
   9. Acceptable Product:
      a. The Dow Chemical Company “THERMAX™ Sheathing.”

E. Acoustical Batt Insulation: Sound attenuation batt insulation as specified in Section 09 81 00.

F. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

G. Spindle Anchors, Washers and Shields: Provide copper coated low carbon steel spindles, angled type where required for attachment of curtain wall insulation, with steel insulation

retainer plates, washers and shields that are listed and labeled for use, and approved by curtain wall insulation Manufacturer for use in curtain wall fire containment assembly. Protect ends of spindles with capped self-locking washers where exposed to contact.

1. Acceptable Products:
   a. Stic-Klip Mfg. Co., Type A or B as necessary, with Type S adhesive
   b. Miracle Adhesive Corp. "Miracle StukUps" with Type HT994 adhesive.
   c. Goodloe E. Moore Gemco Gemco or Tuff-Weld with G-P Improved or Tuff-Bond Quik-Set Type Adhesive as applicable.

H. Safing Clips: Galvanized steel safing clips approved by Manufacturer of safing insulation for holding safing insulation in place.

I. Vapor Retarder Tape: As recommended by the manufacturer of the faced insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine sub surfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of sub surfaces.

B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.2 INSTALLATION

A. Batt and Mineral Wood Board Insulation:
1. Apply no insulation until such time as the Construction has progressed to the point that inclement weather will not damage or wet the insulation material.
2. Fully insulate small areas between closely spaced framing members, pipes, conduits or other obstruction by cutting and fitting insulation material as required to maintain the integrity of the insulation.
3. Installation of insulation of scheduled thickness/R-value is required at all exterior walls, soffits, projections, etc., whether indicated on Drawings or not.
4. Batt insulation at metal studs and other non-nailable members/substrates shall be installed continuously tight against framing members.
   a. Secure in place with string wire or other method as approved by Architect.
5. Place insulation tight to exterior wall or roof substrate without voids.
6. Insulation at ceilings open to roof structure to be installed with vinyl facing to cover insulation.
7. End match neatly with ends fitting snugly.
8. Continuously tape all joints of vapor barrier with manufacturer's recommended sealing tape. Seal insulation to surrounding construction and all penetrations to ensure an airtight seal. Extend vapor barrier continuous past electrical boxes.

B. Fire Safing Insulation: Install in proper sizes on safing clips as needed but not to exceed 24 inches O.C. Leave no voids between walls and edges of slabs.
1. Install safing clips where required to support insulation as required by Code.
2. Cut safing insulation 1/2-inch wider than gap to be filled to ensure compression fit. Seal joint between insulation and edge of slab and curtain wall insulation and between lengths of insulation with calking approved by safing insulation Manufacturer for this purpose. Leave no voids in completed installation.

3.3 CLEANING

A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

B. Protection: Take precautions to protect insulation, both during and after installation, from damage of any kind until covered.

END OF SECTION

SECTION 07 24 00

EXTERIOR

INSULATION

1.01 SUMMARY

A. Section Includes: Code compliant EIFS with moisture drainage incorporating continuous insulation and air/water-resistive barrier applied to sheathing substrate over wood framing.

1.02 DEFINITIONS

A. Base Coat: Material used to encapsulate one or more layers of reinforcing mesh fully embedded that is applied to the outside surface of the insulation board.

B. Building Expansion Joint: A joint through the entire building structure designed to accommodate structural movement.

C. EIFS: Exterior Insulation and Finish System(s)

D. Expansion Joint: A structural discontinuity in the EIFS.

E. Finish: An acrylic-based coating, available in a variety of textures and colors that is applied over the base coat.

F. Insulation Board: Expanded polystyrene (EPS) insulation board, which is affixed to the substrate and creates a layer of continuous insulation.

G. Reinforcing Mesh: Glass fiber mesh(es) used to reinforce the base coat and to provide impact resistance.

H. Sheathing: A substrate in sheet form.

I. Substrate: The material to which the EIFS is affixed.

J. Substrate System: The total wall assembly including the attached substrate to which the Outsulation Plus MD System is affixed.

1.03 SYSTEM DESCRIPTION

A. General: The Exterior Insulation and Finish System (EIFS) shall be Class PB, consisting of an air/water-resistive barrier, an adhesive, expanded polystyrene insulation board, base coat, reinforcing mesh(es) and finish.

B. Design Requirements:
1. At all locations the insulation board shall be completely encapsulated by the reinforcing mesh and adhesive or substrate.
2. Separate insulation board from interior of building by minimum 5/8-inch gypsum sheathing or equivalent thermal barrier material which will limit the average temperature rise of the unexposed surface to not more than 250 degrees F. after 15 minutes of fire exposure when subjected to the ASTM E119 and NFPA 285 time-temperature curve. Install thermal barrier in a manner assuring its remaining in place for a minimum fire exposure of 15 minutes.

3. Insulation Board: Use and maximum thickness shall be in accordance with applicable building code requirements. Length and slope of inclined surfaces shall follow guidelines listed below:
    a. Minimum slope: 6 inches of rise in 12 inches of horizontal projection.
    b. Maximum length of slope: 2.3 times the thickness of the insulation. Length shall not exceed 12 inches.
    c. Inclined surfaces shall not be used for areas as defined as roofs by building codes.
4. Substrate Systems:
    a. Engineered to withstand applicable loads including live, dead, positive and suction wind, seismic, etc.
    b. Bond strength, fastener strength and connection strength shall be analyzed and engineered.
    c. Maximum deflection under positive or suction full design loads of substrate system shall not exceed 1/240th of span.
    d. The substrate shall be flat within 1/4 inch in a 4’-0” radius.
    e. Sheathing substrates shall be oriented with their strong axis perpendicular to the supporting framing.
5. All areas requiring an impact resistance classification higher than "standard", as defined by ASTM E 2486 (formerly EIMA Standard 101.86), shall be as detailed in the drawings and described in the contract documents.
6. Expansion Joints: Install continuous expansion joints at the following locations:
    a. Where expansion joints occur in the substrate.
    b. Where building expansion joints occur.
    c. At floor lines in wood frame construction.
    d. At floor lines in non-wood-farmed buildings where significant movement is expsed.
    e. Where the EIFS abuts other materials.
    f. Where the substrate changes.
    g. Where significant structural movement occurs, such as at:
        1) Changes in roof lines.
        2) Long continuous elevations.
        3) Changes in building shape and structural systems.
    h. In continuous elevations at intervals not exceeding 75’-0”.
    i. Expansion and contraction of the field applied EIFS and adjacent materials shall be taken into account in the design of expansion joints, with proper consideration given to sealant properties, installation conditions, temperature range, coefficient of expansion of materials, joint width-to-depth ratios, etc.
7. Terminations:
    a. Prior to applying the EIFS, wall openings shall be treated with manufacturer’s flashing system or flashing tape per manufacturer’s installation details.
    b. EIFS shall be held back from adjoining materials around openings and penetrations such as windows, doors, and mechanical equipment a minimum of 3/4 inch for sealant application per manufacturer’s installation details.
    c. The system shall be terminated a minimum of 8 inches above finished grade.
    d. Sealants: In accordance with Section 07 92 00 and as follows.
        1) Compatible with the EIFS materials.
        2) Sealant backer rod shall be closed cell.

8. Vapor Retarders:
    a. The use and location of vapor retarders within a wall assembly shall comply with local building code requirements.

b. The type and location shall be as indicated on Drawings.
c. Refer to Dryvit Publication DS159 for additional information.

9. Flashing: provided at all roof-wall intersections, windows, doors, chimneys, decks, balconies and other areas as necessary to prevent water from entering behind EIFS.
10. Details: Follow EIFS manufacturer's latest published information for standard detail treatments. Corners shall be reinforced by wrapping the standard reinforcing mesh around the corner from both directions for a minimum of 8 inches (200mm) as recommended by the manufacturer. Openings shall be reinforced using a 9 inch (230mm) wide strip of standard reinforcing mesh laid at a 45-degree angle to the opening corner as recommended by the manufacturer.

D. Performance Requirements: The following shall be tested in accordance with Dryvit Outsulation Plus MD systems Specifications, DS137 and shall meet the criteria and results listed.
1. Air/Water-Resistive Barrier Coating.
2. Durability.
3. Structural.
4. Impact Resistance
5. Fire Performance.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s product data sheets describing products to be used on this project.

B. Shop Drawings: Provide drawings showing wall layout, all details, connections and expansion joints.

C. Samples: Provide color and texture sample for Architect's approval. Sample shall be 24 x 24 inches mounted on gypsum sheathing (of the type which will be actually used), of each finish, texture and color. Each sample shall be prepared using the same tools and techniques proposed for the actual installation.

D. Test Reports: Submit copies of ICC Research Report verifying the performance of the EIFS.

E. Certificates: Submit a copy of applicator's current certificate of approval from EIFS manufacturer for this Project.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Insulation Board:
a. Separated from the interior of the building by a minimum 15-minute thermal barrier.
b. Listed in the UL Building Materials Directory and have Flame Spread and Smoke Developed rating of not greater than 25 and 450, respectively, in accordance with ASTM E84.
2. EIFS: Approved for use by ICC as described in current ICC Research Committee Report.

B. Quality Assurance Program: Work of this Section shall be in accordance with the following:
1. Approved Applicators: Application of EIFS materials shall be performed by manufacturer-approved applicators that posses current Labor and Material applicator certificates.
2. Construction Document Review: Provide E.I.F.S. manufacturer a complete set of

Construction Documents, including Shop Drawings, for review at least 60 days prior to start of Work of this Section.

a. E.I.F.S. manufacturer will review system conditions and details of proposed application for compliance with manufacturers approved details and specifications and provide a written detail report with recommendations and revisions required by the Manufacturer to qualify the installation for the wall system warranty.

3. Pre-Installation Conference: Schedule a pre-installation conference at least 15 days prior to start of Work of this Section to review exterior insulation and finish system specifications and procedures.
   a. Attendees: Authorized representatives of the Architect, Contractor, E.I.F.S. installer, E.I.F.S. manufacturer's representative, Owner and other trades relevant to the work are required to attend.
   b. Agenda: Discuss items of importance, including the following:
      1) Review Construction Documents to ensure all parties present are in possession of the latest approved documents.
      2) Coordination of the E.I.F.S. applicator's Work with other work which connects with, is adjacent to, or will be concealed by Work of this Section.
      3) Storage of materials and staging areas.
      4) Physical requirements for proper installation or application and, if applicable, proposed protection procedures.
      5) Schedule of required quality assurance inspections.
      6) Lines of communication and establishment of responsibility for the proper communication of non-conforming work and correction procedures.
4. Mock-Ups:
   a. Prior to start of work, construct a sample panel, using job site materials, approximately 10 x 10 feet, under the direction of the Architect.
   b. The sample wall shall provide a standard of workmanship, range of color and texture, and shall include flashings, control joints and sealant system.
   c. Construct successive sample panels until the standard is approved.
   d. When accepted, sample wall shall be the standard of comparison for the remainder of the work.
   e. Upon completion of the project, remove the sample wall from the site and dispose in a legal manner.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact.

B. Storage: Adequately protect against damage while stored at the site in accordance with manufacturer's requirements.

C. Handling: Comply with manufacturer's instructions.

1.07 PROJECT/SITE CONDITIONS

A. Physical Requirements for Proper Installation or Application:
   1. Ambient air temperature shall be 40 degrees F. or greater and rising at the time of installation of the EIFS materials, and remain so for at least 24 hours thereafter.
   2. For EIFS installation in ambient temperatures less than 40 degrees F., maintain supplementary heat for at least 24 hours after EIFS installation.

Subsequent to installation of the EIFS, the wall shall remain free of residual moisture.

1.08 MAINTENANCE

A. Furnish the following maintenance materials:
1. For each finish and color, one can of finish.
2. One can of adhesive.
3. 20 square feet of standard reinforcing mesh.
4. 20 square feet of insulation board.

1.09 WARRANTY

A. Provide manufacturer's Complete 5-year warranty covering both labor and materials used in system, and substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products equaling or exceeding quality requirements of the specified product, of the following manufacturers, as follows or as approved are acceptable for bidding:
1. Dryvit System, Inc., West Warwick, RI www.dryvit.com. Basis of Design to be Dryvit Outsulation Plus MD system.
2. Parex, Redan, GA www.parex.com
3. Pleko Southwest, Tempe, AZ www.pleko.com
4. Senergy, Inc., Cranston RI www.senergyeifs.com
5. STO Industries, Rutland, VT. www.stocorp.com
6. Teifs Wall Systems, San Antonio, TX www.teifs.com

2.02 MATERIALS

A. Exterior Gypsum Sheathing: As specified in Section 09 29 13.

B. Sheathing Fasteners: Corrosion resistant, with anti-corrosive coating capable of withstanding no more than 5 percent red rust after 500 hours of Salt Spray Tests in accordance with ASTM B117. Size and type as used in wind load tests.

C. Portland Cement: ASTM C150, Type I or II.

D. Water: Clear, potable, and free of all foreign matter.

E. Insulation Board: Expanded polystyrene, ASTM C578 Class II, aged (air dried) for 6 weeks at 68 degrees F. minimum, or for 5 days at 140 degrees F. before use.
1. Flame Spread (ASTM E84 or UL 723): Less than 25.
2. Average Density: 1.0 pound per cubic foot.
3. K-value: 0.23 per inch.
4. Thickness: One inch, or as indicated.
5. Size: 24 inches x 48 inches.

F. Standard Reinforcing Mesh: Treated, balanced, open weave, glass fiber type, minimum weight of 4 oz./yd., available in 38 inch and 9 inch widths.

G. High Impact Armor Mesh: Treated, balanced, open weave, glass fiber type, minimum weight of 20 oz./yd., available in 38-inch widths.

H. Waterproofing Base Coat for Low-Slope and Sill Conditions: Acrylic-based, Portland cement mixed, waterproof base coat and adhesive specifically formulated as a waterproofing base coat for use at low slope parapets, sills, and projections.

I. Soffit Vent: Fry Reglet Corporation “Soffit Vent E.I.F.S.” model VFS-600 or approved equal; aluminum alloy with gray epoxy finish; 1/8 inch by 1inch long slots on 1-1/2-inch centers. Provide in locations as indicated and as detailed in the Drawings.

J. Air/Water-Resistive Barrier Components: Provide the following as manufactured by Dryvit or approved equal.
1. Dryvit Backstop® NT: A flexible, polymer-based noncementitious water-resistive coating and air barrier available in Texture and Smooth.
2. Dryvit Grid Tape™: An open weave fiberglass mesh tape with pressure sensitive adhesive available in rolls 102 mm (4 in) wide by 91 m (100 yds) long.
3. Dryvit Backstop DMS: A sprayable single step water-resistive membrane/air barrier and adhesive. Backstop DMS is not approved for use over wood-based substrates.

K. Flashing Materials: Used to protect substrate edges at terminations. Provide the following as manufactured by Dryvit or approved equal.
1. Liquid Applied: An extremely flexible water-based polymer material, ready for use.
   a. Shall be AquaFlash and AquaFlash Mesh
2. Sheet Type:
   a. Shall be Flashing Tape and Surface Conditioner
      1) Dryvit Flashing Tape™: A high-density polyethylene film backed with a rubberized asphalt adhesive available in rolls 102 mm (4 in), 152 mm (6 in) and 229 mm (9 in) wide by 23 m (75 ft) long.
      2) Dryvit Flashing Tape Surface Conditioner™: A water-based surface conditioner and adhesion promoter for the Dryvit Flashing Tape.

L. Dryvit AP Adhesive™: Provide the following as manufactured by Dryvit or approved equal.
1. A moisture cure, urethane-based adhesive used to adhere the Dryvit Drainage Strip and Drainage Track.

M. Drainage Track: Provide the following as manufactured by Dryvit or approved equal. UV treated PVC "J" channel perforated with weep holes, complying with ASTM D 1784 and ASTM C 1063. Drainage track usage is limited to the base of the system at finished grade level. All other horizontal terminations shall utilize the Dryvit Drainage Strip as shown in Outsulation Plus MD Installation Details, DS110. Shall be one of the following or approved equal:
1. Starter Trac STWP – without drip edge by Plastic Components, Inc.
2. Starter Trac STDE – with drip edge by Plastic Components, Inc.
3. Universal Starter Track by Wind-lock Corporation
4. Sloped Starter Strip with Drip by Vinyl Corp.

N. Dryvit Drainage Strip™ or approved equal: A corrugated plastic sheet material, which provides drainage.

O. Adhesives: Used to adhere the EPS to the air/water-resistive barrier, shall be compatible with the water resistive barrier and the EPS. Provide the following as manufactured by Dryvit or approved equal.
1. Cementitious: A liquid polymer-based material, which is field mixed with Portland cement.
   a. Shall be Primus, Genesis or Genesis® FM
2. Ready mixed: A dry blend cementitious, copolymer-based product, field mixed with water.
   a. Shall be Primus® DM, Genesis® DM, Genesis® DMS, Rapidry DM 35- 50 or Rapidry DM 50-75

P. Base Coat: Shall be compatible with the EPS insulation board and reinforcing mesh(es). Provide the following as manufactured by Dryvit or approved equal.
1. Cementitious: A liquid polymer-based material, which is field mixed with Portland cement.
a. Shall be Primus, Genesis or Genesis FM
2. Noncementitious: A factory-mixed, fully formulated, water-based product.
a. Shall be NCB
3. Ready mixed: A dry blend cementitious, copolymer-based product, field mixed with water.
a. Shall be Primus DM, Genesis DM, Genesis DMS, Rapidry DM 35-50 or Rapidry DM 50-75.

Q. Finish: In accordance with types specified in Part 3 – Execution.

R. Sealant System: Shall be compatible with EIFS system. Refer to current manufacturer's literature (Dryvit Publication DS153) for listing of sealants tested by sealant manufacturer for compatibility.

2.03 MIXES

A. Adhesive:
1. Use clean container, free of foreign substance, for mixing and preparing material. Do not use containers which has been used for or cleaned with a petroleum product.
2. Use a mixer similar to Goldblatt Jiffler Mixer No. 15311H7, powered by 1/2-inch drill 400-500 RPM.
3. Measure a given weight of adhesive into a container, and an equal weight of Portland cement into another container.
4. While stirring the adhesive, add small amounts of Portland cement in increments to obtain a final ratio of one-to-one by weight. Continue stirring until the mixture is homogenous.
5. Small amounts of water may be added to the adhesive mixture to adjust workability. The mixture shall not be "watered down."
6. A period of 5 minutes shall elapse after the initial mixing, then the mixture shall be tempered by stirring again.
7. Use mixture immediately after tempering. Pot life is the same as plaster-like materials and depends on ambient temperature and humidity conditions and substrate. Keep container closed when not in use.
8. Under no circumstances use additives, or materials of any kind such as rapid binders, antifreeze, accelerators, fillers, or pigments.

B. Finish Coating:
1. Thoroughly stir coating with a clean high-speed mixer as specified above until a uniform workable consistency is obtained.
2. A small amount of water may be added to adjust workability. Coating shall not be "watered down." Maximum water, 8 ounces per pail.
3. Under no circumstances use additives, or materials of any kind such as rapid binders, antifreeze, accelerators, fillers, or pigments.
4. Apply coating immediately after mixing. Keep container closed when not in use. Pot life depends on ambient temperature and humidity conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
1. Representative of the EIFS manufacturer shall inspect and approve gypsum substrate prior to the application of insulation, as well as the insulation prior to application of the finish.
2. Masonry, concrete and brick substrates shall be flat within 1/4 inch (6mm) within any 4 feet. Follow manufacturer's recommendations for application of additive or leveling coat to assure a smooth surface.
3. Verify gypsum sheathing is installed

3.02 APPLICATION

A. General:
1. The system shall be installed in accordance with the Dryvit Outsulation Plus MD System Application Instructions, DS218.
2. The overall minimum base coat thickness shall be sufficient to fully embed the mesh. The recommended method is to apply the base coat in two (2) passes.

B. Exterior Gypsum Sheathing Board: As specified in Section 09 29 13.

C. Insulation Board:
1. Begin application at the base from drainage track.
2. Apply adhesion to clean hard surface.
3. Apply board with long edge oriented horizontally with its joints offset with respect to the substrate joints and using a running bond pattern.
4. Precut insulation board as required to fit openings, corners and projections.
5. Stagger vertical joints and interlock at corners.

6. Insulation board pieces smaller than 24 inches x 48 inches may be used, such as at corners. In all cases the perimeter of the insulation board shall have the 2-inch ribbon per the Ribbon and Dab Method. Maintain 32 percent minimum contact area.
7. Foam shapes (popouts), as detailed on the drawings, shall be adhered directly to the face of the installed insulation board by applying mixed Adhesive or mixed Dry Adhesive to back of the foam shape and pressing it firmly into position.

D. Adhesive Mixture: Apply using vertical notch trowel application to allow for moisture drainage of system.

E. Mesh:
1. Reverse roll as necessary to remove the tendency of the mesh to curl.
2. Standard Mesh Base Coat:
a. Using a stainless-steel trowel, apply the adhesive mixture to the surface to a uniform dry thickness of 1/16 inch. Apply base coat in 2 applications.
b. Immediately embed the standard reinforcing mesh into the wet adhesive mixture using a trowel.
c. Smooth the surface of the adhesive mixture with a trowel until the reinforcing mesh is fully embedded.
d. The pattern of the mesh shall not be visible beneath the surface of the adhesive mixture.
e. Lap reinforcing mesh pieces a minimum of 2-1/2 inches on all sides, working from the center to the edge while smoothing out wrinkles.
f. A period of 24 hours shall elapse to allow the base coat to form a positive bond.
g. Protect base coat from damage and weather while curing.

3. Heavy Duty Mesh Basecoat: Provide the following at 6’-0” and below and at all corners and facades exposed to abnormal stress or deliberate impacts.

a. Using a stainless-steel trowel, apply the adhesive mixture to the surface to a uniform thickness of 3/32 inch.
b. Immediately embed the high impact armor mesh into the wet adhesive mixture using a trowel.
c. Smooth the surface of adhesive mixture with a trowel until heavy duty reinforcing mesh is fully embedded.
d. The pattern of the mesh shall not be visible beneath the surface of the adhesive mixture.
e. Ends of adjacent heavy duty mesh pieces shall be tightly butted, not lapped.
f. Where heavy duty mesh abuts standard mesh coat, apply sufficient adhesive mixture over adjacent standard mesh, and feather a sufficient distance to provide a smooth invisible transition between the two meshes.
g. Work heavy duty mesh into the adhesive mixture, working from the center to the edge while smoothing out wrinkles.
h. A period of 24 hours shall elapse to allow the base coat to form a positive bond.
i. Protect base coats from damage and weather while curing.
j. Examine the surface of the first layer after curing for projections, lose strands of heavy-duty mesh, and correct to produce a flat surface.
k. Apply a second layer consisting of adhesive mixture and standard reinforcing mesh over the heavy-duty mesh as specified above.

F. Finish:
1. Apply finish continuously and in one operation to the entire wall surface.
2. Maintain a wet edge.
3. The finish shall not be allowed to be set up in a distinct area.
4. Employ sufficient manpower, scaffolding and equipment to ensure a continuous operation and a uniform appearance.
5. Work shall proceed toward the joints and corners.
6. Use clean plastic float for floating.
7. A small amount of clean, potable water may be used to adjust the workability of the finish. Maximum 8 ounces (226 gm) per pail.
8. Until dry, protect the finish from airborne contamination due to dust and soot, and from weather and other damage.
9. Finish shall not be returned into sealant joints.
10. Finish Texture: As scheduled on Drawings.
11. Color(s): As scheduled on Drawings

G. Sealant:
1. Sealant shall not be applied directly to textured finishes or base coat surfaces. Dryvit Outsulation Plus MD System surfaces in contact with sealant shall be coated with Demandit or Color Prime.
2. Color of sealant shall be as selected.
3. Joint design and surface preparation shall be based on sealant manufacturer's recommendations and project conditions.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: During construction the work shall be inspected by the EIFS manufacturer or authorized representative.

B. EIFS Special Inspections: Installation of EIFS shall be inspected during construction as required by Section 1704 of the IBC.
1. Provide free access to Work and cooperate with appointed firm.
2. Inspections shall be performed by a representative of a qualified independent special inspector acceptable to the Owner and meeting qualification requirements.

3. Inspector shall prepare reports indicating that work inspected was done in conformance to approved Construction Documents.
4. Discrepancies shall be immediately corrected by the Contractor.
5. Completed work which does not conform to approved Construction Documents shall be reported to the Architect.
6. Work completed that does not comply with approved Construction Documents shall be rejected.

3.04 CLEANING

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition

END OF SELECTION

SECTION 07 41 13

SHEET METAL ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. This section contains the building paper system, including sealing joints and protrusions through the building paper, with accessories as required for complete installation.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's literature for each type of building paper.

B. Samples: Submit samples of each type of building paper. Submit quality assurance/control submittals either as test reports or manufacturer's certificates indicating materials complying with the specified requirements.

1.03 WARRANTY

A. The building paper manufacturer shall warrant the material meeting the specification herein and that it is tested to ensure conformance to the physical properties listed.

B. The manufacturer is not responsible for damage caused by improper use or handling during and after installation.

PART 2 PRODUCT

2.01 MANUFACTURER

A. The pre-finished standing seam metal roof system shall be as manufactured by MBCI, 10943 North Sam Houston Parkway West, Houston, Texas, 77064, (281) 897-7788, or approved equal.

2.02 MATERIALS

A. Metal roof system shall be 24-gauge Craftsman architectural standing seam metal roof system, small batten profile, 12 inches wide, with concealed fasteners, slope as noted on the Contract Drawings.

1. One piece clip with factory applied mastic, 1" x 1" x 2" with one guide hole in the bottom to accommodate a clip fastener.
2. Substrate: Galvalume sheet steel, 0.5 oz/sf, minimum yield 50,000 psi.
3. Smooth texture.
4. Premium fluorocarbon coating produced with Kynar 500 or Hylar 5000 resin.
5. Color to be determined by the Owner.

B. Roofing materials shall have a Solar Reflectance Index not less than 29 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure items which pass through the building paper are properly and rigidly installed, substrate is free of projections and irregularities which may be detrimental to the proper installation of building paper.

3.02 INSTALLATION

A. Apply the building paper in accordance with the manufacturer's recommendations, laid smooth without folds or bunches of material.

1. Seam Overlap: As recommended by the building paper manufacturer for specific building paper material and application indicated.

2. Sealing: Seal edges and items projecting through vapor retarders and vapor barriers.

B. Inspect and repair the building paper prior to application of finish material over building paper; tape tears, perforations and similar damage.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Flashings, sheet metal work and related items including, but not limited to:
   1. Counterflashing at vertical surfaces.
   2. Flashing at roof penetrations.
   3. Factory fabricated and finished coping system.
   4. Edge flashing.
   5. Other items as indicated.

1.2 SUBMITTALS

A. Shop Drawings: Submit Drawings indicating type of material, gauge, dimensions, profiles, locations where used, fastening and anchoring methods, joints, and provisions of expansion and contraction.

B. Samples: Submit samples of each type of prefinished metal in selected color.

C. Submit manufacturer's Product Data for factory fabricated coping system. Include information for materials, finishes and written installation guide and recommendations.

1.3 QUALITY ASSURANCE

A. Standards:
   1. Comply with design and installation methods of SMACNA Architectural Sheet Metal Manual.
   2. Comply with The NRCA Roofing and Waterproofing Manual installation details.
   3. Comply with current issue of ANSI/SPRI, ES I.
   4. 2018 International Building Code.

B. Performance Requirements:
   1. Sheet metal flashing and trim shall be designed and installed in accordance to Referenced Standards and to withstand Wind Zone 2 wind pressures in compliance with FMG Loss Prevention Data Sheet 1-49.
   2. Factory fabricated coping system shall comply with current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems. All configurations, gauges, attachments and other items shall meet or exceed testing and design criteria related to ES-1.

C. Factory fabricated coping system work shall be performed by the roofing contractor as an integral part of roofing system assembly and warranty.

1.4 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.

B. Storage: Adequately protect against damage while stored at the site. Do not store materials on ground.

C. Handling: Comply with Manufacturer's instructions. Handle with care so as not to buckle or warp metal or damage solder joints.

1.5 PROJECT CONDITIONS

A. Factory Fabricated Coping System:
1. Verify that other trades with related work are complete before mounting coping covers.
2. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
3. Refer to the construction documents, shop drawings and manufacturer's installation instructions.
4. Coordinate installation with roof membrane manufacturer's installation instructions before starting.

1.6 WARRANTY

A. Sheet Metal Flashing and Trim: Furnish 5-year warranty against flashing and sheet metal failure, in which contractor agrees to repair or replace flashing and sheet metal as necessary to maintain work in watertight condition during the warranty period. Warranty to cover workmanship, materials and repair or replacement of same, at no cost to Owner.

B. Factory Fabricated Coping System: The system shall be warranted to perform over the term of the specified roofing system warranty and shall be warranted to not blow off or cause membrane failure, even in wind conditions up to 110 mph or the manufacturer shall replace or repair their materials. A 20-year standard Kynar/Hylar finish warranty shall also be included. Supplied and installed by roofing contractor as part of overall roofing system warranty.

PART 2 PRODUCTS

2.1 MATERIALS

A. Prefinished Metal:
1. Hot-dipped galvanized, ASTM A653 Structural Quality, Grade 40, G90 coating 24-gauge core steel minimum, or prefinished Galvalume - ASTM A792.
2. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14.
3. Finish: Full strength Kynar 500/Hylar 5000 Fluorocarbon coating, applied by the Manufacturer on a continuous coil coating line, with top side dry film thickness of
0.70 to 0.90 mil over 0.25 to 0.35 mil prime coat, to provide a total dry film thickness of 0.95 to 1.25 mil.
a. Bottom side: Coated with primer with a dry film thickness of 0.25

mil.

b. Finish: Conform to all tests for adhesion flexibility, and longevity as specified by the Kynar 500 finish supplier.

c. Color: Custom color as indicated on Drawings or as selected by Architect.

4. Strippable film: Liquid applied to top side of painted coil to protect finish during fabrication, shipping and field handling.

B. Galvanized Steel: ASTM A653, 24 gauge minimum and as indicated, with G-60 coating. Used for sheet metal flashing and trim at concealed from view locations and concealed clips and reinforcements only.

2.2 ACCESSORIES

A. Reglets and Counterflashings: Fry Reglet Corporation, Type SM at masonry and Concrete, or fabricated as indicated on Drawings. Provide prefabricated inside and outside reglet and counterflashing corners.

B. Solder: ASTM B32, 50/50 type.

C. Flux: FS O-F-506.

D. Sealant: As specified in Section 07 92 00.

E. Plastic Cement: ASTM D4586.

F. Roofing Felt: ASTM D226, 15-pound type or 30-pound type.

G. Bituminous Coating: FS TT-C-494 or SSPC paint - 12, dry film 15 mils per coat.

H. Sheet Metal Fasteners: Galvanized steel with soft neoprene washers at exposed fasteners. Where exposed in the finished work of prefinished metal, provide fasteners with prefinished heads matching prefinished metal.

I. Prefinished Metal Seam Sealers and Adhesives: As recommended by prefinished metal manufacturer for waterproof and weather-resistant seaming and adhesive applications of flashing and sheet metal work.

1. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, nonstaining tape.
2. Butyl Sealant: ASTM C1311, single-compound, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

2.3 FACTORY FABRICATED COPING SYSTEM

A. Acceptable Manufacturers: Provide factory-fabricated coping system from one of the following Manufacturers, except as approved otherwise by the Architect, subject to compliance with specifications requirements:

1. Carlisle Syn Tec www.carlisle-syntec.com
2. Metal-Era Inc. www.metalera.com
3. W.P. Hickman www.wph.com

B. Basis of Design: Factory fabricated coping system as manufactured by Carlisle. Other Systems from one of the specified manufacturers may be acceptable that meet all performance and aesthetic criteria as noted in this Section and are approved for use by the roofing manufacturer. If the roofing membrane manufacturer can provide systems that are in conformance with this specification, then they shall be provided by the roofing manufacturer and included as part of the roofing system warranty.

C. Parapet Coping System:
1. Coping: Metal coping cap with anchor/support cleats for capping any parapet wall. The system shall be maintenance free and does not require exposed fasteners. Joints shall be a butt type with concealed splice plates.
2. Performance Characteristics:
a. Coping sections shall expand and contract freely while locked in place on anchor cleats.
b. Coping sections shall lock to anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats.
c. Splice plates include factory applied dual non-curing sealant strips capable of providing a watertight seal.
3. Metal Type and Gauge: Metal type and gauge to be installed that will perform per local wind zone conditions and recommended for use by the manufacturer for this project.
4. Coping Cap: Max. Length of 12’-0”, widths to 24 inches manufactured to job requirements.
5. Coping vertical face and back leg: 2-1/2 inches to 12-1/2 inches manufactured to job requirements.
6. Concealed splice plates: Finished to match finish of coping cap with factory applied dual noncuring sealant strips.
7. Anchor/Support Cleat: Cleat with stainless steel spring mechanically locked to cleat normally 12 inches wide at 6’-0” on center; mechanically fastened as indicated and detailed.
8. Fasteners: Shall provide a minimum pull out resistance of 240# per substrate application. No exposed fasteners shall be permitted. Fasteners shall be electrolytically compatible.
9. Accessories:
a. Corners, end caps, pier caps, etc. shall be fabricated by the coping manufacturer.
b. Welded or quicklock assembly shall be used to maintain watertight integrity.

2.4 FABRICATION

A. Fabricate Flashing and sheet metal from the following:
1. Fabricate pre-manufactured metal coping and edge system and other exposed to view flashing and sheet metal from prefinished metal sheet.
2. Fabricate flashing and sheet metal concealed from view in the finished work from galvanized steel.

B. Fabricate sheet metal with lines, arris, and angles sharp and true, and plane surfaces free from objectionable wave, warp or buckle. From accurate to details.
1. Hem exposed edges to form a 1/2-inch-wide hem on the side concealed from view.
2. Provide concealed stiffeners and reinforcements as necessary to provide

surfaces free of objectionable wave, warp or buckle.

3. Profiles, bends, and intersections shall be even and true to line.

C. Forming, anchoring, expansion and contraction details shall conform to referenced quality standards.

D. Provide for thermal expansion of running trim, flashing, expansion joints, and other items exposed for more than 15 feet continuous length.

E. Fabricate cleats and starter strips of same material as sheet.

F. Form pieces in longest practical lengths, except form flashing and fascia in 8-to-10-foot units.

G. Solder and seal metal joints or use seam sealer/adhesive as recommended by prefinished metal manufacturer. After soldering, remove flux. Wipe and wash solder joints clean.

H. Fabricate corners from one piece with minimum 18-inch-long legs, with mitered corners; solder for rigidity, seal with sealant.

I. Fabricate flashings as indicated on Drawings. Return and brake edges.

J. Where prefabricated counterflashing and reglet system is used, form upper edge of counterflashing with an approved snap lock flange to engage reglet receiver and to provide a spring action at bottom edge against built-up flashing.

2.5 FINISH (unfinished galvanized steel components)

A. Shop prepare and prime exposed ferrous metal surfaces of unfinished galvanized steel sheet to prepare for field painting.

B. Backpaint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 1.5 mil.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

1. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, can't strips and reglets in place, and nailing strips located.
2. Verify membrane termination and base flashings are in place, sealed, and secure.
3. Verify substrate is dry, clean and free of foreign matter.

B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

C. Correct defects prior to installation.

3.2 INSTALLATION

A. Installation shall conform to NRCA and SMACNA manuals.
   1. Slope to provide positive drainage.
   2. Provide sufficient hold-down clips to ensure true alignment and security against wind.
   3. Install with 4-inch minimum overlap.
   4. Bed overlap joints in appropriate sealant as specified in Section 07 92 00.
   5. Form and lap step flashings.
   6. Allow sufficient tolerance for expansion and contraction.
   7. Insulate work to prevent electrolytic action.

B. Expansion Seams: Maintain a watertight installation at expansion seams. Locate expansion seams as shown or if not shown, at the following maximum spacing for each general flashing use:
   1. Flashing, expansion joints, gravel stops, and trim: At 10-foot intervals, 24 inches on each side of corners and intersections.
   2. Sealant-type expansion joints: Where sealant-filled expansion joints are used, embed the hooked flanges of the joint members not less than 1 inch into the sealant. Form joints to completely conceal the sealant. When ambient temperature is moderate at the time of installation (40 to 70 degrees F.), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant type joints at temperatures below 40 degrees F. Installation of sealant is specified in Section 07 92 00.

C. Where dissimilar materials are provided proper separation or protection to minimize the possibility of galvanic action.

D. Soldering:
   1. Solder joints at corner fabrications.
   2. Except where other methods of joining are indicated or specified, solder joints and connections of Sheet Metal Work.
   3. Remove grease and dirt from metal surfaces to be joined.
   4. Remove flux residue by scrubbing, neutralizing with ammonia or a 5 to 10 percent solution of washing soda, followed by a clear water rinse.
   5. Assemble parts and solder using regular non-corrosive resin flux. Heat metal thoroughly to completely sweat solder through full contact area.

E. Sealed Joints: Form nonexpansion, but movable joints in metal with flat lapped seams to accommodate elastomeric sealant to comply with SMACNA Standards. Fill joint with sealant and form metal to completely conceal sealant.
   1. Seal joints at copings and at other movable, non-expansion type joints.

F. Reglets: Install reglets in masonry, concrete or stucco to receive flashings.

G. Counterflashing:
   1. Provide metal counterflashing at top edges of built-up base flashings and at other locations indicated.
   2. Lap end joints a minimum of 3 inches. Do not solder or weld joints. Make flashing continuous at angles. Counterflashing shall overlap base flashing a minimum of 4 inches, unless otherwise indicated.
   3. Where counterflashing terminates in reglets, fasten flashing with lead wedges every 12 inches. Fill reglets continuously with synthetic rubber

typesealant.

H. Factory Fabricated Coping System:
1. Verify as-built conditions the manufacturer's coping and edge details for accuracy to fit the wall assembly prior to fabrication. Comply with the coping manufacturer's installation guide when setting copings.
2. Use mechanical fasteners with minimum 240 lb. pull out resistance for parapet substrates.

3.3 CLEANING

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF
SECTION

SECTION 07 91 00

EXTERIOR WALL JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Joint preparation, priming, backing materials, and weatherseal sealants for exterior wall applications, and accessories indicated, specified, or required to complete application.
   1. Joints in the preformed metal panels, and between this system and surrounding conditions.
   2. Joints in the metal copings and between the copings and the surrounding conditions.
   3. Joints in the Exterior Stone Cladding, where indicated.
   4. Joints as required, indicated or specified in Architectural Drawings and Contract Documents.

1.2 CODES AND STANDARDS

A. In addition to referenced codes and standards within this specification, the work shall comply with the latest edition of the following standards. When conflicts arise between standards, the more stringent shall apply.
   1. AAMA – Architectural Aluminum Manufacturers Association
      a. AAMA 800, Test Methods for Sealants
      b. AAMA CW-13 Structural Sealant Glazing Systems
   2. ASTM – American Society for Testing and Materials
      a. ASTM C509, Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
      b. ASTM C718, Test Method for Ultraviolet (UV) Cold Box Exposure of One-Part Elastomeric, Solvent-Release Type Sealants
      c. ASTM C719, Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
      d. ASTM C793, Test Method for Effects of Accelerated Weathering on Elastomeric Joint Sealants
      e. ASTM C1135, Test Method for Determining Tensile Adhesion Properties of Structural Sealants
      f. ASTM C1401, Guide for Structural Sealant Glazing
      g. ASTM D2203, Test Method for Staining from Sealants
      h. ASTM C 1281 Standard Specification for Preformed Tape Sealants for Glazing Applications
      i. ASTM C 1392 Standard Guide for Evaluating Failure of Structural Sealant Glazing

1.3 ASTM C 1394 Standard Guide for In-Situ Structural Silicone Glazing EvaluationACTION SUBMITTALS

A. Product Data:
   1. Manufacturer’s technical literature for each product indicated, specified, or required.
   2. Color selection charts. Architect’s acceptance will be for color only.
   3. Procedures for priming, backing, installing, tooling, and curing for each type of sealant and each joint condition.
   4. Instructions for handling, storage, mixing, and protection of each type of sealant.

B. Shop Drawings: Incorporate the following information in Exterior Wall Contractor’s Shop

Drawings for each exterior envelope system:

1. Each type of joint condition and adjacent and adjoining exterior wall materials.
2. Backings and accessories.
3. Manufacturers, product name and number, sealant formulation, and sealant color.

C. Samples for Initial Selection: Full range of custom manufacturers samples of actual products showing color for each product exposed to view.

D. Samples for Verification:

1. Samples for each kind and color of sealant in 1/2 in wide joints formed between two 6 in long strips of material matching appearance of exposed surfaces adjacent to sealants.
2. Samples for each kind of backer material, 12 in long.

1.4 INFORMATIONAL SUBMITTALS

A. Warranties: Copy of specified warranty.

B. Manufacturers Project Acceptance Certification: Statement from manufacturer certifying products is suitable for use in specific locations, for specific details, and for applications indicated, specified, or required; and that warranty will be issued.

C. Sealant Adhesion, Compatibility and Staining Test Reports: As specified in PART 1 “Pre-Construction Quality Control”.

D. Structural Silicone Test and Inspection Reports: As specified in PART 1 “STRUCTURAL SILICONE QUALITY CONTROL”.

E. Source Quality Control – Shop Fabricated Panel Sealant Testing: Logs from fabricator specified in PART 2 “Source Quality Control” Article.

F. Manufacturer’s Field Inspection and Testing Reports: Reports of each visit to Project made by representatives of manufacturer specified in PART 3 “Field Quality Control” Article.

1.5 QUALITY ASSURANCE

A. The Exterior Wall Contractor assumes undivided responsibility for the selection, installation and performance of the materials as described above and herein.

1. Compatibility: Sealants, backings, and accessories shall be compatible with one another, within exterior wall systems and with sealants and materials used by other trades under conditions of service and application.
2. Joint sealants are required to establish and maintain weather tight continuous seals on a permanent basis, with recognized limitations of wear and aging as indicated for each application.

B. Manufacturer Qualifications: Company with not less than 10 years’ experience in manufacturing products similar to scope of this Project with a record of successful in-service performance.

C. Installer Qualifications

1. Experience: Company with not less than 10 years’ experience in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production

capability, facilities, and trained and skilled personnel.

2. Supervision: Maintain a competent supervisor who is at Project during times specified work is in progress, and who is experienced in installing work similar in design, products, and extent to scope of this Project.
3. Manufacturer Training: Installer to be trained in proper application techniques, application sequence and special conditions.

D. Manufacturers Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

E. Field Samples for Aesthetic Purposes: Per Architect's instructions, build field samples for color, tooling and aesthetic quality approval. Coordinate with applicable Exterior Building Façade Sections.

F. Pre-Application Conference: Before beginning work of this Section, conduct conference at Project to comply with requirements of appropriate Division 01 Sections and applicable Exterior Building Façade Sections.

G. All shop and field materials as well as workmanship are subject to inspection by the Owner, Architect and Exterior Wall Consultant at all times. Such inspections do not relieve the Exterior Wall Contractor from obligations to comply with all requirements of the Contract Documents.

1.6 PRE-CONSTRUCTION QUALITY CONTROL

A. Laboratory Testing and Inspections: Sealant Manufacturer to perform in-house pre-construction testing and inspections to establish compliance with specified requirements.
1. Test all relevant substrates, including, but not limited to, finished aluminum, stone, stainless steel, metal panels, vision glass, spandrel glass, gaskets, glazing accessories, as well as any other material which will contact the sealant either during installation or normal wall movements.
2. Substitute actual job substrate materials in lieu of standard test materials, e.g. in ASTM C510, use job stone samples in lieu of white cement mortar. Long-term behavior, under compression shall be tested.
3. Tests must include the use of the same sealants on the project, including the project color and approximate joint size and configurations.

B. Tests:
1. Sealant Adhesion Testing:
   a. Method: ASTM C 794
   b. Test must include 21-day water immersion after which silicone must have excellent adhesion to substrates.
   c. Report adhesion strength in terms of shear stress and tensile stress.
2. Sealant Compatibility Testing:
   a. Method: ASTM C 1087
3. Sealant Stain/Migration Testing: (Staining or migration on porous substrates)
   a. Method: ASTM C 1248
   b. Tests must be performed both wet and dry. Substrate must not experience waterproofing of the substrate surface beyond the sealant joint.
4. ASTM C1248 (modified) – Effects on laminated glass
5. Sealant testing against self-adhered waterproofing membrane:
   a. Sealant Adhesion Testing
   b. Sealant Compatibility Testing
   c. Special preparation requirements

C. Structural Silicone Quality Control
1. Submit Quality Control Program to include the tests as specified in PART 2 “Source Quality Control” Article.
2. Method procedure for sealing, bonding and testing of the structural silicone per sealant Manufacturer’s recommendations.
3. Detailed re-glaze procedures for vision and spandrel glass.
4. Field inspection procedure for the perimeter seal on the laminated units and other structural silicone bonds. This procedure should spell out yearly inspections for the first 10 years, and thereafter 2 inspections per year.
5. Prior to the approval of structural silicone designs, laboratory testing for adhesion of a minimum of 3 samples after water immersion of 7 days is required.
6. Sealant methods and test method results must be verified by an independent inspection agency, a minimum of once per shift.
7. The sealant manufacturer must run UV and water immersion tests proving compatibility and performance of all spacers, backers, primers, finishes, etc.
8. All glass in the structural silicone curtain wall system shall be structurally bonded to metal framing with two component structural silicone. This operation must be performed in the off-site factory with rigidly supervised conditions and methods.
9. Working stress of silicone and the silicone bond must be limited to 20 psi.
10. Structural bond of silicone to glass and metal must be inspected on a 100% basis.

D. Reports: Record testing and inspection results and prepare certified reports according to ASTM E 575 format.

E. Equivalent Option to Testing: Testing and inspections will not be required if certified testing reports can be furnished by manufacturer if dated within 2 years of date of time submittal is made.

1.7 SEALANT TESTING ON STONE

A. Submit 6 stone samples 1 in x 6 in x project thickness per type of stone per type of sealant tested, finished per the job conditions to the sealant manufacturer for adhesion, compatibility and stain testing.

B. Prior to the approval of the proposed sealant, a report on this testing and all results must be submitted for review and acceptance.

1.8 FIELD CONDITIONS

A. Ambient Conditions: Proceed with application of sealants under following conditions:
1. When ambient and substrate temperature conditions are within limits permitted by sealant manufacturer.
2. When joint substrates are dry.
3. Where joint widths are within acceptable range allowed by sealant manufacturer.
4. Where contaminants capable of interfering with adhesion have been removed from joint substrates.

B. Weather Conditions Limitation: Proceed with work only when existing and forecasted weather conditions will permit application according to manufacturer’s instructions and warranty requirements.

1.9 FAÇADE MOCK-UP TESTING
1. Refer to Section 01 45 36 – Exterior Wall Laboratory Testing.

1.10 DELIVERY, STORAGE AND HANDLING

A. Quality Standard: AAMA CW-10.

B. Follow Manufacturer's recommendation; prevent deterioration, contamination or damage at all times.

C. Deliver sealant work materials to project site in manufacturer's unopened containers with name, brand, type, grade, color, and expiration date fully indicated.

D. Do not use materials that have exceeded the maximum recommended shelf life.

1.11 WARRANTY

A. Manufacturers Special Warranty: Furnish full replacement of work warranty for a period of 20 years labor and material, matching that provided by Dow Corning Corporation or GE Silicones, from date of substantial completion due to defects, faulty work and failures, including those that do not comply with specified performance requirements signed by an authorized representative using manufacturer's standard form.

B. Installers Special Warranty: Furnish full replacement of work warranty for a period of 5 years from date of substantial completion due to defects, faulty work and failures, including those that do not comply with specified performance requirements, signed by an authorized representative using installer's standard form.

C. Defects, Faulty Work, and Failures: Includes, but not limited to, following:
1. Adhesive or cohesive failure of sealant.
2. Abrasion-resistance failure
3. Lack of resistance to migration.
4. Staining of substrates from sealant or primers.
5. Durability of specified performance.
6. Failure to maintain continuous airtight and watertight seal.
7. Crazing on surface of non-structural sealant.
8. Non-structural sealant hardening beyond Shore A durometer 50 or softening below 20.

D. Exclusions: Includes, but not limited to, deterioration or failure of sealants from following:
1. Movement of structure caused by structural settlement or errors attributable to design or construction resulting in stresses on sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers (listed alphabetically): Subject to compliance with requirements of Contract Documents.
1. Dow Corning Corp.
2. Momentive Performance Materials, Inc. GE Commercial Sealants
3. Pecora Corp.

2.2 PRODUCTS

A. Single Source Responsibility: Furnish each type of product through one source from single manufacturer.

B. Weatherseal Silicone Sealants:
1. Product Quality Standards: SWRI Certified, ASTM C 920, Type S or M, Grade NS, Class as indicated, and Use NT, G, A, O.
2. Federal Specifications: TT-S-00230C and TT-S-001543A
3. Description: 1-Part, neutral cure, non-sag, non-bleeding silicone sealant.
4. Primers: Product provided by sealant manufacturer as required by conditions.
5. Acceptable Manufacturers and Products:
   a. Class 100/50: Low Modulus
      1) Dow Corning Corp.; 790 (Not approved for stone).
      2) Momentive Performance Materials, Inc., GE Commercial Sealants; SilPruf LM SCS2700.
      3) Pecora Corp.; 890.
   b. Class 50: Medium Modulus
      1) Dow Corning Corp.; 795 or 791 (791 for internal gutters for use in aluminum framing only).
      2) Momentive Performance Materials, Inc., GE Commercial Sealants; SilPruf SCS2000.
      3) Pecora Corp.; 8 6 4
   c. Class 50 Non-Staining:
      1) Dow Corning Corp.; 756 SMS
      2) Momentive Performance Materials, Inc., GE Commercial Sealants; SilPruf NB SCS9000.
6. Color: Custom color determined by Architect.

C. Structural Sealants:
1. Product Quality Standards: SWRI Certified, ASTM C 1184 & ASTM C 920.
2. Federal Specifications: TT-S-00230C and TT-S-001543A
3. Description: 1-Part or 2-Part, neutral cure, non-sag, non-staining, non-bleeding silicone sealant.
4. Two Component for Shop Installation:
   a. Type M, Grade NS, Class 12-1/2 or 25, Use NT, G, A, O.
   b. Acceptable Manufacturers and Products:
      1) Dow Corning Corp.; 983.
      2) Momentive Performance Materials, Inc., GE Commercial Sealants; UltraGlaze SSG4400, SSG4600.
      3) Pecora Corp.; 985.
5. One Component for Field Installation:
   a. Type S, Grade NS, Class 25 or 50, Use NT, G, A, O.
   b. Acceptable Manufacturers and Products:
      1) Dow Corning Corp.; 995 and 795.
      2) Momentive Performance Materials, Inc., GE Commercial Sealants; UltraGlaze SSG2000 Silpruf SCS2000, UltraGlaze SSG4000
      3) Pecora Corp.; 895NST.
6. Color: If color other than black is selected and available, gaskets, setting blocks and all in contact with silicone to be silicone based.

D. Sealants over Weather Barriers:
1. Product Quality Standards: SWRI Certified, ASTM C 920, Type S, Grade NS, Class as indicated.
2. Federal Specifications: TT-S-00230C and TT-S-001543A
3. Description: 1-Part, neutral cure, non-sag, non-bleeding silicone sealant.
4. Primers: Product provided by sealant manufacturer as required by conditions.
5. Acceptable Manufacturers and Products:

a. Class 25 Medium Modulus; ASTM C719 +/- 25 percent movement.
1) Dow Corning Corp.; 758.

6. Color: Standard.

E. Foam Backer Rods:
1. Preformed joint filler, non-staining. Diameter approximately 25 percent larger than joint width, unless otherwise directed by manufacturer.
2. Bi-cellular Structure with Surface Skin:
a. Product Quality Standard: ASTM C 1330, Type B.
b. Description: Non-gassing, extruded polyolefin; acceptable to joint sealant manufacturer.
c. Available Manufacturers and Products:
1) Nomaco Inc.; SOF-Rod (Dual-Rod) Backer Rod
2) BASF; Sonneborn, Sonolastic Soft Backer Rod: Degussa
3) Industrial Thermo Polymers LTD.; Soft-Type Insulating Backer Rod
3. Closed Cell Structure:
a. Product Quality Standard: ASTM C 1330, Type C.
b. Description: Non-gassing, extruded polyethylene; acceptable to joint sealant manufacturer.
c. Available Manufacturers and Products:
1) Backer Rod Manufacturing, Inc.; Mile High Foam Backer Rod.
2) BASF; Sonolastic, Closed-Cell Backer Rod.
3) Industrial Thermo Polymers LTD.; ITP Std. Insulating Backer Rod.
4) Nomaco Inc.; Green Rod or HBR Backer Rod.
4. Open Cell Structure:
a. Open cell backer rod is only acceptable under the following conditions:
1) With ultra low modules sealants used against a non porous substrate.
2) When a double line of sealant is required to allow for curing of sealant at the back line. Face line of sealant should be closed cell.
b. Product Quality Standard: ASTM C 1330, Type O.
c. Description: Extruded polyurethane; acceptable to joint sealant manufacturer.
d. Available Manufacturers and Products:
1) Backer Rod Manufacturing, Inc.; Denver Foam Backer Rod.
2) Industrial Thermo Polymers LTD.; Tundra Open Cell Foam Backer Rod.
3) Nomaco Inc.; Foam-Pak II Backer Rod.

F. Bond-Breaker Tape:
1. Description: Teflon or polyethylene tape, self-adhering, if necessary, recommended by sealant manufacturer.
2. Available Manufacturers and Products:
a. 3M, Industrial Adhesives and Tapes Division; Polyethylene Tape 483.
b. Norton; TBond II V2200 Foam Spacer, Thermalbond V2100 Foam Spacer

G. Primers: Product provided by sealant manufacturer as required by conditions.
1. As recommended by sealant manufacturer in writing, having been tested for staining and durability on samples of actual surfaces to be sealed.
2. Structural silicone in contact with a fluoropolymer painted, ASTM 2605 substrate must be primed with sealant manufacturer's recommended product and must follow special substrate preparation requirements as described herein.

2.3 ACCESSORIES

A. Cleaners for Non-Porous Surfaces: Chemical cleaners recommended by sealant manufacturer in writing, free of harming residues, non-staining, and formulated to promote optimum adhesion.
   1. MEK, Toluene or Xylene are not acceptable except in cases of extreme cleaning conditions.

2.4 SOURCE QUALITY CONTROL

A. Fabricator Testing: Fabricator shall, through its own laboratory testing, perform source quality control testing of units with structural sealant at the glazing and assembly facility to establish compliance with specified requirements.
   1. Methods:
      a. Product Mix Check: Butterfly Test.
      b. Work Life Check: Snap Time Test.
      c. Adhesion
      d. Ratio Check (By Weight)
      e. Finished Unit De-Glazing and Sealant Inspection
         1) 1 out of the first 10 finished units
         2) 1 out of the first 40 finished units
         3) 1 of the next 50 finished units
         4) 1 of each subsequent 100 units (until project completion) once 10 successive, successful de-glazing tests are experienced.
      f. Execute a full negative design pressure test of one full size unit randomly selected from the production line at the minimum rate of 1every 50 units.
         1) The test units might be used on the project at the conclusion of successful test results.
   2. A failure of any tested unit will require the testing of the 2 units manufactured immediately before and after the failed unit. Depending on the success or failure of subsequent tests, and the determination of cause of initial failure, additional tests may be required.
   3. All samples must demonstrate the ability to surpass a tensile load per linear centimeter equivalent to three times the design pressure.
   4. Testing shall be witnessed, and results recorded by a Professional Engineer or an independent testing laboratory.
   5. Additional tests as required by Sealant Manufacturer.

B. Reports: Maintain long-indicating tests conducted, sealant lot numbers, dates, times, results.

PART 3 EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to which sealants will be applied for compliance with requirements and other conditions affecting performance.
   2. Joint widths, depths, and conditions detailed on shop drawings shall be considered as minimum allowable requirements except where they may conflict with sealant manufacturer's recommendations. In all cases, joints must be uniform in width.
   3. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   4. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. General:
1. Comply with manufacturer's written instructions, specifications, and recommendations for cleaning and surface preparation.
2. Surfaces shall have no defects or errors which would result in poor or potentially defective application or would cause latent defects in work.

B. Joint Cleaning:
1. Foreign Material: Remove that could interfere with adhesion of sealant, including, but not limited to, dust, loose materials, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Remove protective coatings on metallic surfaces by a solvent that leaves no residue. Use clean white cloths for cleaning with solvent and drying.
3. Concrete Substrates: Remove laitance and form-release agents.
4. Porous Joint Substrates: Clean by brushing, grinding, mechanical abrading, abrasive blast cleaning, water blast cleaning, or combination of these methods to produce a clean, sound substrate capable of developing optimum bond with sealants. Remove loose particles remaining after cleaning by vacuuming or blowing out joints with oil-free compressed air.
5. Non-Porous Joint Substrates: Clean with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of sealants.

C. Joint Priming:
1. Prime joint substrates where recommended by sealant manufacturer, or as required per test results.
2. Confine primers to areas of sealant bond; do not allow spillage or migration onto adjoining surfaces.

D. Aluminum Finish at Structural Silicone
1. Mill finish is not acceptable.
2. Fluoropolymer paint conforming to AAMA 2605.
3. Alodine conversion coating.

E. Priming of surfaces receiving Structural Silicone Sealant:
1. Prior to installing two-part fast cure structural sealant, abrade fluoropolymer painted substrate with alcohol soaked "scotch brite" pads and wipe clean with a lint-free rag.
2. Any primers that are used with the structural silicone shall be pre-approved in writing by the sealant manufacturer for the noted application and environment including specific installation and handling instructions. No structurally glazed unit shall be moved prior to sample testing that shows 100% cohesive failure has been achieved.

F. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces. Remove tape immediately after tooling without disturbing joint seal.

3.3 APPLICATION

A. Application Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:
1. ASTM C 1193
2. ASTM C 920. Use Classification for substrate material allowed.

3. Respective manufacturers' written application instructions.
4. Approved submittals.
5. Contract Documents.

B. Sealant Backings: Install to support sealants during application at position required to produce cross-sectional shapes and depth-to-width ratio to allow optimum sealant movement capability.
   1. Foam Backer Rods: Install in joints using tool to control depth; compress rods 25 to 50 percent.
      a. Avoid gaps between ends of rods.
      b. Avoid stretching, twisting, braiding, puncturing, or tearing rods.
      c. Remove absorbent rods that have become wet or damaged before sealant application and replace with dry materials.
      d. Do not apply sealant without back-up materials.
   2. Bond-Breaker Tape: Install where joint is not deep enough to allow for use of foam backer rods.
      a. Three-side adhesion is acceptable only for the sealing at joinery of members that are to be rigidly attached to each other by means of screws or welding restricting all movement.

C. Sealants:
   1. Do not apply to damp surfaces or during inclement weather. Do not heat joints to dry them or raise the temperature.
   2. Mill finish aluminum is not acceptable at structural silicone bonding surfaces.
   3. Apply immediately after setting backings, under pressure with hand or power actuated gun so sealants directly contacts and fully wets joint substrates.
   4. Produce uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
   5. Immediately after sealant application and before skinning or curing begins, dry tool sealants to form smooth, uniform beads of slightly concave profile, unless specified otherwise; to eliminate air pockets; and to ensure contact and adhesion of sealant with joint substrates.
      a. Remove excess sealant from surfaces adjacent to joints.
      b. Do not water wet tool or use tooling agents.

D. Install a heal bead of silicone sealant at all entrance glass canopy. No exposed gaskets allowed.

E. All internal sealants used to seal glass pockets, end dams and gutters shall be silicone installed per manufacturer's recommendation. Splice details shall be designed using silicone or a combination of silicone and a non-curing, non-hardening, non-skimming butyl. Splice joint to be designed to separate the different sealants.

3.4 FIELD QUALITY CONTROL

A. Field Inspection:
   1. Sealant Manufacturer representatives shall inspect first days work and periodically inspect work to ensure application is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Submit written reports of each visit.
   2. State if installation methods complied with the manufacturer's printed instructions and their field representative's verbal instructions and were proper and adequate for the condition of installation and use.

B. Field Adhesion and Cohesion Testing: Sealant manufacturer representative will perform a minimum of 20 field tests to determine if installed work complies with specified requirements. Tests to be witnessed by Owner, Architect and Exterior Wall Consultant.

Test sealant after it has fully cured (7-21 days).

1. Provide testing as follows to demonstrate curing properties:
   a. Between 24 and 72 hours prior to initial application.
   b. Prior to use of each new shipment of materials.
   c. Not less than twice a month for existing stored materials.

C. Testing of field installed Structural Silicone.
   1. Vertical or sloped glass must be tested at a rate of 1 light out of each 100 lights of glass. Silicone shall be cut out and all silicone joints inspected during production on the job site.

D. Reports: Record test results and prepare reports according to ASTM E 575 and ASTM C 1521 formats.

E. Re-testing and Re-inspections Due to Failures:
   1. Perform further testing to ascertain the extent of the problem. All failed sealants are to be replaced promptly, and the resulting weather tightness must be verified.
   2. Remove from site marginal or defective material.
   3. Contractor responsible for expenses incurred, without additional cost to Owner, due to failure of work to pass testing and inspections.

F. Repairs for Destructive Testing:
   1. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints.
   2. Ensure original sealant surfaces are clean and new sealant properly contacts original sealant.

3.5 CLEANING

A. In-Progress Cleaning: Remove excess sealant, or smears adjacent to joints, as work progresses by methods and with cleaning materials approved in writing by respective product manufacturers.

3.6 PROTECTION

A. General Requirements: Protect 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 sealants immediately so applications with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 07 92 00

SEALANT AND

CAULKING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes the following:
1. Joints sealants and installation accessories for interior and exterior locations except for exterior wall joint sealants and acoustical sealants as specified in other Sections.

B. Related Sections:
1. Section 07 91 00 – Exterior Wall Joint Sealants, for all sealants in joints in exterior metal panel systems, and between these systems and surrounding adjacent materials and finishes.
2. Section 07 92 19 – Acoustical Sealants, for sealants for use in sound isolating partitions including interior side of exterior walls.

1.2 SUBMITTALS

A. Product Data:
1. Submit Manufacturer's current specifications and recommended installation procedures.
2. Submit sample warranty to be signed jointly by applicator and Manufacturer.
3. Submit Manufacturer's standard color chart.
4. Certification in the form of standard data sheet or letter that each type of compound and sealant to be furnished complies with these specifications.
5. Statement that each product to be furnished is recommended for the application shown for this project.
6. Complete instructions for handling, storage, mixing, priming, installation, curing and protection of each type of sealant.

B. Shop Drawings: Illustrations in sufficient detail to show installation and interface of the work of this Section with the work of adjacent trades.

C. Field Adhesion Test and Stain Reports: Submit copies of logs and test reports showing results of field adhesion testing and stain testing.

D. Submit three (3) samples of each specified product, 12-inch minimum lengths, and installed between representative samples of materials to be sealed for each product. Architect's acceptance will be for color only.

E. Certifications: Submit certification signed jointly by Contractor and Sealant Manufacturer, certifying that products comply with specification requirements, are proper and adequate for the condition of installation and use, have been properly selected and designed for applications where they are to be installed, and that sealants and accessory materials have been installed in accordance with Manufacturer’s printed instructions and recommendations of Manufacturer’s field representative.

F. Provide a procedure detailing the cleaning, priming, taping, tooling and other steps recommended to ensure satisfactory function and appearance.

G. Contract Closeout: Submit Manufacturer's Warranty.

1.3 QUALITY ASSURANCE

A. Qualifications: Installers shall be thoroughly trained and experienced in the necessary skills and shall be thoroughly familiar with the specified requirements.

B. Field Adhesion Testing: Perform preconstruction adhesion testing for each type of sealant and substrate as follows:
1. Arrange for Manufacturer’s field technical representative to be present during testing.
2. Install sealant in test joints in minimum 60-inch lengths.
3. Test joints by standard field adhesion hand pull test.
4. For joints with dissimilar substrates, test adhesion to each substrate separately as recommended by sealant Manufacturer.
5. Conduct number of field adhesion tests for each type of sealant and each type of substrate as follows:
   a. Not less than 10 tests for the first 1,000 feet of installed sealant and 1 test for each additional 1,000 feet of sealant installed, or 1 test per floor per elevation.
6. Document results of field adhesion tests and record results in field adhesion test log.
7. Include in log data on pull distance used to test each joint sealant.
8. Include data on joints where material connected with pull portion of sealant failed to adhere to joint substrate or tore cohesively.
9. Inspect joints and record data for the following:
   a. Complete fill.
   b. No voids.
   c. Joint dimensions matching those of Manufacturer’s recommended details.
10. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
11. Do not install joint sealants that fail to adhere to joint substrates during testing.
12. Repair sealant test areas by removing damaged materials and applying sealant to test area using same procedure used to originally install the sealant.

C. Stain Testing: Perform Stain testing of natural stone, masonry and other porous substrates proposed for use in the Work. Obtain actual samples of materials proposed for use and test to determine if permanent discoloration of porous surfaces will occur from direct contact with sealants. Perform stain testing in conformance with ASTM C1248 and as follows:
1. Arrange for Manufacturer’s field technical representative to be present during examination of test results.
2. Cut substrate to provide flat surface for application of sealant.
3. Separate substrate materials by removable shims to create 1/2 x 1/2 x 3-inch joint.
4. Fill joint with scheduled sealant, tool, and allow to cure for 21 days at room temperature.
5. After 21-day curing, remove shims, compress joint to 50 percent of original joint width to 1/4 inch, and place in an oven at 158 degrees F. for 14 days.
6. After 14 days in oven, remove and allow sample to cool to room temperature.
7. Examine sample to determine presence of discoloration or change in appearance in any way to exposed surfaces.

8. After visual inspection, cut sample in half to determine presence of discoloration or change in appearance in any way into the sample itself at the adhesive bond line and presence of bleeding into the area around the adhesive bond line.
9. Document results of stain tests and record results in stain test log.
10. Do not install sealants that show evidence of staining substrates.

D. Field Color and Workmanship Samples: Seal a section of joint as directed, under job conditions, at least 7 days prior to start of work for review by Architect. When approved, sample shall be used as a standard of comparison for remainder of work.

E. Manufacturer and sealants Subcontractor to submit log of testing, on company letterhead for each test performed indicating, but not limited to the following:
1. Date
2. Project identification
3. Sealant identification including name, type and batch number
4. Test performance, i.e., acceptable, marginal, not acceptable
5. Storage conditions
6. Signature of person conducting test

F. Location where the test was conducted.

G. If tests indicate sealant material is marginal or not acceptable, sealant is not to be used. Tester is to immediately notify Architect and Contractor of the deficient materials. The sealant Subcontractor is to immediately remove deficient materials from site.

H. Inspections
1. Coordinate sealant selection and application as necessary for the full and satisfactory compatibility and performance between all sealants used under this section with all other applicable and related sections using sealants that may be in direct contact with work of this section.
2. Take all required steps and precautions to properly isolate and prevent any degree of incompatibility between sealants, all in strict accordance with Manufacturer's specifications, recommendations and instructions.
3. Contractor is to periodically test sealants in place in addition to the Manufacturer's field testing, for adhesion, using methods recommended by sealant Manufacturer. Promptly replace all sealant that does not adhere or fails to cure.
4. Contractor shall arrange to meet the sealant Manufacturer at the jobsite and witness initial installation of sealant on the project with the Contractor, Architect and other Consultants.

1.4 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.

B. Storage: Adequately protect against damage while stored at the site. Maintain product in accordance with Manufacturer's recommendations with proper precautions to ensure fitness of material when installed.

C. Handling: Comply with Manufacturer's instructions.

1.5 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Observe Manufacturer's temperature service range. Do not apply sealant when weather conditions will inhibit bonding and curing.

1.6 WARRANTY

A. Provide warranty, in writing and signed jointly by the installer and sealant Manufacturer, to replace sealants which fail at no additional cost to the Owner because of loss of cohesion or adhesion, or do not cure, and which fail to achieve air-tight and water-tight seal as follows:
   1. Sealant Types "A" and "B": 5 years.
   2. Sealant Types "C1" and "C2": 20 years.
   3. Sealant Types "D" and "E": 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Furnish products of one of the following manufacturers, except as approved otherwise by the Architect, subject to compliance with specifications requirements:
   1. Pecora www.pecora.com
   2. Dow Corning Corp. www.dowcorning.com
   3. General Electric www.ge.com
   4. Sonneborn / Chemrex www.chemrex.com

B. Single Source Responsibility for Joint Sealer Materials:
   1. Obtain joint sealer materials from a single Manufacturer for each different product required.
   2. If sealants from separate Manufacturers must be used and could come in contact with each other, provide written certification from every Manufacturer involved that the sealants are compatible and will adhere to each other.

2.2 MATERIALS

A. General: Sealants, primers, back-up materials, preformed joint fillers, bond breakers and related materials shall be compatible with adjoining materials.

B. Sealant:
   1. General: The selection of proper sealant for a particular joint shall be in accordance with current published recommendations of the Manufacturer.
   2. Types: See Schedule in Part 3 for the location where each type of sealant is to be provided.
      a. Type "A": Ultra-low modulus, self-leveling, one-component, silicone sealant conforming to ASTM C920, Type S, Grade SL, Class 100/25, Use T, A, M, and O; Dow Corning SL Parking Structure Sealant (Self Leveling), Pecora 300/310 SL, or Tremco Spectrem 900 SL; OR Low-modulus, non-sag, one-component silicone sealant conforming to ASTM C920, Type S, Grade NS, Class 100/25, Use T, A, M, and O. Dow Corning NS Parking Structure Sealant (Non-Sag), Pecora 301/311 NS, or Tremco Spectrem 800; OR Ultra-low modulus, fast-cure, two-component, neutral-cure silicone sealant conforming to ASTM C920, Type S, Grade FC, Class 100/25, Use T, A, M, and O; Dow Corning FC Parking Structure Sealant (Fast Cure). Pavement joint sealants shall comply with Uniform Standard Specifications for Public Works' Construction, Off-Site Improvements, Mohave County, Area Arizona, latest edition (USSPWC).
      b. Type "B": Silicone sealant conforming to ASTM C920, Type M, Grade NS, Class 25, Use NT, M, A, O, and capable of withstanding movement of 50% in extension and compression, and sustained temperatures of 250 degrees F in service. Dow Corning 790, 795, CCS and CWS.

c. Type "C-1": One-part low modulus moisture cure silicone rubber sealant conforming to FS TT-S-001543A, Class A, FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O, and capable of withstanding movement of 100% in extension and 50% in compression in service. Dow Corning 790 Silicone Glazing Sealant or Pecora 890.

d. Type "C-2": One-part medium modulus neutral cure silicone rubber sealant conforming to FS TT-S-001543A, Class A, FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O, and capable of withstanding movement of 50% in extension and 50% in compression in service. Pecora 895, Dow Corning 795 or Dow Corning 791 or 756 SMS (non-stainging). Provide Dow Corning 756 SMS where sealant with reduced soiling is indicated.

e. Type "D": Medium-modulus, single-component, pre-pigmented, neutral-cure silicone sealant conforming to ASTM C920, Type S, Grade NS, Class 50, Use NT, G, M, A, O. Dow Corning 756 SMS Building Sealant.

f. Type "E": Silicone rubber sealant with mold inhibitor. General Electric Sanitary 1700, Tremco Tremsil 200, Dow Corning 786, Pecora 898, Sonneborn Omni-Plus.

g. Type "F": Refer to Section 07 92 19.

3. Exterior Wall Joint Sealants: As specified in Section 07 91 00.

4. Color: Provide standard or custom colors as selected by Architect. In general, sealant shall be in colors matching the adjacent materials unless specifically noted otherwise on Drawings.

D. Primer: Non-staining type, recommended by sealant Manufacturer to suit application.

E. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant Manufacturer; compatible with joint forming materials.

F. Joint Filler (Backer):

1. Buildings: ASTM C1330, Type B; round bi-cellular or closed cell polyethylene, urethane or neoprene foam rod; oversized 30 to 50 percent; "SofRod" as manufactured by Nomaco.

2. Pavement: ASTM D5249, Type 3, round bi-cellular or closed cell polyethylene, urethane or neoprene foam rod; oversized 30 to 50 percent; "SofRod" as manufactured by Nomaco.

G. Bond Breaker: Pressure sensitive tape recommended by sealant Manufacturer to suit application.

H. Gloss Reducer: Silica sand No. 20, color to match adjacent surface. Gloss reducer shall be provided at traffic sealant applications.

I. Other Materials: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor and approved by the sealant Manufacturer as compatible, subject to the review by the Architect.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces. Verify, before proceeding with this Work that required inspections of existing conditions have been completed.

B. Coordination: Coordinate with other work which affects, connects with, or will be

concealed by this Work.

3.2 PREPARATION

A. Clean, prepare, and prime joints in accordance with Manufacturer's instructions. Remove loose materials, dust, oil, grease, water, surface dirt, frost, old caulking material and other foreign matters which may impair adhesion of sealant.
   1. Clean porous materials where necessary by grinding, sand or water-blast cleaning, mechanical abrading, acid washing or combination of these methods as required to provide a clean, sound base surface for sealant adhesion. Clean nonporous surfaces, either mechanically or chemically.
   2. Remove laitance by acid washing, grinding or mechanical abrading. Remove form oils by sand or water-blast cleaning. Remove all loose particles present or resulting from grinding, abrading or blast cleaning by blowing out joints with oil free compressed air or by vacuuming joint prior to application of primer or sealant.
   3. Remove protective coatings from metallic surfaces by two rag solvent wipe method. Use clean white cloths or lint free paper towels for cleaning with solvent and drying. Clean joint areas protected with masking tape or strippable film with solvent after removal of tape or film. Do not allow solvent to air dry without wiping.

B. Verify that joint shaping materials and release tapes are compatible with sealant.

C. Examine joint dimensions and size materials to achieve required width/depth ratios.
   1. Joint widths, depths, and conditions detailed on shop drawings by related work contractors shall be considered as minimum allowable requirements except where they may conflict with sealant Manufacturer's recommendations. In all cases, joints must be uniform in width. Do not seal joints until they are in compliance with drawings, or meet the accepted control section standard. Notify general Contractor and Architect of Conditions not compliant with Drawings or acceptable standards.
   2. Clean out and rake to full width and depth, joints to receive sealant, back-up material or preformed joint filler. Make joints of sufficient width and depth to accommodate specified back-up material or preformed joint filler and sealant.

D. Use joint filler to achieve required joint depths, to allow sealants to perform properly.

E. Use bond breaker where required.

F. Protect adjacent surfaces from damage by masking when necessary.

3.3 INSTALLATION

A. General:
1. Install sealant in accordance with Manufacturer's instructions.
2. In general, seal openings and other locations which normally require sealant to seal against infiltration from air, water and most insects, including; but not limited to:
a. Construction and expansion joints.
b. Joints between dissimilar materials.
c. Joints around windows, door frames, louvers and other penetrations and openings in the exterior wall.
d. Interior wall openings.
e. Other locations indicated on drawings.
3. Follow sealant Manufacturer's instruction regarding surface preparation, priming, application life, and application procedure. Consult sealant Manufacturer for recommendation for application procedure. Apply sealant within recommended temperature ranges. Consult Manufacturer when sealant cannot be applied within recommended temperature ranges. Consult sealant Manufacturer for recommendation for application of silicone sealant when air temperature is below 40 degrees F., or surface temperatures of sealant contact surfaces are above 115 degrees F.
4. Apply masking tape, where required, in continuous strips in alignment with joint edge. Remove tape immediately after joints have been sealed and tooled as directed. Sealant on face of adjacent stone or other materials will not be acceptable.

B. Joints:
1. Free of air pockets, foreign embedded matter, ridges, and sags.
2. Tool joints concave.

C. Apply sealant under pressure with hand or power actuated gun or other appropriate means. Gun shall have nozzle of proper size and provide sufficient pressure to completely fill joints as detailed.

D. Neatly point or tool joint surfaces to provide slightly concave surfaces, free of wrinkles and skips, uniformly smooth and with perfect adhesion along both sides of joint. All joints to be “Dry tooled”. Do not use water-wet tool or tooling solutions.

E. Sealant applied to joints adjacent to mortar joints shall be sanded to achieve texture similar to that of adjacent mortar joint.

F. Sealant applied between EIFS and adjacent aluminum storefront, entrance door frames, hollow metal door frames, wall panels, masonry construction, louvers and vents, and similar items penetrating or adjacent to EIFS shall be applied to the EIFS base coat. Coordinate sealant application with installation of EIFS system.

G. Consult sealant Manufacturer regarding the proper method of installing back-up material or joint filler at proper depth in joint to provide specified sealant dimensions. Compress back-up material 25 to 50 percent into the joints as required. Do not apply sealant without back-up materials. Install bond breaker strip between sealant and non-release type back-up material. Three side adhesion is acceptable only for the sealing at joinery of members that are to be rigidly attached to each other by means of screws or welding restricting all movement.

H. Install back-up rod stock into the joint to avoid length-wise stretching. Rod stock shall not be twisted or braided. Use bond breaker strip in all joints where sufficient room for back-up does not exist.

I. Surfaces of joints to be sealed must be dry. Do not attempt sealant work on wet surfaces or where frost is present. Consult sealant Manufacturer regarding the procedures for determining acceptable surface conditions.

3.4 CLEANING

A. Clean adjacent surfaces of sealant as work progresses.

B. Use solvent or cleaning agent as recommended by sealant Manufacturer.

C. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises.

3.5 SCHEDULE

A. Expansion and Control Joints:
1. Horizontal traffic (Interior and exterior pavement joint sealant): Type "A". Provide gloss reducer.
2. Joints around exterior windows and doors, exterior columns, louvers, masonry, concrete to concrete, steel, wall penetrations, connections, parapet caps, other joints to seal off building from exterior air and moisture: Type "B".
3. Glass (except insulating glass or special coated glass), aluminum, E.I.F.S., Natural Stone, and plastics: Type "C-1".
4. Glass (including insulating glass or special coated glass), aluminum and plastics: Type "C-2".
5. Porous Stone, Masonry, and Painted Metals: Type "D".

B. Non-expanding Joints:
1. Glass (except insulating glass or special coated glass), Aluminum, E.I.F.S., Natural Stone, and Plastics: Type "C-1".
2. Glass (including insulating glass or special coated glass), Aluminum and Plastics: Type "C-2".
3. Porous Stone, Masonry, and Painted Metals: Type "D".
4. Concrete to Concrete, Stucco, Masonry, Aluminum, Steel, and Wood: Type "C-1".

C. Mechanical (ductwork and air conditioning): Refer to Division 23.

D. Plumbing Fixtures and other Wet Areas (around toilet, bath, kitchen fixtures, and food service equipment): Type "E".

E. Acoustical (acoustical applications where sealant is required): Refer to Section 07 92 19.

F. Exterior Wall Joint Sealants: Refer to Section 07 91 00 (sealants in joints in glazed aluminum systems, exterior metal panel systems, and between these systems and surrounding adjacent materials and finishes).

END OF SECTION

SECTION 07 92 19

ACOUSTICAL SEALANTS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes sealants for use in sound isolating partitions including exterior walls.

1.2 REFERENCES

A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. ASTM C919 Standard Practice for Use of Sealants in Acoustical Applications.

C. ASTM E497 Standard Practice for Installing Sound-Isolating Lightweight Partitions.

D. ASTM C843 Specification for Latex Sealants.

E. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

F. Federal TT-S-1657 Interim Federal Specification for Sealing Compound – Single Component, Butyl Rubber Based, Solvent Release Type.

G. UL 263 Fire Tests of Building Construction and Materials.

1.3 SUBMITTALS

A. Comply with Section 07 92 00 – Joint Sealers.

1.4 QUALITY ASSURANCE

A. Comply with Section 07 92 00 – Joint Sealers.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 07 92 00 – Joint Sealers.

1.7 FIELD MEASUREMENTS

A. Verify gap dimensions before installation. Gap width shall not exceed that listed by the Manufacturer of sealant used.

1.8 WARRANTY

A. Provide Manufacturer's standard 1 year warranty for barrier assembly.

PART 2 PRODUCTS

2.1 ACRYLIC COPOLYMERE (LATEX) SEALANT

A. Acceptable Products:
1. Owens Corning QuietZone
2. USG Sheetrock Acoustic Sealant
3. Pecora AIS-919

B. Shall meet or exceed the requirements of ASTM C843.

C. Shall have a flame spread not greater than 25 and smoked development not greater than 50 when tested in accordance with ASTM E-84.

2.2 BUTYL RUBBER BASED SEALANT

A. Acceptable Products:
1. Tremco 579.34 Acoustic Sealant
2. Pecora BA-98

B. Shall meet or exceed the requirements of Federal TT-S-1657

2.3 FIRE RATED SEALANT

A. Acceptable Products:
1. Pecora AC-20 FTR
2. RectorSeal Biostop 500+

2.4 BACKER ROD & BACKING

A. Shall be as manufactured by Backer Rod Manufacturing and Supply Company or approved equal.

B. Shall meet or exceed the requirements of ASTM C843 and applied in accordance with fire stop system UL listing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with ASTM C919, ASTM E497, or Manufacturer's direction, whichever is most restrictive.

B. Backer rods shall be used as required to control sealant depth per Manufacturer's instructions.

C. Surface receiving sealant shall be clean, dry and free of dust or other foreign matter.

D. Concrete surfaces shall be fully cured, curing aids and form release agents removed.

E. Metal surfaces shall be wire brushed and solvent cleaned. All oxides, oils and solvent residues shall be removed.

F. Paint or final finish shall not be applied over sealant until completely cured. Refer to Manufacturer's data for cure times.

G. Butyl sealant shall not be used where painting is required.

H. Fire rated sealants shall be installed per fire stop system UL listing.

I. Butyl rubber-based sealant shall be used outdoors only. This type of sealant is typically flammable.

J. Sealants shall not be applied to building interiors until the building is enclosed and building temperatures are maintained at 55 degrees F minimum. Adequate ventilation shall be provided.

K. Install acoustical sealants at all locations where indicated on Drawings and as necessary to provide the acoustical ratings indicated, and as follows:
   1. Where gypsum board joins other walls or surfaces at sound control partitions.
   2. Around penetrating items through demising partitions and other sound rated partitions. Refer to Section 07 84 00 – Firestopping for fire stopping sealers required to be used for sealing around penetrations in fire-rated partitions.
   3. Other locations as indicated on Drawings.

END OF SECTION

SECTION 08 11 00

HOLLOW METAL

DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes hollow metal steel doors and frames as shown on Drawings and as specified herein.

1.2 SUBMITTALS

A. Shop Drawings: Submit Drawings showing elevations of each door and frame type, typical and details of construction, location and installation requirements for hardware, size and thickness of material.

B. Fire Rated Doors and Frames:
1. Installation Instructions: Door and frame manufacturer shall clearly identify the hardware products, other materials, and work requirements necessary to maintain compliance with UL 10(c) (positive pressure testing) as required by 2018 IBC Section 716.
2. Certification: Submit certification that fire rated doors (including frames and hardware as a unit) will comply with UL 10(c) (positive pressure testing) as required by 2018 IBC Section 716.

C. Furnish recognized independent test lab certification that products comply with ANSI A250.4.

1.3 DELIVERY AND STORAGE

A. Deliver welded frames with spreaders and doors with wrappers.

B. Store doors and frames under protective cover in dry, enclosed spaces at the site. Place doors and frames on non-staining blocking Raise bottoms of doors at least 4 inches high and provide 1/4-inch air space between stacked doors to avoid metal to metal contact and permit air circulation.

1.4 QUALITY ASSURANCE

A. Doors and frames shall be certified to comply with ANSI A250.4, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing, and ANSI A250.8, Recommended Specifications for Standard Steel Doors and Frames.

1.5 WARRANTY

A. Special Warranty: Furnish the following warranty to Owner:
1. Warrant doors against defects in materials and workmanship for a period of 3 years after date of substantial completion of Project.
2. Replacement under warranty shall include removal of the defective door and hardware, hanging, re-installation of hardware, and painting including adjacent finishes if damaged.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Furnish steel doors and frames from one of the following Manufacturers, except as approved otherwise by the Architect, subject to compliance with specifications requirements:
1. Steelcraft Manufacturing Co. www.steelcraft.com
2. Curries Company www.curries.com
3. The Ceco Corporation www.cecodoor.com
4. The Kewanee Corp. www.kewaneecorp.com
5. Republic Builders Products www.republicdoor.com
6. Fleming Steel Doors and Frames www.flemingdoor.com

B. Doors and frames shall be furnished by the same Manufacturer.

2.2 MATERIALS

A. Doors: Furnish Level, Model and Physical Performance level in accordance with ANSI A250.8/SDI-100.
1. Level: Level 2, 18 gauge at interior doors and Level 3, 16 gauge at exterior doors, or as otherwise scheduled or indicated on Drawings.
2. Physical Performance: Level B at interior doors and Level A at exterior doors, or as otherwise scheduled or indicated on Drawings.
3. Model: Model 2, Seamless.

B. Cores:
1. Interior Doors: Honeycomb, Polystyrene, Polyurethane, or Vertical steel stiffener core. Provide insulation core (polystyrene or polyurethane) at door to temperature-controlled rooms.
2. Exterior Doors: Provide Polystyrene or Polyurethane core at exterior doors.
3. Core shall be as allowed by UL 10(c) for fire rated doors.

C. Frames: ANSI A250.8/SDI 100, 16-gauge steel at interior frames with 18-gauge doors and 14-gauge steel at exterior frames with 16-gauge doors.

D. Glazing Beads: Minimum 20-gaugesteel.

E. Steel: ASTM A1008 cold-rolled or ASTM A1011 hot-rolled. Hot-dip galvanized meeting ASTM A653, Grade G60, or Grade A60 galvannealed for exterior openings.

F. Rain Drips: Reese A201 A or equal my Pemko or National Guard.

G. Paint: Non-lifting, rust-inhibitive grey primer meeting ANSI A224.1, compatible with field finish specified in Section 09 91 00, applied after bonderizing.

2.3 FABRICATION- DOORS

A. Construct hollow metal doors, flush and vision lite types as scheduled on Drawings, in accordance with ANSI A250.8/SDI-100 with core as specified above. Reinforce top and bottom of doors horizontally by 16-gauge steel channels, full width, spot welded to each face at least 3 inches on center. Bevel edge of lock stile.
1. Door Top Edge: Close top of all doors flush as an integral part of the door construction, or by placing end closure channel with web of channel flush with top edge of door (not inverted), or by addition of end cap at top of door, spot welded to each face at least 3 inches on center, filled and dressed smooth.
2. Door Bottom Edge: Close bottom edges of all exterior doors with inverted end closure or end cap to provide channel to accept concealed automatic door bottom or seal.

B. Door Edge Joint and Treatment: Joints at the edges of doors shall have manufacturer's standard edge construction with continuously welded seam, dressed smooth.

C. Hardware Reinforcement: Provide steel plate reinforcement of the following minimum thickness fabricated from steel of same material as door faces. Coordinate with hardware schedule:
1. Hinges: 7 gauge by 1-1/2 inch by length of hinge plus 6 inches minimum, securely welded to door edge with a minimum of 6 spot welds.
2. High Frequency Hinges: 12-gauge channel, full length of door edge.
3. Lock Faces and Flush Bolts: 12-gauge steel plate. Provide reinforcement at each door face for locks.
4. All Other Surface Mounted Hardware: 12-gauge steel plate.

D. Reinforce openings in doors for lites and vents on all sides with 14-gauge steel channel.

E. Provide continuous drip cap at top of all exterior out-swinging doors.

F. Provide non-egress double doors with one-piece astragals of 14-gauge steel unless otherwise indicated or scheduled. Provide solid drip cap at top of exterior out-swinging doors.

G. Accurately mortise doors for locks and hinges. Provide adequate box type reinforcement with steel plates welded to the interior reinforcing channels and drilled and tapped. Provide reinforcement for all other items of hardware.

H. Doors with glass lite openings shall have trim recessed from the face of the door, beveled and attached with screws.

I. Louvers: Provide sightproof louvers inserted into the panels. Form louver frames of minimum 20-gauge steel. Weld or tenon minimum 24 gauge blades to frame and fasten the entire assembly to the door with moldings. The moldings, when used, shall be an integral part of the louver.

J. Fire-Rated Doors: Provide fire rated doors investigated and tested as fire door doors, complete with type of hardware to be used. Identify each fire door with recognized testing laboratory labels, indicating applicable fire rating of steel doors. Doors required to meet smoke and draft control assembly requirements shall have labels that identify that the door has been tested and approved for smoke and draft control assemblies (S-label). Construct doors to comply with NFPA Standard No. 80 and UL-10(c).

2.4 FABRICATION - FRAMES

A. Construct to shapes and sizes shown, meeting various wall thicknesses in accordance with ANSI/SDI-100.

B. Fully Welded Frames: Where indicated, provide continuously weld face seam, fill, grind and dress smooth face frame miters. Continuously back-weld inside of miter including casing, stop, soffit and rabbit.

C. Knock-Down Frames: Where indicated, provide knock down frames with compression lug assembly to close and lock corner miters.

D. Mortise, reinforce, drill and tap for standard weight, full mortise template hinges and template strike.

E. Provide not less than three 18-gauge anchors per jamb, or as shown on Drawings, spaced for maximum stiffness. Provide adjustable 18-gauge floor clips at each jamb, welded to back face of jamb, punched for securing to floor with two spaced anchors.

F. Make cutouts for required hardware specified under Section 08 71 00, from templates furnished. Reinforce butt cutouts with minimum 8-gauge thick steel plate drilled and tapped and welded in place. When heavy duty hinges are specified, provide high frequency reinforcing at frames for hinges. Coordinate with hardware vendor. Provide strike stops of frames with holes for three rubber door silencers; on double door frames, provide for two silencers per door at head.

1. Hardware Reinforcement: Provide steel plate reinforcement of the following minimum thickness fabricated from steel of same material as frames. Coordinate with hardware schedule:
   a. Hinge Cutouts: 7-gauge high frequency steel plate drilled and tapped and fully welded in place top and bottom. 7 gauge at intermediate locations.
   b. Strikes and Flush Bolts: 12 gauge.
   c. Surface Mounted Hold-Open Arms and Closers: 7 gauge
   d. Exit Devices and Corner Reinforcement: 12 gauge

G. For openings over 42 inches wide and at double openings, reinforce head members full length with a matching profile of 12-gauge steel. Provide anchor at midpoint of door, if practical.

H. Construct frames for UL labeled doors in accordance with UL requirements and label as scheduled. Frames required to meet smoke and draft control assembly requirements have labels that identify that the frame has been tested and approved for smoke and draft control assemblies (S-label).

I. Rain Drips: Provide rain drips at all exterior hollow metal door frames at exposed exterior walls whether scheduled in hardware sets or not.

2.5 FABRICATION TOLERANCES

A. Allowable Tolerances for Fabrication: As specified in ANSI/SDI-117, Manufacturing Tolerances Standard Steel Doors and Frames.

2.6 PAINTING

A. Bonderize and prime doors and frames with one shop coat of rust inhibitive primer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install metal door frames plumb, level, rigid and in true alignment as recommended in SDI 105 and ANSI/DHI A115.IG, and the following:

1. Cross Site Reveal: Not to exceed 3/16 inch as measured against stop of installed frames and doors. Doors and frames exceeding maximum allowed cross site reveal shall be removed and replaced at no additional expense to Owner.

B. Install doors and fasten to maintain alignment with frames to achieve maximum operational effectiveness and appearance.

1. Maintain clearances as specified in ANSI A250.8, 2.1.8.
2. Shim as required per NFPA 80, ANSI/A115.IG and SDI 122.

C. Fill backs of frames solid with mortar at concrete and masonry construction. Hand trowel a stiff mortar to frames. Pumped mortar slurry is not allowed.

D. Fill backs of frames with full thickness acoustical insulation specified in Section 09 81 00 at all doors within acoustically rated walls and at other locations where indicated.

E. Install fire doors and frames to comply with NFPA 80 and in accordance with manufacturer's printed instructions.

F. Prepare and install doors in accordance with ANSI A115 and SDI 122.

3.2 CLEANING

A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 08 11 13

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes hollow metal steel doors and frames as shown on Drawings and as specified herein.

B. Related Sections:
1. Section 08 12 16 – Interior Aluminum Door Frames, for prefinished, extruded aluminum interior door frames for wood doors within Guestrooms, and as scheduled.
2. Section 08 71 00 – Door Hardware.

1.2 SUBMITTALS

A. Shop Drawings: Submit Drawings showing elevations of each door and frame type, typical and details of construction, location and installation requirements for hardware, size and thickness of material.

B. Fire Rated Doors and Frames:
1. Installation Instructions: Door and frame manufacturer shall clearly identify the hardware products, other materials and work requirements necessary to maintain compliance with UL 10(c) (positive pressure testing) as required by 2012 IBC Section 716.
2. Certification: Submit certification that fire rated doors (including frames and hardware as a unit) will comply with UL 10(c) (positive pressure testing) as required by 2012 IBC Section 716.

C. Furnish recognized independent test lab certification that products comply with ANSI A250.4.

1.3 DELIVERY AND STORAGE

A. Deliver welded frames with spreaders and doors with wrappers.

B. Store doors and frames under protective cover in dry, enclosed spaces at the site. Place doors and frames on non-staining blocking Raise bottoms of doors at least 4 inches high and provide 1/4-inch air space between stacked doors to avoid metal to metal contact and permit air circulation.

1.4 QUALITY ASSURANCE

A. Doors and frames shall be certified to comply with ANSI A250.4, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing, and ANSI A250.8, Recommended Specifications for Standard Steel Doors and Frames.

1.5 WARRANTY

A. Special Warranty: Furnish the following warranty to Owner:
   1. Warrant doors against defects in materials and workmanship for a period of 3 years after date of substantial completion of Project.
   2. Replacement under warranty shall include removal of the defective door and hardware, hanging, re-installation of hardware, and painting including adjacent finishes if damaged.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Furnish steel doors and frames from one of the following Manufacturers, except as approved otherwise by the Architect, subject to compliance with specifications requirements:
   1. Steelcraft Manufacturing Co. www.steelcraft.com
   2. Curries Company www.curries.com
   3. The Ceco Corporation www.cecodoor.com
   4. The Kewanee Corp. www.kewaneecorp.com
   5. Republic Builders Products www.republicdoor.com
   6. Fleming Steel Doors and Frames www.flemingdoor.com

B. Doors and frames shall be furnished by the same Manufacturer.

2.2 MATERIALS

A. Doors: Furnish Level, Model and Physical Performance level in accordance with ANSI A250.8/SDI-100.
   1. Level: Level 2, 18 gauge at interior doors and Level 3, 16 gauge at exterior doors, or as otherwise scheduled or indicated on Drawings.
   2. Physical Performance: Level B at interior doors and Level A at exterior doors, or as otherwise scheduled or indicated on Drawings.
   3. Model: Model 2, Seamless.

B. Cores:
   1. Interior Doors: Honeycomb, Polystyrene, Polyurethane, or Vertical steel stiffener core. Provide insulation core (polystyrene or polyurethane) at door to temperature-controlled rooms.
   2. Exterior Doors: Provide Polystyrene or Polyurethane core at exterior doors.
   3. Core shall be as allowed by UL 10(c) for fire rated doors.

C. Frames: ANSI A250.8/SDI 100, 16-gauge steel at interior frames with 18-gauge doors and 14-gauge steel at exterior frames with 16-gauge doors.

D. Glazing Beads: Minimum 20-gaugesteel.

E. Steel: ASTM A1008 cold-rolled or ASTM A1011 hot-rolled. Hot-dip galvanized meeting ASTM A653, Grade G60, or Grade A60 galvannealed for exterior openings.

F. Rain Drips: Reese A201 A or equal my Pemko or National Guard.

G. Paint: Non-lifting, rust-inhibitive grey primer meeting ANSI A224.1, compatible with field finish specified in Section 09 91 00, applied after bonderizing.

2.3 FABRICATION- DOORS

A. Construct hollow metal doors, flush and vision lite types as scheduled on Drawings, in accordance with ANSI A250.8/SDI-100 with core as specified above. Reinforce top and bottom of doors horizontally by 16-gauge steel channels, full width, spot welded to each face at least 3 inches on center. Bevel edge of lock stile.
   1. Door Top Edge: Close top of all doors flush as an integral part of the door construction, or by placing end closure channel with web of channel flush with top edge of door (not inverted), or by addition of end cap at top of door, spot welded to each face at least 3 inches on center, filled and dressed smooth.
   2. Door Bottom Edge: Close bottom edges of all exterior doors with inverted end closure or end cap to provide channel to accept concealed automatic door bottom or seal.

B. Door Edge Joint and Treatment: Joints at the edges of doors shall have manufacturer's standard edge construction with continuously welded seam, dressed smooth.

C. Hardware Reinforcement: Provide steel plate reinforcement of the following minimum thickness fabricated from steel of same material as door faces. Coordinate with hardware schedule:
   1. Hinges: 7 gauge by 1-1/2 inch by length of hinge plus 6 inches minimum, securely welded to door edge with a minimum of 6 spot welds.
   2. High Frequency Hinges: 12-gauge channel, full length of door edge.
   3. Lock Faces and Flush Bolts: 12-gauge steel plate. Provide reinforcement at each door face for locks.
   4. All Other Surface Mounted Hardware: 12-gauge steel plate.

D. Reinforce openings in doors for lites and vents on all sides with 14-gauge steel channel.

E. Provide continuous drip cap at top of all exterior out-swinging doors.

F. Provide non-egress double doors with one-piece astragals of 14-gauge steel unless otherwise indicated or scheduled. Provide solid drip cap at top of exterior out-swinging doors.

G. Accurately mortise doors for locks and hinges. Provide adequate box type reinforcement with steel plates welded to the interior reinforcing channels and drilled and tapped. Provide reinforcement for all other items of hardware.

H. Doors with glass lite openings shall have trim recessed from the face of the door, beveled and attached with screws.

I. Louvers: Provide sightproof louvers inserted into the panels. Form louver frames of minimum 20-gauge steel. Weld or tenon minimum 24-gauge blades to frame and fasten the entire assembly to the door with moldings. The moldings, when used, shall be an integral part of the louver.

J. Fire-Rated Doors: Provide fire rated doors investigated and tested as fire door doors, complete with type of hardware to be used. Identify each fire door with recognized testing laboratory labels, indicating applicable fire rating of steel doors. Doors required to meet smoke and draft control assembly requirements shall have labels that identify that the door has been tested and approved for smoke and draft control assemblies (S-label). Construct doors to comply with NFPA Standard No. 80 and UL-10(c).

2.4 FABRICATION - FRAMES

A. Construct to shapes and sizes shown, meeting various wall thicknesses in accordance with ANSI/SDI-100.

B. Fully Welded Frames: Where indicated, provide continuously weld face seam, fill, grind and dress smooth face frame miters. Continuously back-weld inside of miter including casing, stop, soffit and rabbit.

C. Knock-Down Frames: Where indicated, provide knock down frames with compression lug assembly to close and lock corner miters.

D. Mortise, reinforce, drill and tap for standard weight, full mortise template hinges and template strike.

E. Provide not less than three 18-gauge anchors per jamb, or as shown on Drawings, spaced for maximum stiffness. Provide adjustable 18-gauge floor clips at each jamb, welded to back face of jamb, punched for securing to floor with two spaced anchors.

F. Make cutouts for required hardware specified under Section 08 71 00, from templates furnished. Reinforce butt cutouts with minimum 8-gauge thick steel plate drilled and tapped and welded in place. When heavy duty hinges are specified, provide high frequency reinforcing at frames for hinges. Coordinate with hardware vendor. Provide strike stops of frames with holes for three rubber door silencers; on double door frames, provide for two silencers per door at head.
   1. Hardware Reinforcement: Provide steel plate reinforcement of the following minimum thickness fabricated from steel of same material as frames. Coordinate with hardware schedule:
      a. Hinge Cutouts: 7-gauge high frequency steel plate drilled and tapped and fully welded in place top and bottom. 7 gauge at intermediate locations.
      b. Strikes and Flush Bolts: 12 gauge.
      c. Surface Mounted Hold-Open Arms and Closers: 7 gauge
      d. Exit Devices and Corner Reinforcement: 12 gauge

G. For openings over 42 inches wide and at double openings, reinforce head members full length with a matching profile of 12-gauge steel. Provide anchor at midpoint of door, if practical.

H. Construct frames for UL labeled doors in accordance with UL requirements and label as scheduled. Frames required to meet smoke and draft control assembly requirements shall have labels that identify that the frame has been tested and approved for smoke and draft control assemblies (S-label).

I. Rain Drips: Provide rain drip at all exterior hollow metal door frames at exposed exterior walls whether scheduled in hardware sets or not.

2.5 FABRICATION TOLERANCES

A. Allowable Tolerances for Fabrication: As specified in ANSI/SDI-117, Manufacturing Tolerances Standard Steel Doors and Frames.

2.6 PAINTING

A. Bonderize and prime doors and frames with one shop coat of rust inhibitive primer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install metal door frames plumb, level, rigid and in true alignment as recommended in SDI 105 and ANSI/DHI A115.IG, and the following:
   1. Cross Site Reveal: Not to exceed 3/16 inch as measured against stop of installed frames and doors. Doors and frames exceeding maximum allowed cross site reveal shall be removed and replaced at no additional expense to Owner.

B. Install doors and fasten to maintain alignment with frames to achieve maximum operational effectiveness and appearance.
   1. Maintain clearances as specified in ANSI A250.8, 2.1.8.
   2. Shim as required per NFPA 80, ANSI/A115.IG and SDI 122.

C. Fill backs of frames solid with mortar at concrete and masonry construction. Hand trowel a stiff mortar to frames. Pumped mortar slurry is not allowed.

D. Fill backs of frames with full thickness acoustical insulation specified in Section 09 81 00 at all doors within acoustically rated walls and at other locations where indicated.

E. Install fire doors and frames to comply with NFPA 80 and in accordance with manufacturer's printed instructions.

F. Prepare and install doors in accordance with ANSI A115 and SDI 122.

3.2 CLEANING

A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

1.1 SUMMARY

A. SECTION INCLUDES

1. Finish hardware for doors.
2. Electronic hardware.
3. Thresholds & weatherstripping
4. Keying System
5. Templates
6. Hardware schedule

1.2 RELATED SECTIONS

1. 08 11 00 - Hollow metal doors and frames.

1.3 REFERENCES

A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.

1. DHI - Recommended Locations for Builders' Hardware.
2. NFPA 80 - Standards for Fire Doors and Windows.
3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
4. UL - Building Material Directory.
5. DHI - Door and Hardware Institute
6. WHI - Warnock Hersey
7. BHMA - Builders Hardware Manufacturers Association
8. ANSI – American National Standards Institute
9. IBC - International Building Code Edition as adopted and amended by local building code authorities

1.4 SUBMITTALS

A. Schedules: Submit detailed finish hardware schedule and product data in accordance with section 01 35 00. Furnish a typewritten schedule in **DHI** vertical format complete with catalog cuts. Schedule shall be complete, including, size, type, manufacturers name and number, and finish of each item required. Include complete schedule of keying system.

B. Samples: If requested, submit sample of each type of finish hardware proposed for the project. If approved, samples may be used on project.

C. Templates: Furnish templates required for fabrication of hollow metal doors and frames, aluminum and glass doors, or other items related to hardware

1.5 QUALITY ASSURANCE

A. Hardware supplier shall have a minimum of three years experience in supplying hardware for projects of this size and scope and shall have in his employ a certified Architectural Hardware Consultant (AHC) to prepare submittals and coordinate proper preparation for and installation of hardware. The hardware supplier needs to be an authorized factory stocking dealer of the specified products that are being supplied for the project and in good standings with the factory.

B. Manufacturers and model numbers listed are to establish a standard of quality. Hardware manufacturers that are not listed will need to be prior approved by the architect, provide required data and physical samples and submitted in accordance with Section 01 25 00.

C. Regulatory requirements: Conform to code requirements applicable to fire rated doors and frames and to accessibility for the physically handicapped.

1.6 DELIVERY, STORAGE AND HANDLING

A. Package each item of hardware in original containers and mark each to correspond with heading numbers on the hardware schedule.

B. Include necessary instructions, templates, drawings and fasteners for proper installation.

C. Store off the floor in a clean dry area out of the way of work in progress

1.7 WARRANTY

A. Provide warranty of hardware items for one year.
1. Provide a Thirty-year warranty for door Closers.
2. Provide a Ten-year warranty for door Lever locks.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Catalog numbers of manufacturers listed have been used to establish the quality required. Other manufactures to be prior approved by architect per paragraph 1.5, A.

Hinges	Ives
Locks	Schlage
Closers	LCN
Flat goods	Ives
OH Stops	Glynn Johnson
Cores	Schlage

2.2 MATERIALS

A. Screws and Fasteners: Furnish all exposed fasteners to match item being secured. Make all fasteners of the same material as item being fastened except provide stainless steel or brass for securing aluminum items.

B. Hardware Groups: Please See Drawings

I. Silencers
1. Provide 3 for each single door and 2 for each pair of doors. Not required on door having seals.

K. Thresholds and Weather stripping as shown on drawings

2.3 FINISHES

A. Provide matching finishes for hardware items at each door opening to the greatest extent possible, except as otherwise indicated.

B. Provide finishes which comply with those established by BHMA listed in "Materials and Finishes Standard 1301".

C. Finishes for this project are as shown on drawings

2.4 KEYING

A Key all locks into New master key system in accordance with owner's instructions.

PART 3EXECUTION

3.1 EXAMINATION

A. Examine doors, frames and related items for conditions that would prevent proper application of finish hardware. Do not proceed until defects have been corrected.

3.2 INSTALLATION

A. Install each item in accordance with manufacturer's instructions and recommendations. Set units level, plumb and true to line and location. Do not install surface mounted items until finishes have been completed on substrate.

3.3 ADJUST AND CLEAN

A. At final completion hardware shall be left clean and free from disfigurement. Make a final adjustment to closers and other items of hardware. Where hardware is found defective repair, or replace or otherwise correct as required.

3.4 HARDWARE SETS

A. While the following hardware sets are intended to cover all doors, and establish a type and standard of quality, it is the responsibility of the hardware supplier to examine the plans and specifications and furnish proper hardware for all openings. The hardware supplier shall review the entire specification versus the door schedule and notify the architect of any errors, inconsistencies, or omissions during the bid period.

⸗⸗ = Hardware Item Requiring Electrical Coordination

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HARDWARE GROUP NO. 01

102 103 104

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	CORRIDOR LOCK	L9456T 06A L583-363 L283-722		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4040XP		689	LCN
1	EA	FLOOR STOP	FS436		626	IVE
1	EA	WEATHERSTRIP	8303AA		AA	ZER
1	EA	DOOR SWEEP	111AA		AA	ZER
1	EA	THRESHOLD	8655A-223		A	ZER

HARDWARE GROUP NO. 02

101

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	CONST LATCHING BOLT	FB51P		630	IVE
1	EA	STOREROOM LOCK	ND80TD RHO 14-042		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	WEATHERSTRIP	8303AA		AA	ZER
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	ASTRAGAL	43SP X 188S		SP	ZER
1	EA	THRESHOLD	8655A-223		A	ZER

END OF SECTION

SECTION 09 24 00

STUCCO

1.1 SUMMARY

A. Section Includes: Gypsum board and installation accessories as shown on Drawings and as specified herein.

B. Related Sections:
1. Section 09 29 00 – Gypsum Board

1.2 SYSTEM DESCRIPTION

A. Acoustical Attenuation for Interior Partitions: Comply with STC rating indicated for Partition Types indicated on Drawings and inaccordance with ANSI/ASTM E90.

1.3 SUBMITTALS

A. Product Data: Submit data on gypsum board, joint, finish and accessories.

B. Samples: Submit two (2) samples, minimum 8 inches long each, of each type of decorative reveal, edge trim, wall cap with acoustical gasket, and texture finishes specified.

C. Reports: Submit fire test report for fire rated assemblies and acoustical performance test reports for acoustically-rated assemblies.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in Gypsum Board Systems Work with 2 years documented experience and approved by Manufacturer.

B. Regulatory Requirements: Conform to applicable code for fire rated assemblies as shown on the Drawings.

C. Comply with applicable specification recommendations of GA-216 and GA-600 as published by the Gypsum Association.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with GA-216 and Manufacturer's directions.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:
1. Maintain temperature of installed gypsum board spaces in range of 55 degrees F. to 90 degrees F. until building is entirely closed, in accordance with Gypsum Association GA-220 and GA 236.
2. Ventilate as required to eliminate excessive moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
1. Georgia-Pacific Gypsum (GP) www.buildgp.com
2. Gold Bond Building Products Div., National Gypsum Co. www.nationalgypsum.com
3. United States Gypsum Co. www.usg.com
4. CertainTeed (BPB Gypsum) www.bpb-na.com
5. Pabco Gypsum www.pabcogypsum.com

2.2 GYPSUM BOARD MATERIALS

A. Standard Gypsum Board: ANSI/ASTM C36 or ASTM C1396; 5/8-inch thick, maximum permissible length; ends square cut, tapered edges. Provide sag-resistant type for ceiling applications.

B. Fire Rated Gypsum Board: ANSI/ASTM C36 or ASTM C1396; fire resistive type, UL rated; 5/8-inch, maximum permissible length; ends square cut, tapered edges. Provide sag-resistant type for ceiling applications.

C. Moisture Resistant Gypsum Board: DensArmor Plus Interior Guard moisture, mold and mildew resistant coated glass mat faced gypsum core panels complying with ANSI/ASTM C630 or ASTM C1177, and resistant to mold and mildew per ASTM D3273, as manufactured by G-P Gypsum Corporation; 5/8-inch thick, maximum permissible length; tapered edges. Provide DensArmor Plus Fireguard, 5/8-inch panels where indicated.

D. Flexible Gypsum Board: ANSI/ASTM C36; 1/4-inch thick, maximum permissible length; ends square cut, tapered edges. Provide Gold Bond 1/4 inch High Flex Wallboard, or as approved.

E. Glass-Matt Faced Exterior Gypsum Sheathing Board: As specified in Section 09 29 13 – Exterior Gypsum Sheathing.

F. Shaft Wall: As specified in Section 09 21 19 – Gypsum Board Shaft Wall Assemblies.

G. Ceramic Tile Backer Board: As specified in Section 09 30 00 - Ceramic Tile.

2.3 ACCESSORIES

A. Adhesive: ASTM C557.

B. Acoustical Sealant: As specified in Section 07 92 19 – Acoustical Sealants.

C. Corner Beads: GA216; Type CB; electro-galvanized steel.

D. Edge Trim: GA216; Type L or J bead; electro-galvanized steel and Type LC rolled-formed zinc. Milcore No. 66 J-metal edge, or as approved by Architect, where indicated at unfinished gypsum board edges against other finish materials.

E. Control Joint: No. 093, roll-formed zinc, as manufactured by U.S. Gypsum, Unimast, or Dietrich.

F. Wall End Caps: Aluminum break metal wall end cap formed from break metal specified in Section 08 44 13. Form to tightly fit finished wall thickness shown, with leg lengths as detailed, finish to match specified aluminum window wall.

G. Resilient Acoustical Gaskets (Gypsum Board Wall to Exterior Aluminum Window Wall Interface Gasket): “Acousti-Gasket” acoustical gasket tape, viscoelastic cellular rubber reinforced with solid rubber particles bonded to cellulose with peel and stick back, 5/16 inch thick x 1-1/2 inch width, as manufactured by Acoustical Surfaces, Inc. www.acousticalsurfaces.com

H. Joint Materials: ANSI/ASTM C475; reinforcing tape, joint compound, adhesive, water, and fasteners. For coated board and gypsum sheathing, use material recommended by Board Manufacturer.
1. Use 2 inch wide 10 x 10 glass mesh tape at moisture resistant gypsum board.
2. Use only setting type joint compound at moisture resistant gypsum board.

I. Screws: ASTM C1002 for steel drill screws. Type G for fastening to gypsum board, Type S for fastening to light gauge steel framing and Type W for fastening to wood framing.

J. Wall Texture: As manufactured by USG, multi-purpose, pre-packaged, non-asbestos type.

K. Drywall Primer:
1. Paint material specifically formulated to fill the pores and equalize the suction difference between gypsum board surface paper and the compound used on finished joints, angles, fastener heads and accessories and over skim coatings.
2. Drywall primer which is applied to the finished surface of the work specified in this section shall be provided as specified under Sections 09 91 00 and 09 72 00 as applicable.
3. A good quality, white latex drywall primer formulated with high binder solids, applied undiluted, and shall be applied to gypsum board surfaces prior to the application of texture materials.

L. DrywallPrimer-Surfacer: Acceptable products:
1. Sheetrock brand Tuff-Hide primer surfacer, USG Corporation www.usg.com

M. Expanded Metal Security Mesh: As specified in Section 05 50 00.

N. Acoustical Putty/Pads: Lowry’s electrical box pads, Harry A Lowry & Associates www.halowry.com

PART 3 EXECUTION

3.1 INSPECTION

A. Verify that site conditions are ready to receive Work and opening dimensions are as instructed by the Manufacturer.

B. Beginning of installation means acceptance of substrate.

3.2 GYPSUM BOARD INSTALLATION

Install gypsum board in accordance with GA-201, GA-216, and ASTM C840 and Manufacturer's instructions as applicable

A. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.

B. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.

C. Ceiling Boards:
   1. Install gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Use screws when fastening gypsum board to metal framing.

E. Double and Multi-Layer Applications:
   1. Place first layer perpendicular to framing or furring members.
   2. Use fire rated gypsum board for fire rated partitions.
   3. Place second layer perpendicular to first layer.
   4. Offset joints of second layer from joints of first layer.
   5. Do not glue laminate. Screw successive layers of wallboard to framing members only; use screws of sufficient length to penetrate framing members and assure a permanent solid connection thereto.

F. Flexible Gypsum Board - Double Layer Application:
   1. Apply stop to one end of the concave curved wall to resist strain.
   2. Apply pressure to the unrestrained end of the board forcing the field of the gypsum board into firm contact with theframing.
   3. Fasten gypsum board working from the “stopped” end or edge.
   4. Hold gypsum board in firm contact with framing members while fastening.
   5. Offset joints of second layer from joints of first layer.
   6. Secure second layer through first layer to framing in same manner as first layer.

G. Direct Bonding To CMU or Concrete: Where gypsum board is indicated to be applied directly to CMU or concrete wall substrate, comply with gypsum board Manufacturer’s recommendations for application of adhesive, and temporarily brace or fasten gypsum panels until fastening adhesive has set.

H. Expanded Metal Security Mesh: Install expanded metal security mesh over first layer of gypsum board with security type attachment clips at a maximum of 12 inches center to center at each stud location. Adjacent panels shall be staggered and butted over stud location.

I. Treat cut edges and holes in moisture resistant gypsum board with sealant.

J. Place control joints consistent with lines of building spaces as indicated on Drawings and as recommended by Board Manufacturer.

K. Gypsum Board Wall to Aluminum Window Wall Interface: Install wall end caps and acoustical gasket tape at interface with vertical mullion of exterior window wall to

assure acoustical seal.

1. Remove release paper from acoustical gasket tape and adhere to wall end cap vertically centered on aluminum window wall vertical mullion. Install tape in continuous one-piece length without gaps.

Install end cap tight against mullion with acoustical gasket compressed

1. Assure cap is installed plumb and centered on mullion, or as otherwise shown on Drawings.
2. Install metal stud wall framing specified in Section 09 22 16 and gypsum board panels as specified herein, with gypsum board wall construction tightly fitted to installed end cap.
3. Install acoustical sealant as specified below in addition to acoustical gasket tape to assure acoustical seal at wall interface with aluminum window wall.
4. Alternate construction method may be used provided acoustical gasket and end caps are installed tight to aluminum window wall frame as detailed.

B. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials. Use J-metal edge where indicated at unfinished gypsum board edges against other finish materials.

3.2 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. Taping, filling, and sanding is not required at surfaces behind ceramic tile.

3.3 ACOUSTICAL WALLS AND TREATMENT

A. Install gypsum board in accordance with manufacturer's requirements to achieve required acoustical design rating at ceiling and walls. All gypsum board shall be screwed. Nailing of gypsum board will not be accepted.

B. Vertical and Horizontal Application: Gypsum drywall shall be applied with the long edge parallel to the framing members. All joints shall occur over framing members. Screw edge and field spacing shall be in accordance with the drywall manufacturer's recommendations. All screws shall penetrate studs or resilient channels, as shown. The number and type of screws used by the manufacturer to meet requirements shall be used by the Contractor.

C. Multiple Layers: Where multiply layers of gypsum wallboard occur, do not glue laminate. Screw successive layers of wallboard to framing members only; use screws of sufficient length to penetrate framing members and assure a permanent solid connection thereto.

D. Staggered Joints: Stagger all joints of gypsum drywall where multiple layers occur. Minimum distance between joints of staggered layers shall be equal to the typical distance between framingmembers.

E. Taping and Finishing: Where single layer of gypsum wallboard occurs, tape all joints. Where multiply layer of wallboard occur, tape outer joints only. Fire tape outer layer only of all gypsum wallboard above the ceiling line. All taping and finishing shall be executed

in accordance with the drywall manufacturer's recommendations.

F. Mechanical Contact Between Wall Sections: When more than one set of studs is used in a partition, there shall be no mechanical or structural contact between the various partition wall sections, except as indicated in the Drawings.

Wall Penetrations: Avoid all wall penetrations wherever possible. Any unavoidable penetrations of the gypsum wallboard by piping, conduits, ducts, etc. shall be done in accordance with the Drawings and in such a manner as to maintain the sound and vibration control characteristics inherent in the basic wall or ceiling being penetrated

A. Gypsum board gaps at the base, head and sides of the wall shall be no greater than 1/4 inch.

B. Install acoustical sealant in accordance with Manufacturer's instructions and Section 07 92 19.

C. Install acoustical sealant at gypsum board perimeter at:
1. Metal framing: Two beads.
2. Base layer of double layer applications, if applicable.
3. Face layer.
4. Seal all around all gypsum board penetrations by conduit, pipe, ductwork, and rough-in electrical/telephone boxes, etc.

D. Install acoustical sealant where gypsum board joins other walls or surfaces at sound control partitions.

E. Provide acoustical putty or putty pads around all electrical boxes and other penetrating items in all acoustically rated walls or walls with acoustical insulation as detailed.
1. Clean electrical boxes and other surfaces to receive acoustical putty or putty pads in accordance with Manufacturer’s instructions prior to application.
2. Place and mold material completely around back and side of box and fold around conduit entering box.

3.2 FINISHING OF GYPSUM BOARD SURFACES

A. Provide finish of gypsum board surfaces in accordance with the Gypsum Association "Recommended Specification: Levels of Gypsum Board Finish" as follows as noted on Room Finish Schedule:
1. Level 0 (Temporary Construction): No taping, finishing, or accessories required.
2. Level 1 (Fire Taping at plenum areas above ceiling, in attics, in areas where the assembly will be concealed or in building service corridors and other areas not normally open to public view):
a. Joints and interior angles shall have tape embedded in joint compound.
b. Surface shall be free of excess joint compound.
c. Tool marks and ridges are acceptable.
3. Level 2 (Water resistant gypsum backing for tile) (Areas to receive ceramic, stone or glass tile, stone wall panels, applied wall panels, wood paneling, applied products, etc., except where product being installed requires a higher level of finish.):
a. Joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating joint compound over joints and interior angles.

b. Fastener heads and accessories shall be covered with a coat of joint compound.
c. Surface shall be free of excess joint compound.
d. Tool marks and ridges are acceptable.
e. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.

2. Level 3 (Utility, Equipment, Mechanical, Janitor Rooms, and Similar Spaces) (Appearance areas to receive heavy or medium texture (spray or hand applied) finishes before final painting, or where heavy grade wallcoverings are to be applied as final decoration. This level of finish is not to be used where smooth painted surface or light to medium wallcoverings are to be applied.):
   a. Joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over joints and interior angles.
   b. Fastener heads and accessories shall be covered with 2 separate coats of joint compound.
   c. Joint compound shall be smooth and free of tool marks and ridges.
   d. Surface to be coated with Drywall Primer as specified herein prior to application of texture.
   e. Untextured surfaces to be coated with Drywall Primer prior to application of final finishes as specified in Sections 09 91 00 and 09 72 00, as applicable.
3. Level 4: Typical finish for all BOH, Office, and Similar Employee areas unless otherwise indicated on Drawings or indicated to receive gloss or semi-gloss paints. (Appearance areas to receive flat paints, light texture, or where backed wall coverings are to be applied. This level of finish is not to be used where gloss, semi-gloss and enamel paints are to be applied):
   a. Joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over flat joints and one separate coat of joint compound applied over interior angles.
   b. Fastener heads and accessories shall be covered with 3 separate coats of joint compound.
   c. Joint compound shall be smooth and free of tool marks and ridges.
   d. Surface to be coated with Drywall Primer as specified herein prior to application of texture.
   e. Untextured surfaces to be coated with Drywall Primer prior to application of final finishes as specified in 09 91 00 and 09 72 00, as applicable.
4. Level 5: (Typical finish for all Casino, Restaurants, Bars, Food Courts, Retail, Hotel Lobby, Guestrooms and Suites, Spa, and similar public spaces unless otherwise indicated. (Appearance areas to receive gloss, semi-gloss, enamel, or non-textured flat paints where severe lighting conditions occur):
   a. Joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over flat joints and one separate coat applied over interior angles.
   b. Fastener heads and accessories shall be covered with 3 separate coats of joint compound.
   c. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface to fill imperfections in the joint work, smooth the paper texture and provide a uniform surface for decorating. Excess compound shall be

immediately sheared off, leaving a film of skim coating compound completely covering the paper.

d. The surface shall be smooth and free of tool marks andridges.

e. Surface to be coated with Drywall Primer as specified herein prior to application of texture.

f. Untextured surfaces to be coated with Drywall Primer prior to application of final finishes as specified in Sections 09 91 00 and 09 72 00, as applicable.

L. Level 5 Option: A drywall primer-surfacer may be used in lieu of a skim coat level 5 of joint compound and paint primer.

1. Prepare wall surface to a level4 finish.
2. Spray apply the drywall primer-surfacer over the entire surface after joints have been properly treated to the level 4 finish.
3. Apply the primer-surfacer at a thickness and method per Manufacturer's recommendations.

M. Surfaces shall be free of dust, dirt and oil and shall received Drywall Primer before application of texture or skim coat as required by the manufacturer of the texture or skim coat materials.

N. Surface Finish: Produce surface finish to match approved sample, type as indicated below.

1. Casino, Restaurants, Bars, Food Courts, Retail, Hotel Lobby, Guestrooms and Suites, Spa, and similar Public Spaces: Smooth finish typical, unless otherwise indicated to receive textured and/or specialty finishes as indicated on Interior Drawings and Specifications.
2. Back-of-House, Offices, Mechanical, Utility, equipment, Janitor Rooms and Similar Areas: Light knock-down or medium orange-peel texture as approved by Architect, unless otherwise indicated on Drawings.

O. Do not wash joint compound or wall finish materials down site drains.

3.3 CLEANING

A. After completion of wallboard installation, taping and texturing, remove rubbish, excess material and equipment from building and job site, leaving floors and other surfaces clean.

B. Remove overspray from adjoining construction.

C. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

3.4 PROTECTION

A. Protect Work from damage until acceptance.

B. Repair or replace damaged Work.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Rough Carpentry – Section 06 10 00

B. Painting - Section 09 91 00.

1.02 SUBMITTAL

A. Manufacturer's literature, indicating material to be supplied, and conformance with specification.

B. Sample panel for texture approval.

1.03 DELIVERY, HANDLING AND STORAGE

A. Deliver, store and stack wallboard such that long lengths are not stacked over shorter lengths.

B. Handle to avoid damage or breakage.

C. Tape and joint compounds shall be in manufacturer's new, unopened containers.

1.04 JOB CONDITIONS

A. Environmental:

1. During cold weather, areas receiving wallboard installation should be maintained between 50 degree F and 70 degree F for 24 hours before, during and after wallboard and joint treatment.

B. Ventilation:

1. Provide ventilation during joint applications.

2. Allow additional drying time for coats of joint treatment during slow drying period.

C. Systems:

1. Contractor shall use the products of one manufacturer so as to provide one responsibility of performance on those items approved in writing by the board manufacturer.

PART 2 - PRODUCTS

2.01 GYPSUM WALL AND CEILING BOARD

A. Shall be tapered rounded edge gypsum board in lengths as long as practical to minimize the number of joints and shall be the following types and thickness:

1. General: 5/8-inch all areas, ASTM C36, type "X" fire code.

2. Wet Areas: 5/8-inch water-resistant, ASTM C63 and ASTM C36 type "X" fire code.

2.02 STUDS AND SUPPORTS

A. Regular Partitions: wood studs, refer to Section 06 10 00

2.03 FASTENERS

A. Screws:

1. Self-drilling, self-tapping, bugle head type W for wallboard to wood application.

2. Lengths:

a. Single Layer or Base Layer: Type W, 1-1/4-inch.

2.04 JOINT TREATMENT

A. Joint Tape: ASTM C475, Ready mix compounds.

B. Joint Compound: ASTM C475, Ready mix compounds.

2.05 TRIM ACCESSORIES

A. Metal Edge Trim: U.S. Gypsum No. 801-A or approved equal.

B. Metal Corner Bead: U.S. Gypsum No. 800 or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Erection shall be in strict accordance with system manufacturer's printed instructions and as specified.

3.02 PARTITION FRAMING

A. Align all partitions accurately according to the partition layout.

3.03 ERECTION OF GYPSUM WALLBOARD

A. Basic Single Layer System, Treated Joints:

1. All ends and edges of all gypsum wallboard shall occur over framing members, except when joints are at right angles to framing members as in horizontal application or when the end joints are to be back-blocked except

as specified for water resistive and wallboard under ceramic tile.

2. Apply wallboard first to the ceiling and then to the walls. Ceiling board shall extend into corners. To minimize end joints, use wallboard of maximum practical lengths. Boards shall be brought into contact, but shall not be forced into place. Where ends or edges abut, they shall be neatly fitted. Stagger end joints. Joints on opposite sides of a partition shall be so arranged as to occur on different studs.

3. Attach wallboard to framing supports by power driven screws. Space fasteners not less than 3/8-inch from edges and ends of wallboard. Stagger screws on adjoining edges or ends. While the fasteners are being driven, hold the wallboard in firm contact with the underlying support. Proceed from center toward ends and edges.

   a. For vertical single-layer wallboard application space 1-1/4 inch Type W screws in maximum of 12" o/c. in the filed of the board and 8" o/c. along abutting edges.

   b. For horizontal single-layer wallboard application, space 1-1/4 inch Type W screws a maximum of 12" o/c. in field of board and 8" o/c. along abutting end joints.

4. Back-blocking of ceiling end joints is recommended when construction occurs during adverse job or weather conditions. Float end joints between furring channels and back-block joint with a continuous 8-inch face panel strip adhesively applied, or screw attach floated ends to a 5 foot channel centered over joint.

5. Isolate gypsum panel surfaces with control joints or other means where (a) partition abuts a structural element (except floor) or dissimilar wall or partition or other vertical penetration; (b) construction changes within the plane of the partition or ceiling (c) partition run exceeds 30 feet; (d) ceiling dimensions exceed 50 feet in either direction; (e) the area within separate ceiling sections exceeds 2,500 square feet; (f) wings of "L", "U" and "T"-shaped ceiling areas are joined. Door frames may be used as control joints if control joints extend to ceiling from both corners.

6. Penetrations of the gypsum panel diaphragm, such as door frames, borrowed light openings, vents, grilles, access panels and light troffers, require additional reinforcement at the corners to distribute concentrated stresses if a control joint is not used.

B. Water Resistant Gypsum Wallboard:

1. Provide appropriate blocking, headers, or supports to receive toilet room accessories, wall bumpers, or similar items as may be required. Install suitable blocking between the studs. Place one row of horizontal blocking at location required between base and ceiling for support of horizontal wallboard joint where ceramic tile is scheduled.

2. Use water-resistant wallboard in toilets, janitor and storage rooms, at exterior soffits, and where noted or scheduled.

3. Fasten wallboard with screws 8" o/c. maximum.

4. All cut edges, utility holes and joints, including those at all angle intersections, shall be treated with water-resistant sealant before installation. Treat all fastener heads with sealant after installation.

5. In areas to be tiled, do not tape joints or angles with conventional wallboard joint systems.

6. Prior to the erection of tile, caulk all openings around pipes, fixtures, etc., flush with waterproof, non-hardening sealant.

3.04 ACCESS PANELS

A. Install access panels specified in DIVISION 22 and 23. Panels similar to Milcor, size as required for concealed expansion joints, valves, traps, pilot stations and similar items requiring accessibility. Panels shall be proper type for ceiling or wall in which they are installed.

3.05 JOINT TREATMENT

A. Treatment of joints and screw heads with joint compound may be omitted where gypsum panels serve as a base for adhesively applied acoustical tile.

B. Application – Pre-fill:

1. Mix joint compound according to the directions on the bag. Do not over mix or use extremely cold water or cold joint compound.

2. Pre-fill all "V" grooves formed by abutting, rounded edges of sheetrock with joint compound. Apply a flexible 5-inch or 6-inch joint finishing knife or Ames Pre-fill tool. Fill the "V" joint flush and wipe away any excess compound beyond the "V" group, leaving a clear depression to receive tape. Allow the pre-fill to harden before the next application.

C. Application – Joint Treatment:

1. Mix joint compounds in strict accordance with manufacturer's recommendations.

2. Taping or Embedding: Apply joint compound in a thin uniform layer to all joints and angles to be reinforced. Apply reinforcing tape immediately centered over the joints and seated into the compound. Sufficient compound approximately 1/64 inch x 1/32-inch must remain under the tape to provide proper bond. A skim coat shall immediately follow tape embedment but not to function as a fill or second coat. Properly fold and embed tape in all angles to provide a true angle. The tape or embedding coat must be thoroughly dry before application of the fill coat.

3. Filling: Apply compound over the embedding coat, filling the board taper flush with the surface. The fill coat shall cover the tape and father out slightly beyond the tape. On joints with no taper, the fill coat shall cover the tape

and father out at least 4-inches on either side of the tape. No fill coat is necessary on interior angles. The fill coat shall be thoroughly dry before application of the finish coat.

4. Finishing: Spread joint compound evenly over and extended slightly beyond the fill coat on all joints and feather to a smooth uniform finish. Over tapered edges, the finished joint shall not protrude beyond the plane of the surface. All taped angles shall receive a finish coat to cover the tape and taping compound, providing a true angle. Where necessary, sand between coats and following the final application of compound to provide a smooth surface ready for decoration.

5. Filling and Finishing of Fastener Depression: Apply a taping or all-purpose compound as the first coat to all fastener depressions. Follow this with a minimum of 2 additional coats of all-purpose compound, leaving all depressions level with the plane of the surface.

6. Application of Corner Reinforcement: Use taping or all-purpose compound to apply and embed the paper flanges.

7. Finishing Beads and Trim.

   a. Fill Coat: Apply joint compound to all bead and trim and properly feather out from the ground to the plane of the surface. The compound shall be thoroughly dry prior to the application of the second fill coat.

   b. Second Fill Coat: Apply joint compound in the same manner as the first fill coat and extend slightly beyond onto the face of the board. The compound must be thoroughly dry prior to application of the finish coat.

   c. Finish Coat: Apply joint compound to all bead and trim extending slightly beyond the second fill coat and properly feathered from the ground to the plane of the surface. The finish coat shall be sanded as necessary to provide a flat smooth surface ready for texturing.

   d. Treat all internal and external angles formed by the intersection of either wallboard surfaces or other surfaces with metal trim or a joint system in accordance with the drawing details.

   e. All vertical or horizontal external corners shall have reinforcement applied in accordance with manufacturer's directions.

8. All vertical or horizontal intersection of gypsum wallboard with concrete masonry units, window and door frames or other dissimilar materials shall be made with metal trim. Joints shall be caulked.

9. Control Joints: Break panel joint and back by double framing members. Attach control joint to face layer with screws or 9/16-inch galvanized staples spaced 6-inch o/c. on both flanges along entire length of joint. Add 2-inch wide gypsum panel strip behind joint to maintain integrity of fire rated partitions and floor-ceiling assemblies.

3.06 SURFACE FINISHING

A. Surface Finish: Smooth.

B. Surface Preparation: All surfaces, including joint compounds and patching treatment, must be dry, clean and sound. Drywall joints fastener heads must be properly treated. Smooth scratches and scuffs; dull glossy surfaces. Prime exposed metal with a rust-inhibiting primer. Apply a primer-sealer and allow to dry prior to texturing. When using all-purpose joint compounds for texturing, use an oil-based primer-sealer.

C. Mixing: Mix joint compound to a consistency approximating that used for hand taping.

D. Skim Coat Application: Using a trowel, broad knife, or long nap texture roller, apply only sufficient amounts of joint compound to cover the drywall surface. Then immediately wipe the compound as tightly as possible over the panel surface using a trowel or broad knife. During cold weather maintain temperature range between 55 degrees F. and 70 degrees F. for twenty-four hours before, during, and after gypsum wallboard, joint treatment, and skim coat application.

End of Section

SECTION 09 30 13

PORCELAIN TILE

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Gypsum Drywall Systems - Section 09 29 00.

1.02 QUALITY ASSURANCE

A. Install tile, trimmers, and grout in accordance with applicable installation methods as described in the "Tile Council of America Handbook for Ceramic Tile Installations".

1.03 SUBMITTALS

A. Complete list of materials and methods intended for use.

B. Sample of tile for color and finish.

1.04 DELIVERY, HANDLING AND STORAGE

A. Deliver, store and handle materials to prevent inclusion of foreign matter and/or water to prevent damage.

B. Material shall be delivered to job site in manufacturer's unopened containers.

1.05 EXAMINE SURFACES TO RECEIVE TILE

A. All surfaces to be dry, clean, free of oil or waxy films, firm, level and plumb. Do not proceed until satisfactory provisions have been made.

1.06 STARTING OF WORK

A. Starting of work will imply acceptance of surfaces to receive tile within the limits established in the Specification section.

1.07 CONDITIONS

A. Tile shall be installed only when weather and/or building temperature is 50 degrees F or above. Adhesives used at lower temperatures shall only be allowed with manufacturer's specific instructions.

PART 2 - PRODUCTS

2.01 BOND COAT

A. Sand - Portland Cement Mortar with HYDROMENT Acrylic Latex or Mortar Admixture or approved equal.

2.02 GROUT

A. Sand - Portland Cement Grout with HYDROMENT Acrylic Latex Grout Additive or approved equal.

2.03 PORCELAIN TILE

A. WALL TILE: At locations shown, all tile to be Color Code: DR09 -Notable Beige, Series Dignitary, as manufactured by Daltile or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Install wall tile in accordance with the Tile Council of America Installation Method W243-18. Comply with applicable parts of ANSI 108 Series of tile installation. Consult with product manufacturers for specific instructions.

B. Install floor tile in accordance with the Tile Council of America Installation Method F113-18. Comply with applicable parts of ANSI 108 Series of tile installation. Consult with product manufacturers for specific instructions.

3.02 PROTECTION

A. Leave finished installation free of cracked, chipped broken, unbonded or otherwise defective tile work.

End of Section

END OF SECTION

SECTION 09 77 33

FRP WALL PANELS

PART 1 GENERAL

1.1 SUBMITTALS

A. Product Data: Manufacturer's Specifications and installation instructions for each material and accessory.

B. Submit Manufacturer's full range of color and pattern samples of wall panels and trim pieces for Architect's selection. Submit two samples of selected products.

C. Submit cleaning and maintenance instructions in accordance with Section 01 77 00.

1.2 DELIVERY, STORAGE AND HANDLING

A. Deliver materials clearly labeled to identify Manufacturer, brand name, quality or grade and fire hazard classification.

B. Store horizontally in original undamaged packages.

1.3 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Install materials when temperature and humidity conditions approximate conditions that will exist when building is occupied.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Furnish products of one of the specified Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements.
1. Crane Composites, Inc. (Kemlite), Channahon, IL (800) 435-0080 www.kemlite.com
2. Marlite, Inc., Dover, OH (303) 343-6621 www.marlite.com

2.2 MATERIALS

A. FRP Panels: Fiberglass reinforced plastic panels complying with the following:
1. Class: Class I (A) FR panels.
2. Thickness: 0.090.
3. Texture: Embossed texture.
4. Color: As indicated on Interior Drawings and Specifications.

B. Adhesive for panel installation: Manufacturer's recommended type for use with selected materials, waterproof, mildew resistant nonstaining type.

C. Edge Sealant: Type "E" clear mildew resistant silicone sealant as specified in Section 07 92 00, or mildew resistant sealant recommended by manufacturer for sealing panel edges and moldings.

D. Moldings: All molding shall be 1-piece vinyl of the following types, color to match FRP.
1. Panel Edges: "J" type Cap molding.
2. Panel to Panel: "H" type Division Bar molding.
3. Inside Corner: "J" type Inside Corner molding with radius edge.
4. Outside Corner: "J" type Outside Corner molding with extended leg.
5. Ceiling: "J" type Ceiling molding with radius edge, or use inside corner molding.

E. Fasteners: Manufacturer's standard nylon drive pins.

F. Miscellaneous Items: Furnish and install supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation whether or not specified or indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
1. Examine substrate and conditions under which the material is to be installed.
2. Verify that surfaces, when tested with moisture meter, have proper moisture content.
3. Verify that nails and screws are recessed, with joints and depressions taped, finish and sealed.
4. Remove contaminants from areas to be covered.
5. Do not proceed with Work until Work of other Trades which passes through wall covering has been completed and unsatisfactory conditions have been corrected.
6. Start of Work indicates acceptance of responsibility for performance and any required remedial Work.

3.2 INSTALLATION

A. Install panels in accordance with Manufacturer's printed instructions using full sheet mastic coverage method plus nylon fasteners.

B. Make joints with 1/8 inch space for expansion and use moldings designed for each condition for the Project.

C. Bevel back edges of panels with block plane to permit proper fit into moldings.

D. Place a continuous bead of sealant in the receiver channel of all moldings immediately prior to installation of FRP panels. Place continuous bead of sealant at all edges and tool to smooth, slightly concave shape.

E. If one end of panel must be mechanically fastened, do not fasten the other end.

F. Remove plumbing escutcheons, switchplates, wall plates, and surface-mounted fixtures, and cut wall paneling evenly to fit. Replace items after completion of Work.

G. Where applicable, install paneling before installation of plumbing, casings, bases, cabinets and other items to be applied over paneling.

3.3 CLEANING

A. Remove excess adhesive and smudges with soft cloth and mineral spirits.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.01 SCOPE

A. This section includes surface preparation, painting and finishing of exposed interior and exterior items and surfaces.

B. Furnish extra materials matching products installed and equaling 2% or 5 gallons, whichever is greater, of each color and type of paint installed. Identify with appropriate labels.

1.02 WORK INCLUDED

A. Painting shall include and not be limited to emulsions, enamels, paints, varnishes and sealers.

B. It is the intent of these specifications to secure a completely finished paint job in accordance with the best usual practices.

C. All surfaces exposed in the finished work, except surfaces and areas specified not bed painted with an appropriate finish even though not specifically mentioned herein.

D. Gray prime coated material, whether baked or not is not to be construed as a finish coat.

E. The color selection shall be of unlimited paint colors for interior painted surfaces. The placement of colors shall be selected by the Architect during the submittal process.

1.03 QUALITY ASSURANCE

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:

1. The Owner will engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the Contractor.

2. The testing laboratory will perform appropriate tests for the following characteristics as required by the Owner:

a. Quantitative materials analysis.

b. Abrasion Resistance.

c. Apparent reflectivity.

d. Flexibility.

e. Washability.

f. Absorption.

g. Accelerated weathering.

h. Dry opacity.

i. Accelerated yellowness.

j. Re-coating.

k. Skinning.

l. Re-coating.

m. Skinning.

n. Color retention.

o. Alkali and mildew resistance.

p. Adhesion.

B. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove non-complying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

C. Field quality control:

1. Request review of first finished room, space, or item of each color scheme required by Architect for color, texture, and workmanship.

2. Use first acceptable room, space or item as project standard for each color scheme.

3. For spray application paint surface not smaller than 100 square feet as project standard.

1.04 SUBMITTALS

A. Submit six (6) copies of the manufacturer's descriptive literature, including Material Safety Data Sheets (MSDS) and color selection charts. Submittal must state volatile organic compound (VOC) emissions for each paint and coating to be used.

B. Color samples: Make samples not less than 12 inches square and prepare at the project site on hardboard. Submit in duplicate.

1.05 DELIVERY, HANDLING AND STORAGE

A. Deliver unopened sealed containers with labels legible and intact.

B. Store only acceptable project materials on project site in a suitable location. Restrict storage to paint materials and related equipment. Comply with applicable health and fire regulations.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Comply with manufacturer's recommendation as to environmental conditions under which coatings and coating system can be applied.

B. Do not apply finish in areas where dust is being generated.

C. Lighting: Provide not less than 20 foot candles illumination for all surfaces to be painted or coated.

D. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Paint materials shall be as manufactured by Sherwin Williams, Series 200, or manufacturers that are equal or superior to those specified.

Dunn Edwards	Pittsburgh Paints
DeVoe and Raynolds, Co.	Dutch Boy
Benjamin Moore & Co.	Glidden Paint Co.
Cabot Stains	Sinclair Paint Co.
Olympic Stains	

B. Paint shall be well ground, shall show easy brushing properties, and shall be of such composition that it can be easily broken up with a paddle to a smooth consistency. The paint shall neither settle badly nor cake in the containers. It shall be suitable for spraying when thinned with not more than 12 percent by volume. Percentages referred to herein are by weight unless specified elsewhere.

C. Materials selected for coating systems for each type surface shall be the product of one manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES

A. General:

1. Hardware, hardware accessories, plates, lighting fixtures and similar items in place prior to painting shall be removed during operations and repositioned upon completion of each space.

2. Except as otherwise specified, all surfaces to be painted shall be clean,

smooth, dry and free from dust, grit and frost.

3. The moisture content of wood shall not exceed 12 percent at the time paint is applied.

4. All work shall be done in a workmanlike manner, leaving the finished surfaced free from drops, ridges, waves, laps and brush marks.

5. Paint shall be applied under dry and dust-free conditions.

6. All primer and intermediate coats of paint shall be unscarred and completely integral at the time of application of each succeeding coat.

7. Sufficient time shall be allowed between coats to insure proper and thorough drying.

8. Paints shall be thoroughly stirred and kept at a uniform consistency during application and shall not be thinned in excess of the printed directions of the manufacturer. Paint containers shall not be opened until required for use.

9. Floors, roofs and other adjacent work shall be properly protected by drop cloths or other covering.

B. Metal Work: Shop-primed metal work shall be kept clean and free from corrosion following installation. Abraded surfaces shall be re-touched prior to finish painting, using the same type of paint as the priming coat.

C. Wood Work: All millwork shall be sandpapered before application of the primer sealer. All interior surfaces of doors, drawers, and interiors shall be finished.

D. Puttying: After the priming coat has been applied, nail holes, cracks, and other depressions shall be filled with putty, colored to match the finish coat, and sandpapered smooth. Putty shall be dry before subsequent painting.

E. Drywall: Shall be thoroughly dry, clean and free from grit.

3.02 PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the condition of the building in his charge.

B. He shall protect all adjacent work and materials from soiling or damage.

3.03 INSPECTION

A. Every facility shall be provided for inspection at all reasonable times.

B. Any work not conforming to these specifications shall be cleaned and repainted at the expenses of the painting contractor.

3.04 COMPLETION

A. At completion, damaged or defaced finish shall be touched up, restored in first-class condition.

B. Painted or finished surfaces damaged in fitting or erection shall be restored.

C. Touch-up shall be without perceptible difference in hue between the touch-up and the preceding coat.

D. In the event the touch-up does not match the coating in color, all surfaces in the area or room of that color shall be repainted to a uniform color.

3.05 REMOVAL

A. The Contractor shall remove all surplus materials, scaffolds, etc., from the premises and shall clean off all misplaced paint, stain, etc., to leave the premises clean.

3.06 PAINT SCHEDULE

A. This schedule is intended to cover items to be painted but does not limit the Contractor from painting all materials that normally and reasonably require paint. Where color numbers or designations are utilized on the drawings, these numbers refer to Dunn-Edwards and colors shall match Dunn-Edwards chips or designations. Prime and second coat shall be tinted to differentiate from final coat.

B. Interior Surfaces:

1. Drywall Surfaces (Dry):

1 coat Wall prime and sealer
2 coats Egg Shell Alkyd Enamel

2. Drywall Surfaces (Wet):

1 coat Wall primer and sealer
2 coats Semi-gloss Alkyd enamel

3. Metal Surfaces:

2 coat Metal primer (unless shop coated or previously painted)
2 coats Alkyd enamel

C. Plumbing, Heating and Electrical Items: Where exposed in finished areas, all plumbing, heating and electrical items not provided with approved factory finish shall be painted by the contractor, including all exposed piping, grills ducts, raceways, conduit, etc. Pipe insulation shall be given one coat of sizing before painting. Items shall be painted colors as selected by the Architect, and in the manner specified for painting on metal. Throats of ducts behind all grills and registers shall be painted with two coats of alkyd enamel paint to limit of vision. Paint for electrical and mechanical items shall be special heat-resistant type, as manufactured for such use.

End of Section

SECTION 09 95 00

PREFINISHED WALL PANELS

PART 1 - GENERAL

1.01 SCOPE

A. Furnish all labor, materials, equipment, and services necessary for the installation of pre-finished fiberglass reinforced plastic (FRP) wall panels for decorative and/or sanitary environments, locations as noted in the Contract Drawings.

B. Related work in other areas.

1. Gypsum Board – Section 09 29 00.

2. Plumbing – Division 22.

3. Electrical System – Division 26.

1.02 REFERENCES

A. ASTM D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

B. ASTM D570 – Standard Test Method for Water Absorption of Plastics.

C. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.

D. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

E. ASTM D2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

F. ASTM D5319 – Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.

G. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Submit manufacturer's product data, installation instructions, and material safety data sheets (MSDS).

B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns

and textures. Indicate location and dimension of joints and fastener attachment.

C. Samples: Submit selection and verification samples for finishes, colors and textures of each type of panel, trim and fastener.

D. Quality Assurance/Control Submittals:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

2. Certificates:

a. Submit manufacturer's certificate that products meet or exceed specified requirement.

b. Submit certificate of installer's qualifications.

1.04 QUALITY ASSURANCE

A. Utilize an installer having demonstrated experience on projects of similar size and complexity, with a minimum of five (5) years experience.

B. Conform to ASTM E84 for interior finish for smoke and flame spread requirements meeting Class A material.

1.05 DELIVERY, HANDLING AND STORAGE

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1. Store panels indoors, under cover, and protected from the elements.

2. Lay panels flat – do not stand panels on edge.

3. Protect panels from moisture.

4. Do not store panels in contact with the floor or against an outside wall.

C. Remove foreign matter from face of panel by using a soft bristle brush, avoiding abrasive action.

1.06 ENVIRONMENTAL CONDITIONS

A. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation and residual moisture from plaster, concrete or terrazzo has dissipated.

B. Panels should be allowed to acclimate to a room temperature of 70°F for 48 hours prior to installation.

C. Provide ventilation to disperse fumes during application of adhesives as recommended by the adhesive manufacturer.

D. Field Measurement: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.07 WARRANTY

A. Submit, for the owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights the owner may have under the contract documents.

1. The warranty period shall be for one (1) years commencing on date of Substantial Completion.

PART 2 - MATERIALS

2.01 MANUFACTURER

A. Decorative and sanitary wall panels shall be as manufactured by Marlite, 202 Harger Street, Dover, Ohio, 44622, (330) 343-6621, or approved equal.

B. All wall panel materials and accessories shall be provided from a single source manufacturer.

2.02 MATERIALS

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D5319. Front finish color shall be determined by the Owner.

1. Standard FRP: white, pebble surface texture.

2.03 ACCESSORIES

A. Adhesive: Provide panel adhesive as recommended by panel manufacturer. Adhesive shall meet VOC requirements of Section 07950.

B. All trim shall be heavy weight extruded aluminum, 6063-T6 alloy, pre-finished at the factory. Trim finish color shall be determined by the Owner.

1. All PVC base molding shall be rigid extruded PVC with integral color, color shall be determined by the Owner.

C. Fasteners shall be non-staining nylon drive rivets matching panel colors, length to suit project conditions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are acceptable for installation of wall panels.

B. Examine back-up surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails are countersunk and joints and cracks are filled flush and smooth with the adjoining surface.

C. Do not proceed with installation of wall panels until unacceptable conditions are corrected.

3.02 PREPARATION

A. Prior to installing panels, remove packaging and allow panels to acclimate to a room temperature of 70°F for at least 48 hours.

B. Wall substrate must be dry and free from dirt, dust, grease and other contaminants.

C. Walls must be flat and even. Remove high spots and fill low spots with material acceptable to panel manufacturer.

D. Remove soluble or loose paint and other foreign matter that might interfere with proper adhesive bond.

E. Open cartons and carefully inspect all panels. Do not install damaged panels.

3.03 INSTALLATION

A. Comply with the instructions and recommendations of the wall panel manufacturer.

B. All moldings must provide for a minimum 1/8” expansion joint to ensure proper installation.

C. Protect decorative laminate face of panel by covering work area.

D. Follow adhesive manufacturer’s recommendations for appropriate height of adhesive bead left by trowel and do not allow adhesive to skin over.

E. Install panels using the manufacturer’s color matched sealant, color by Owner.

3.04 CLEAN-UP

A. Clean panel surfaces in compliance with manufacturer’s recommendations.

1. Use a clean, damp, non-abrasive cotton cloth and a mild liquid detergent or household cleaner. Do not use abrasive cleaners.

2. Rinse with clean water using a clean, non-abrasive cotton cloth.

3. Dry panels with a soft, clean, non-abrasive cotton cloth.

3.05 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site.

END OF SECTION

SECTION 11 00 00

MATERIAL AND

EQUIPMENT

PART 1 - GENERAL

1.01 REQUIREMENT

A. Material and equipment incorporated into the work:

1. Shall conform to applicable specifications and standards.

2. Shall comply with size, make, type and quality specified, or as specifically approved in writing by the Architect.

3. Manufactured and Fabricated Products:

a. Design, fabricate and assemble in accord with the best engineering and shop practices.

b. Manufacture like parts of duplicate units to standard sizes and gauges to be interchangeable.

c. Two or more items of the same kind shall be identical, by the same manufacturer.

d. Products shall be suitable for service condition.

e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.02 MANUFACTURER'S INSTRUCTIONS

A. When Contract documents require that installation of Work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Architect.

1. Maintain one (1) set of complete instructions at the Job Site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Architect for further instructions.

2. Do not proceed with work without clear instructions.

3. Perform Work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.03 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the Site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.04 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.

B. Store products subject to damage by the elements in weather-tight enclosures.

C. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

D. Exterior Storage:

1. Store fabricated products above the ground, on blocking or skids; prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

2. Store loose granular materials in a wall drained area on solid surfaces to prevent mixing with foreign matter.

E. Arrange storage in a manner to provide easy access for inspection and make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

F. Protection after installation:

1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 22 05 16

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Rubber union connector packless expansion joints.
2. Flexible-hose packless expansion joints.
3. Metal-bellows packless expansion joints.
4. Externally pressurized metal-bellows packless expansion joints.
5. Rubber packless expansion joints.
6. Grooved-joint expansion joints.
7. Alignment guides and anchors.
8. Pipe loops and swing connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

2.2 PACKLESS EXPANSION JOINTS

A. Rubber Union Connector Expansion Joints RUEJ-01:

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

    a. Amber/Booth Company, Inc.; a VMC Group Company.
    b. Flex-Hose Co., Inc.
    c. Flexicraft Industries.
    d. General Rubber Corporation.
    e. Mason Industries, Inc.
    f. Proco Products, Inc.
    g. Unaflex.
    h. Unisource Manufacturing, Inc.

2. Material: Twin reinforced-rubber spheres with external restraining cables.
3. Minimum Pressure Rating: 150 psig at 170 deg F, unless otherwise indicated.
4. End Connections for NPS 2 and Smaller: Threaded.

B. Flexible-Hose Packless Expansion Joints FHEJ-01:

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

    a. Flex Pression Ltd.
    b. Flex-Hose Co., Inc.
    c. Flexicraft Industries.
    d. Mason Industries, Inc.
    e. Metraflex Company (The).
    f. Unisource Manufacturing, Inc.

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.

    a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
    b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.

5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.

6. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon-steel fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.

7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.

8. Expansion Joints for Steel Piping NPS 8 to NPS 12: Carbon-steel fittings with welded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F and 90 psig at 600 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.

C. Metal-Bellows Packless Expansion Joints MBEJ-01:

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

    a. Adsco Manufacturing LLC.
    b. American BOA, Inc.
    c. Badger Industries, Inc.
    d. Expansion Joint Systems, Inc.
    e. Flex Pression Ltd.

f. Flex-Hose Co., Inc.
g. Flexicraft Industries.
h. Flex-Weld, Inc.
i. Flo Fab inc.
j. Hyspan Precision Products, Inc.
k. Mason Industries, Inc.
l. Metraflex Company (The).
m. Proco Products, Inc.
n. Senior Flexonics Pathway.
o. Tozen Corporation.
p. U.S. Bellows, Inc.
q. Unaflex.
r. Unisource Manufacturing, Inc.
s. Universal Metal Hose.
t. WahlcoMetroflex.

2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
3. Type: Circular, corrugated bellows with external tie rods.
4. Minimum Pressure Rating: 150 psig, unless otherwise indicated.
5. Configuration: Single joint class(es), unless otherwise indicated.
6. Expansion Joints for Copper Tubing: Single- or multi- ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.

   a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint or threaded.
   b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Solder joint or threaded.
   c. End Connections for Copper Tubing NPS 5 and Larger: Flanged.

7. Expansion Joints for Steel Piping: Single- or multi- ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.

   a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
   b. End Connections for Steel Pipe NPS 2-1/2 and Larger: Flanged.

D. Externally Pressurized Metal-Bellows Packless Expansion Joints EPEJ-01:

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

   a. Adsco Manufacturing LLC.
   b. Flex-Hose Co., Inc.
   c. Hyspan Precision Products, Inc.
   d. Mason Industries, Inc.
   e. Metraflex Company (The).
   f. U.S. Bellows, Inc.

2. Minimum Pressure Rating: 150 psig, unless otherwise indicated.
3. Description:

   a. Totally enclosed, externally pressurized, multi-ply, stainless-steel bellows isolated from fluid flow by an internal pipe sleeve.
   b. Carbon-steel housing.
   c. Drain plugs and lifting lug for NPS 3 and larger.
   d. Bellows shall have operating clearance between the internal pipe sleeves and the

external shrouds.

e. Joints shall be supplied with a built-in scale to confirm the starting position and operating movement.
f. Joint Axial Movement: 6 inches of compression and 1 inch of extension.

4. Permanent Locking Bolts: Set locking bolts to maintain joint lengths during installation. Temporary welding tabs that are removed after installation in lieu of locking bolts are not acceptable.
5. End Connection Configuration: Flanged; one raised, fixed and one floating flange.

E. Rubber Packless Expansion Joints REJ-01:

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

a. Amber/Booth Company, Inc.; a VMC Group Company.
b. Flex-Hose Co., Inc.
c. Flexicraft Industries.
d. Flex-Weld, Inc.
e. Garlock Sealing Technologies.
f. General Rubber Corporation.
g. Mason Industries, Inc.
h. Metraflex Company (The).
i. Proco Products, Inc.
j. Red Valve Company, Inc.
k. Tozen Corporation.
l. Unaflex.
m. Unisource Manufacturing, Inc.

2. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
3. Material: Fabric-reinforced rubber complying with FSA-PSJ-703.
4. Arch Type: Single or multiple arches with external control rods.
5. Spherical Type: Single or multiple spheres with external control rods.
6. Minimum Pressure Rating for NPS 1-1/2 to NPS 4: 150 psig at 220 deg F.
7. Minimum Pressure Rating for NPS 5 and NPS 6: 140 psig at 200 deg F.
8. Minimum Pressure Rating for NPS 8 to NPS 12: 140 psig at 180 deg F,
9. Material for Water: Buna-N.
10. End Connections: Full-faced, integral steel flanges with steel retaining rings.

2.3 GROOVED-JOINT EXPANSION JOINTS

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

1. Anvil International.
2. Shurjoint Piping Products.
3. Victaulic Company.

B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

C. Standard: AWWA C606, for grooved joints.

D. Nipples: ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.

E. Couplings: Five, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water, and bolts and nuts.

2.4 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides AG-01:

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

   a. Adsco Manufacturing LLC.
   b. Advanced Thermal Systems, Inc.
   c. Flex-Hose Co., Inc.
   d. Flexicraft Industries.
   e. Flex-Weld, Inc.
   f. Hyspan Precision Products, Inc.
   g. Mason Industries, Inc.
   h. Metraflex Company (The).
   i. Senior Flexonics Pathway.
   j. U.S. Bellows, Inc.
   k. Unisource Manufacturing, Inc.

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

   a. Stud: Threaded, zinc-coated carbon steel.
   b. Expansion Plug: Zinc-coated steel.
   c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

   a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
   b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
   c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

C. Install rubber packless expansion joints according to FSA-PSJ-703.

D. Install grooved-joint expansion joints to grooved-end steel piping.

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.

2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION

SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

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

1. Smith, Jay R. Mfg. Co.
2. Zurn Industries, LLC.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

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

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

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

1. HOLDRITE.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6 Galvanized-steel-pipe sleeves.
   b. Piping NPS 6 Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6 Sleeve-seal fittings.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6 Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: PVC-pipe sleeves.
b. Piping NPS 6 and Larger: PVC-pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6 PVC-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 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 setscrewfastener.

B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

C. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

D. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated 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 or split-casting brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with rough-brass finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.

2. Escutcheons for Existing Piping:

a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with rough-brass finish.
h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
i. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.
j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.
6. Test plugs.
7. Test-plug kits.

B. Related Sections:

1. Section 221113 "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
2. Section 221116 "Domestic Water Piping" for water meters inside the building.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

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

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.
7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.
9. Tel-Tru Manufacturing Company.
10. Trerice, H. O. Co.
11. Watts; a Watts Water Technologies company.
12. Weiss Instruments, Inc.
13. Weksler Glass Thermometer Corp.
14. WIKA Instrument Corporation.
15. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus, or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

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

a. Ashcroft Inc.
b. Marsh Bellofram.
c. Miljoco Corporation.
d. Palmer Wahl Instrumentation Group.
e. REOTEMP Instrument Corporation.
f. Trerice, H. O. Co.
g. Weiss Instruments, Inc.

2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.
10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus, or minus 1 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

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

    a. Trerice, H. O. Co.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Back angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

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

    a. Flo Fab inc.
    b. Miljoco Corporation.
    c. Palmer Wahl Instrumentation Group.
    d. Tel-Tru Manufacturing Company.
    e. Trerice, H. O. Co.
    f. Weiss Instruments, Inc.
    g. Weksler Glass Thermometer Corp.
    h. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

C. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:

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

    a. Ernst Flow Industries.
    b. Marsh Bellofram.
    c. Miljoco Corporation.
    d. Palmer Wahl Instrumentation Group.
    e. REOTEMP Instrument Corporation.
    f. Watts; a Watts Water Technologies company.
    g. Weiss Instruments, Inc.
    h. Weksler Glass Thermometer Corp.
    i. WIKA Instrument Corporation.

2. Standard: ASME B40.200.
3. Case: Plastic; 7-inch nominal size unless otherwise indicated. Case Form: Adjustable angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
6. Window: Glass.
7. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.

9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.4 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.5 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

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

    a. AMETEK, Inc.
    b. Ashcroft Inc.
    c. Ernst Flow Industries.
    d. Flo Fab inc.
    e. Marsh Bellofram.
    f. Miljoco Corporation.
    g. Noshok.
    h. Palmer Wahl Instrumentation Group.
    i. REOTEMP Instrument Corporation.
    j. Tel-Tru Manufacturing Company.
    k. Trerice, H. O. Co.
    l. Watts; a Watts Water Technologies company.
    m. Weiss Instruments, Inc.
    n. Weksler Glass Thermometer Corp.
    o. WIKA Instrument Corporation.
    p. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled Solid-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

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

   a. AMETEK, Inc.
   b. Ashcroft Inc.
   c. Flo Fab inc.
   d. Marsh Bellofram.
   e. Miljoco Corporation.
   f. Noshok.
   g. Palmer Wahl Instrumentation Group.
   h. REOTEMP Instrument Corporation.
   i. Tel-Tru Manufacturing Company.
   j. Trerice, H. O. Co.
   k. Weiss Instruments, Inc.
   l. Weksler Glass Thermometer Corp.
   m. WIKA Instrument Corporation.
   n. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.6 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.7 TEST PLUGS

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

1. Flow Design, Inc.
2. Miljoco Corporation.

3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts; a Watts Water Technologies company.
8. Weiss Instruments, Inc.
9. Weksler Glass Thermometer Corp.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: EPDM self-sealing rubber.

2.8 TEST-PLUG KITS

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

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts; a Watts Water Technologies company.
8. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.

F. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Industrial-style, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with EPDM self-sealing rubber inserts.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Industrial-style, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with EPDM self-sealing rubber inserts.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Industrial-style, liquid-in-glass type.
4. Test plug with EPDM self-sealing rubber inserts.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F.

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Liquid-filled Solid-front, pressure-relief, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with EPDM self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be[**one of**] the following:

1. Liquid-filled Solid-front, pressure-relief, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with EPDM self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each domestic water pump shall be[**one of**] the following:

1. Liquid-filled Solid-front, pressure-relief, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 200 psi.

B. Scale Range for Domestic Water Piping: 0 to 200 psi.

END OF SECTION

SECTION 22 05 23.12

BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Steel ball valves.
4. Iron ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

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 B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. 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. 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 BRASS BALL VALVES

A. One-Piece, Brass Ball Valves:

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

a. KITZ Corporation.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Forged brass or bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass or stainless steel.
h. Ball: Chrome-plated brass or stainless steel.

i. Port: Reduced.

B. Two-Piece, Brass Ball Valves with Full Port and Stainless-Steel Trim:

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

a. Jomar Valve.
b. KITZ Corporation.
c. Marwin Valve; Richards Industries.
d. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

C. Two-Piece, Brass Ball Valves with Regular Port and Stainless-Steel Trim:

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

a. Jamesbury; Metso.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Brass or bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Regular.

2.3 BRONZE BALL VALVES

A. One-Piece, Bronze Ball Valves with Stainless-Steel Trim:

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

a. Conbraco Industries, Inc.
b. NIBCO INC.
c. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Reduced.

B. Two-Piece, Bronze Ball Valves with Full Port and Stainless-Steel Trim:

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

a. Conbraco Industries, Inc.
b. Crane; Crane Energy Flow Solutions.
c. Hammond Valve.
d. Lance Valves.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded or soldered.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

C. Two-Piece, Bronze Ball Valves with Regular Port and Stainless-Steel Trim:

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

a. Conbraco Industries, Inc.
b. Hammond Valve.
c. NIBCO INC.
d. Stockham; Crane Energy Flow Solutions.
e. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded.

f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Regular.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 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.

E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 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 Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. One piece, brass ball valve.
3. One piece, bronze ball valve with stainless-steel trim.
4. Two-piece, brass ball valves with full port and stainless-steel trim.
5. Two-piece, bronze ball valves with full port and stainless-steel trim.

B. Pipe NPS 2-1/2 and Larger:

1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Class 150, steel ball valves with full port.
3. Class 150, iron ball valves.

END OF SECTION

SECTION 22 05 23.13

BUTTERFLY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Iron, single-flange butterfly valves.
2. Iron, grooved-end butterfly valves.
3. Chainwheels.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set butterfly valves closed or slightly open.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 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 B16.1 for flanges on iron valves.
2. ASME B16.5 for flanges on steel valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B31.9 for building service piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

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. Gear Actuator: For valves NPS 8 and larger.
2. Handlever: For valves NPS 6 and smaller.
3. Chainwheel: Device for attachment to gear, handlever, or stem; of size and with chain for mounting height, according to "Valve Installation" Article.

H. Valves in Insulated Piping: With 2-inch stem extensions.

2.2 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. Iron, Single-Flange Butterfly Valves with Aluminum-Bronze Disc:

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

a. ABZ Valve and Controls.
b. Conbraco Industries, Inc.
c. Cooper Cameron Valves.
d. DeZURIK.
e. Flo Fab inc.
f. Hammond Valve.
g. Jenkins Valves; Crane Energy Flow Solutions.
h. KITZ Corporation.

i. Legend Valve & Fitting, Inc.
j. Milwaukee Valve Company.
k. NIBCO INC.
l. Norriseal.
m. Red-White Valve Corporation.
n. Spence Strainers International.
o. Stockham; Crane Energy Flow Solutions.
p. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

B. Iron, Single-Flange Butterfly Valves with Stainless-Steel Disc:

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

a. ABZ Valve and Controls.
b. American Valve, Inc.
c. Conbraco Industries, Inc.
d. Cooper Cameron Valves.
e. DeZURIK.
f. Flo Fab inc.
g. Hammond Valve.
h. Jenkins Valves; Crane Energy Flow Solutions.
i. KITZ Corporation.
j. Legend Valve & Fitting, Inc.
k. Milwaukee Valve Company.
l. Mueller Steam Specialty.
m. NIBCO INC.
n. Norriseal.
o. Red-White Valve Corporation.
p. Spence Strainers International.
q. Stockham; Crane Energy Flow Solutions.
r. Sure Flow Equipment Inc.
s. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating, NPS 12 and Smaller: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

2.3 DUCTILE-IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

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

a. Kennedy Valve Company; a division of McWane, Inc.
b. Shurjoint Piping Products.
c. Tyco Fire Products LP.
d. Victaulic Company.
e. Zurn Industries, LLC.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 175 psig.
c. Body Material: Coated, ductile iron.
d. Stem: Two-piece stainless steel.
e. Disc: Coated, ductile iron.
f. Seal: EPDM.

B. 300 CWP, Iron, Grooved-End Butterfly Valves:

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

a. Anvil International.
b. Kennedy Valve Company; a division of McWane, Inc.
c. Mueller Steam Specialty.
d. NIBCO INC.
e. Shurjoint Piping Products.
f. Tyco Fire Products LP.
g. Victaulic Company.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating, NPS 8 and Smaller: 300 psig.
c. CWP Rating, NPS 10 and Larger: 200 psig.
d. Body Material: Coated, ductile iron.
e. Stem: Two-piece stainless steel.
f. Disc: Coated, ductile iron.
g. Seal: EPDM.

2.4 CHAINWHEELS

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

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, chain guides, chain, and attachment brackets for mounting chainwheels directly to handwheels.

1. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc or epoxy coating.
2. Chain: Stainless steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine mating flange faces for damage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

D. Do not attempt to repair defective valves; replace with new valves.

3.2 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.

E. Install chainwheels on operators for butterfly valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, stainless-steel disc.
B. Ductile-Iron, Grooved-End Butterfly Valves: 300 CWP.

END OF SECTION

SECTION 22 05 23.14

CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze lift check valves.
2. Bronze swing check valves.
3. Iron swing check valves.
4. Iron swing check valves with closure control.
5. Iron, grooved-end swing check valves.
6. Iron, center-guided check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 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 B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

E. 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.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

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

a. Crane; Crane Energy Flow Solutions.
b. Jenkins Valves; Crane Energy Flow Solutions.
c. Stockham; Crane Energy Flow Solutions.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.

e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:

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

a. Flo Fab Inc.
b. Hammond Valve.
c. KITZ Corporation.
d. Milwaukee Valve Company.
e. Mueller Steam Specialty.
f. NIBCO INC.
g. Red-White Valve Corporation.
h. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: NBR, PTFE.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze, Swing Check Valves with Bronze Disc:

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

a. American Valve, Inc.
b. Crane; Crane Energy Flow Solutions.
c. Hammond Valve.
d. Jenkins Valves; Crane Energy Flow Solutions.
e. KITZ Corporation.
f. Macomb Groups (The).
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Stockham; Crane Energy Flow Solutions.
l. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

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

a. Crane; Crane Energy Flow Solutions.
b. Hammond Valve.
c. Jenkins Valves; Crane Energy Flow Solutions.
d. KITZ Corporation.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corporation.
h. Stockham; Crane Energy Flow Solutions.
i. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: PTFE.

C. Class 150, Bronze Swing Check Valves with Bronze Disc:

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

a. American Valve, Inc.
b. Crane; Crane Energy Flow Solutions.
c. Jenkins Valves; Crane Energy Flow Solutions.
d. Jomar Valve.
e. KITZ Corporation.
f. Macomb Groups (The).
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Stockham; Crane Energy Flow Solutions.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

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

a. Crane; Crane Energy Flow Solutions.

b. Hammond Valve.
c. Jenkins Valves; Crane Energy Flow Solutions.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: PTFE.

2.4 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

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

a. Crane; Crane Energy Flow Solutions.
b. Stockham; Crane Energy Flow Solutions.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Composition.
g. Seat Ring: Bronze.
h. Disc Holder: Bronze.
i. Disc: PTFE.
j. Gasket: Asbestos free.

2.5 IRON, CENTER-GUIDED, SPRING-LOADED CHECK VALVES

A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

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

a. Anvil International.
b. APCO Willamette Valve and Primer Corporation.
c. Crispin Valve.
d. DFT Inc.
e. Flo Fab inc.
f. GA Industries, Inc.
g. Hammond Valve.
h. Metraflex Company (The).

i. Milwaukee Valve Company.
j. Mueller Steam Specialty.
k. NIBCO INC.
l. Spence Strainers International.
m. Sure Flow Equipment Inc.
n. Val-Matic Valve & Manufacturing Corp.
o. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

B. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:

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

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flomatic Corporation.
e. Hammond Valve.
f. Metraflex Company (The).
g. Milwaukee Valve Company.
h. Mueller Steam Specialty.
i. NIBCO INC.
j. Spence Strainers International.
k. Sure Flow Equipment Inc.
l. Val-Matic Valve & Manufacturing Corp.
m. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

C. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

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

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 300 psig.
c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

D. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:

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

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 300 psig.
c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

E. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

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

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flo Fab Inc.
e. Hammond Valve.
f. Metraflex Company (The).
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Sure Flow Equipment Inc.
j. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

F. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:

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

a. APCO Willamette Valve and Primer Corporation.

b. Crispin Valve.
c. DFT Inc.
d. Flomatic Corporation.
e. Hammond Valve.
f. Metraflex Company (The).
g. Milwaukee Valve Company.
h. Mueller Steam Specialty.
i. NIBCO INC.
j. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

G. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

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

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flo Fab Inc.
e. Hammond Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Spence Strainers International.
i. Sure Flow Equipment Inc.
j. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: EPDM or NBR.

H. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

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

a. Anvil International.
b. APCO Willamette Valve and Primer Corporation.
c. Crispin Valve.
d. DFT Inc.
e. GA Industries, Inc.
f. Hammond Valve.
g. Milwaukee Valve Company.

h. NIBCO INC.
i. Sure Flow Equipment Inc.
j. Val-Matic Valve & Manufacturing Corp.
k. Zurn Industries, LLC.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: EPDM or NBR.

I. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

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

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 300 psig.
c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
d. Style: Compact wafer, spring loaded.
e. Seat: EPDM or NBR.

J. Class 150, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

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

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 300 psig.
c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: EPDM or NBR.

K. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

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

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flo Fab Inc.
e. Hammond Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Sure Flow Equipment Inc.
i. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: EPDM or NBR.

L. Class 250, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

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

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: EPDM or NBR.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 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.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, resilient-seat check valves.
c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
3. For Copper Tubing, NPS 5 and Larger: Flanged.
4. For Steel Piping, NPS 2 and Smaller: Threaded.

5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
6. For Steel Piping, NPS 5 and Larger: Flanged.
7. For Grooved-End Copper Tubing: Grooved.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze swing check valves, Class 150, nonmetallic disc with soldered or threaded end connections.

B. Pipe NPS 2-1/2 and Larger:

1. Iron swing check valves, Class 250, nonmetallic-to-metal seats with threaded or flanged end connections.
2. Iron swing check valves with closure control, Class 125, lever and spring with threaded or flanged end connections.
3. Iron, center-guided check valves, Class 150, compact wafer.
4. Iron, center-guided check valves, Class 150,, resilient seat with threaded or flanged end connections.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment supports.

B. Related Sections:

1. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
2. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 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, including pipe stands, 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 and obtain approval from authorities having jurisdiction.

1.5 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. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. 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. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 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.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless 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 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

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

a. Allied Tube & Conduit; a part of Atkore International.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Flex-Strut Inc.
d. Thomas & Betts Corporation, A Member of the ABB Group.
e. Unistrut; an Atkore International company.
f. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc.
8. Paint Coating: Acrylic.

2.4 THERMAL-HANGER SHIELD INSERTS

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

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 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, stainless- 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.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 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.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.9 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. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick 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.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. 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.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. 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.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. 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.

O. 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 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood 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. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting."] Section 099123 "Interior Painting."

C. 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 metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. 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. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off- center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. 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.
15. 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.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. 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.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. 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.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. 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.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. 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. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. 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.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. 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.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. 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 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.
12. Snubbers.
13. Restraint channel bracings.
14. Restraint cables.
15. Seismic-restraint accessories.
16. Mechanical anchor bolts.
17. Adhesive anchor bolts.

B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
2. Section 230548 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State ofCalifornia).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint componentrequired.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities havingjurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

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

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic- restraint designs must be signed and sealed by a qualified professionalengineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading: See structural documentation.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

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

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.

f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Ribbed pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.

a. Surface Pattern: Waffle pattern.
b. Infused nonwoven cotton or synthetic fibers.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

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

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

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

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.

e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

a. Housing: Cast-ductile iron or welded steel.
b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.5 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

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

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at ratedload.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screwto fasten and level equipment.

2.6 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

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

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.

f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at ratedload.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top housing with elastomeric pad.

2.7 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:

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

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Housing: Steel housing with vertical-limit stops to prevent spring extension due toweight being removed.

a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top plate with elastomeric pad.
c. Internal leveling bolt that acts as blocking during installation.

3. Restraint: Limit stop as required for equipment and authorities havingjurisdiction.
4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at ratedload.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

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

following:

a. Ace Mountings Co., Inc
b. California Dynamics Corporation.
c. Isolation Technology, Inc
d. Kinetics Noise Control, Inc
e. Mason Industries, Inc
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

3. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

4. Outside Spring Diameter: Not less than 80 percent of the compressed height ofthe spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at ratedload.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.9 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.10 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.11 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:.

g. Vibration Mountings & Controls, Inc.

1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.12 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
.

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

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Kinetics Noise Control, Inc.
d. Mason Industries, Inc.
e. Vibration Eliminator Co., Inc.
f. Vibration Isolation.
g. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height ofthe spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at ratedload.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.13 RESTRAINT CHANNEL BRACINGS

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

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut; an Atkore International company.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.14 RESTRAINT CABLES

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

1. Kinetics Noise Control, Inc.
2. Loos & Co., Inc.
3. Mason Industries, Inc.
4. Vibration Mountings & Controls, Inc.

B. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.15 SEISMIC-RESTRAINT ACCESSORIES

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

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. TOLCO.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections Reinforcing steel angle clamped to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts andstuds.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.16 MECHANICAL ANCHOR BOLTS

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

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.17 ADHESIVE ANCHOR BOLTS

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

1. Hilti, Inc.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.

B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have beencorrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 “Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

D. Equipment Restraints:

1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

E. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached towall.

J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

K. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or

branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 221116 "Domestic Water Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

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

a. Brady Corporation.
b. Brimar Industries, Inc.

c. Carlton Industries, LP.
d. Champion America.
e. Craftmark Pipe Markers.
f. emedco.
g. Kolbi Pipe Marker Co.
h. LEM Products Inc.
i. Marking Services, Inc.
j. Seton Identification Products.

2. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: Yellow.
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 rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

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

a. Brady Corporation.
b. Brimar Industries, Inc.
c. Carlton Industries, LP.
d. Champion America.
e. Craftmark Pipe Markers.
f. emedco.
g. Kolbi Pipe Marker Co.
h. LEM Products Inc.
i. Marking Services, Inc.
j. Seton Identification Products.

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: Black.
4. Background Color: Yellow.
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.

C. 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.

D. 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 PIPE LABELS

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

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark Pipe Markers.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Sevices Inc.
11. Seton Identification Products.

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 partially cover 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.

2.3 VALVE TAGS

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

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark Pipe Markers.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.

10. Marking Services, Inc.
11. Seton Identification Products.

B. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain or S-hook.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."

B. 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 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.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

D. Pipe Label Color Schedule:

1. Domestic Water Piping

a. Background: Safety green.
b. Letter Colors: White.

2. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Safety black.
b. Letter Color: White.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches, round.
b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Colors:

a. Cold Water: Safety green.
b. Hot Water: Natural Safety green.

3. Letter Colors:

a. Cold Water: White.
b. Hot Water: White.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. 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.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.

4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. 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.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

a. One 10-foot section of NPS 2 straight pipe.
b. One each of a 90-degree threaded, welded, and flanged elbow.
c. One each of a threaded, welded, and flanged tee fitting.
d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
e. Four support hangers including hanger shield and insert.
f. One threaded strainer and one flanged strainer with removable portion of insulation.
g. One threaded reducer and one welded reducer.
h. One pressure temperature tap.
i. One mechanical coupling.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.

4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

D. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "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. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Pittsburgh Corning Corporation.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
6. 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.

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

a. Aeroflex USA, Inc.
b. Armacell LLC.
c. K-Flex USA.

H. Mineral-Fiber, Preformed Pipe Insulation:

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

a. Johns Manville; a Berkshire Hathaway company.
b. Knauf Insulation.
c. Manson Insulation Inc.
d. Owens Corning.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

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

a. Ramco Insulation, Inc.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

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

a. Ramco Insulation, Inc.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

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

a. Ramco Insulation, Inc.

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

a. Foster Brand; H. B. Fuller Construction Products.

2. 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).
3. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA, Inc.
b. Armacell LLC.
c. Foster Brand; H. B. Fuller Construction Products.
d. K-Flex USA.

2. 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).
3. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
d. Mon-Eco Industries, Inc.

2. 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).
3. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
d. Mon-Eco Industries, Inc.

2. 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).
3. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Corning Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. P.I.C. Plastics, Inc.
d. Speedline Corporation.

2. 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).
3. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Foster Brand; H. B. Fuller Construction Products.
    b. Knauf Insulation.
    c. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Knauf Insulation.
    e. Mon-Eco Industries, Inc.
    f. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Vimasco Corporation.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. Joint Sealants:

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

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.
   e. Pittsburgh Corning Corporation.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. 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).
7. 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, PVDC, and PVC Jacket Flashing Sealants:

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

   a. Childers Brand; H. B. Fuller Construction Products.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. 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).
7. 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."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. 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.

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

   a. Johns Manville; a Berkshire Hathaway company.
   b. P.I.C. Plastics, Inc.
   c. Proto Corporation.
   d. Speedline Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. 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. 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.

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

a. Pittsburgh Corning Corporation.
b. Polyguard Products, Inc.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

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

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc., an American Biltrite company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc., an American Biltrite company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Compac Corporation.
b. Ideal Tape Co., Inc., an American Biltrite company.
c. Venture Tape.

2. Width: 2 inches.

3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

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

   a. ITW Insulation Systems; Illinois Tool Works, Inc.
   b. RPR Products, Inc.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy 0.062-inch soft-annealed, stainless steel.

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

   a. C & F Wire.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:

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

   a. Engineered Brass Company.
   b. Insul-Tect Products Co.
   c. McGuire Manufacturing.
   d. Plumberex Specialty Products, Inc.
   e. Truebro.
   f. Zurn Industries, LLC.

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

a. Truebro.
b. Zurn Industries, LLC.

2. 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 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of 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 4 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.

3.4 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.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same

material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
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.

3.6 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.

3.7 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.

3.8 INSTALLATION OF MINERAL-FIBER 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.

3.9 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.

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 099000 "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. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. 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.

D. 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 Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 3/4 inch (19 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 1 inch (25 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 1 inch (25 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 1 inch (25 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

C. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 1 inch (25 mm) thick.

c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
d. Install on the first 10”-0” of piping and on roofdrains.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 1 inch (25 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 3/4 inch (19 mm) thick.

F. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches (50 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches (38 mm) thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 3/4 inch (19 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

H. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.

I. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches (50 mm) thick.
b. Flexible Elastomeric: 2 inches (50 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches (50 mm) thick.
b. Flexible Elastomeric: 2 inches (50 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches (50 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.

D. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

E. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type II: 1 inch (25 mm) thick.

3.15 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches (50 mm) 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. None.
2. PVC: 20 mils (0.5 mm) thick.

D. Piping, Exposed:

1. None.

2. PVC: 20 mils (0.5 mm) 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 (0.5 mm) thick.

D. Piping, Exposed:

1. PVC: 20 mils (0.5 mm) thick.

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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 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. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. 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.

F. Appurtenances for Grooved-End Copper Tubing:

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

   a. Anvil International.
   b. Shurjoint Piping Products.
   c. Victaulic Company.

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:

   a. Copper-tube dimensions and design similar to AWWA C606.
   b. Ferrous housing sections.
   c. EPDM-rubber gaskets suitable for hot and cold water.
   d. Bolts and nuts.
   e. Minimum Pressure Rating: 300 psig.

2.3 STAINLESS-STEEL PIPING

A. Potable-water piping and components shall comply with NSF 61 Annex G.

B. Stainless-Steel Pipe: ASTM A 312/A 312M, Schedule 10 and Schedule 40.

C. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M.

D. Appurtenances for Grooved-End, Stainless-Steel Pipe:

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

   a. Anvil International.
   b. Grinnell Mechanical Products.
   c. Shurjoint Piping Products.
   d. Victaulic Company.

2. Fittings for Grooved-End, Stainless-Steel Pipe: Stainless-steel casting with dimensions matching stainless-steel pipe.
3. Mechanical Couplings for Grooved-End, Stainless-Steel Pipe:

    a. AWWA C606 for stainless-steel-pipe dimensions.
    b. Stainless-steel housing sections.
    c. Stainless-steel bolts and nuts.
    d. EPDM-rubber gaskets suitable for hot and cold water.
    e. Minimum Pressure Rating:

        1) NPS 8 and Smaller: 600 psig.
        2) NPS 10 and NPS 12: 400 psig.
        3) NPS 14 to NPS 24: 250 psig.

2.4 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.

2.5 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. Sleeve-Type Transition Coupling: AWWA C219.

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

    a. Cascade Waterworks Mfg. Co.
    b. Dresser, Inc.
    c. Ford Meter Box Company, Inc. (The).
    d. JCM Industries, Inc.
    e. Romac Industries, Inc.

f. Smith, Jay R. Mfg. Co.
g. Smith-Blair, Inc.
h. Viking Johnson.

D. Plastic-to-Metal Transition Fittings:

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

a. Charlotte Pipe and Foundry Company.
b. Harvel Plastics, Inc.
c. Spears Manufacturing Company.
d. Uponor.

2. Description:

a. CPVC or 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.

E. Plastic-to-Metal Transition Unions:

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

a. Colonial Engineering, Inc.
b. NIBCO INC.
c. Spears Manufacturing Company.

2. Description:

a. CPVC or PVC four-part union.
b. Brass or stainless-steel threaded end.
c. Solvent-cement-joint or threaded plastic end.
d. Rubber O-ring.
e. Union nut.

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

a. A.Y. McDonald Mfg. Co.
b. Capitol Manufacturing Company.
c. Central Plastics Company.
d. HART Industrial Unions, LLC.
e. Jomar Valve.

f. Matco-Norca.
g. Watts; a Watts Water Technologies company.
h. Wilkins.
i. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Pressure Rating: 150 psig.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

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

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca.
d. Watts; a Watts Water Technologies company.
e. Wilkins.
f. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 150 psig.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

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

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

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

a. Elster Perfection Corporation.
b. Grinnell Mechanical Products.
c. Matco-Norca.
d. Precision Plumbing Products.
e. Victaulic Company.

2. Standard: IAPMO PS 66.

3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. 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 underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

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 unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

R. 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."

S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

T. 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."

U. 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."

V. 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. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

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.

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 unions.

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 couplings or nipples.

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 stainless-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. 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. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. 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. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard or soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

F. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

G. 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- or wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.

H. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
3. Stainless-steel Schedule 10 pipe, grooved-joint fittings, and grooved joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose stations.
9. Hose bibbs.
10. Wall hydrants.
11. Ground hydrants.
12. Post hydrants.
13. Drain valves.
14. Water-hammer arresters.
15. Air vents.
16. Trap-seal primer valves.
17. Trap-seal primer systems.
18. Specialty valves.
19. Flexible connectors.
20. Water meters.

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 221116 "Domestic Water Piping" for water meters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

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: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

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

a. Ames Co.
b. Ames Fire & Waterworks.
c. Cash Acme.
d. Conbraco Industries, Inc.
e. FEBCO.
f. Rain Bird Corporation.
g. Toro Company (The).
h. Watts; a Watts Water Technologies company.

2. Standard: ASSE 1001.

3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

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

    a. Arrowhead Brass Products.
    b. Cash Acme.
    c. Conbraco Industries, Inc.
    d. Legend Valve & Fitting, Inc.
    e. MIFAB, Inc.
    f. Prier Products, Inc.
    g. Watts; a Watts Water Technologies company.
    h. Woodford Manufacturing Company.
    i. Zurn Industries, LLC.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

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

    a. Cash Acme.
    b. Conbraco Industries, Inc.
    c. FEBCO.
    d. Honeywell Water Controls.
    e. Legend Valve & Fitting, Inc.
    f. Watts; a Watts Water Technologies company.
    g. Zurn Industries, LLC.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: NPS 3/4.
5. Body: Bronze.
6. End Connections: Union, solder joint.
7. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers: See schedule on drawings: (RPBP-1)

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

    a. Ames Co.
    b. Ames Fire & Waterworks.
    c. Conbraco Industries, Inc.
    d. FEBCO.
    e. Flomatic Corporation.
    f. Watts; a Watts Water Technologies company.
    g. Zurn Industries, LLC.

2. Standard: ASSE 1013.

C. Beverage-Dispensing-Equipment Backflow Preventers:

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

   a. Conbraco Industries, Inc.
   b. Watts; a Watts Water Technologies company.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

D. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

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

   a. Cash Acme.
   b. Lancer Corporation.
   c. Watts; a Watts Water Technologies company.

2. Standard: ASSE 1032.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

E. Reduced-Pressure-Detector, Fire-Protection, Backflow-Preventer Assemblies: See schedule on drawings:

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

   a. Ames Co.
   b. Ames Fire & Waterworks.
   c. Conbraco Industries, Inc.
   d. FEBCO.
   e. Watts; a Watts Water Technologies company.
   f. Zurn Industries, LLC.

2. Standard: ASSE 1047 and is FM Global approved or UL listed.
3. Operation: Continuous-pressure applications.

F. Backflow-Preventer Test Kits:

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

   a. Conbraco Industries, Inc.
   b. FEBCO.
   c. Flomatic Corporation.

d. Watts; a Watts Water Technologies company.
e. Zurn Industries, LLC.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

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

a. Cash Acme.
b. Conbraco Industries, Inc.
c. Honeywell Water Controls.
d. Watts; a Watts Water Technologies company.
e. Zurn Industries, LLC.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.6 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves: See schedule on drawings.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:Armstrong International, Inc.
b. Flo Fab Inc.
c. ITT Corporation.
d. NIBCO INC.
e. Schneider Electric USA, Inc.
f. TACO Incorporated.
g. Watts; a Watts Water Technologies company.

2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
3. Body: Brass.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

C. Memory-Stop Balancing Valves: See schedule on drawings.

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

a. Conbraco Industries, Inc.

b. Hammond Valve.
c. Jenkins Valves; Crane Energy Flow Solutions.
d. NIBCO INC.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices: See schedule on drawings.

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

a. Armstrong International, Inc.
b. Cash Acme.
c. Conbraco Industries, Inc.
d. Honeywell Water Controls.
e. Legend Valve & Fitting, Inc.
f. Leonard Valve Company.
g. Powers.
h. Symmons Industries, Inc.
i. TACO Incorporated.
j. Watts; a Watts Water Technologies company.
k. Zurn Industries, LLC.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded or union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Rough bronze.

B. Manifold, Thermostatic, Water Mixing-Valve Assemblies: See schedule on drawings.

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

a. Leonard Valve Company.
b. Powers.
c. Symmons Industries, Inc.

2. Description: Factory-fabricated, exposed-mounted, thermostatically controlled, water mixing-valve assembly in two-valve parallel arrangement.

3. Large-Flow Parallel: Thermostatic, water mixing valve and downstream-pressure regulator with pressure gages on inlet and outlet.
4. Intermediate-Flow Parallel: Thermostatic, water mixing valve and downstream-pressure regulator with pressure gages on inlet and outlet.
5. Small-Flow Parallel: Thermostatic, water mixing valve.
6. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
7. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
8. Pressure Rating: 125 psig minimum unless otherwise indicated.
9. Thermostatic Mixing Valve and Water Regulator Finish: Rough bronze.
10. Piping Finish: Copper.

C. Individual-Fixture, Water Tempering Valves: See schedule on drawings.

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

   a. Cash Acme.
   b. Conbraco Industries, Inc.
   c. Honeywell Water Controls.
   d. Lawler Manufacturing Company, Inc.
   e. Leonard Valve Company.
   f. Powers.
   g. Watts; a Watts Water Technologies company.
   h. Zurn Industries, LLC.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

2.8 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.020 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
   c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Pipe plug.

2.9 OUTLET BOXES

A. Icemaker Outlet Boxes: See schedule on drawings.

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

   a. Acorn Engineering Company.
   b. IPS Corporation.
   c. LSP Products Group, Inc.
   d. Oatey.
   e. Plastic Oddities.

2. Mounting: Recessed.

3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.10 HOSE STATIONS

A. Hot- and Cold-Water Hose Stations: (HB-3) See schedule on drawings.

1. Standard: ASME A112.18.1.
2. Faucet Type: Blending valve.
3. Cabinet: Stainless-steel enclosure with exposed valve handles, hose connection, and hose rack. Include thermometer in front.
4. Hose-Rack Material: Stainless steel.
5. Body Material: Bronze with stainless-steel wetted parts.
6. Body Finish: Rough bronze or chrome plated.
7. Mounting: Wall, with reinforcement.
8. Supply Fittings: Two NPS 1/2 gate, globe, or ball valves and check valves and NPS 1/2 copper, water tubing. Omit check valves if check stops are included with fitting.
9. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 25 feet long.
10. Nozzle: With hand-squeeze, on-off control.
11. Vacuum Breaker: Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052; and garden-hose thread complying with ASME B1.20.7 on outlet.

2.11 HOSE BIBBS

A. Hose Bibbs : See schedule on drawings.

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.

11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.12 WALL HYDRANTS

A. Nonfreeze Wall Hydrants: See schedule on drawings.
1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants: See schedule on drawings.
1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Vacuum Breaker:
    a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.
10. Operating Keys(s): Two with each wall hydrant.

C. Vacuum Breaker Wall Hydrants: See schedule on drawings.
1. Standard: ASSE 1019, Type A or Type B.
2. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
3. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
4. Pressure Rating: 125 psig.
5. Operation: wheel handle.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 1/2 or NPS 3/4.
8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.13 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters: See schedule on drawings.
   1. Standard: ASSE 1010 or PDI-WH 201.
   2. Type: Copper tube with piston.
   3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.14 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

   1. Body: Bronze.
   2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
   3. Float: Replaceable, corrosion-resistant metal.
   4. Mechanism and Seat: Stainless steel.
   5. Size: NPS 3/8 minimum inlet.
   6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

   1. Body: Stainless steel.
   2. Pressure Rating: 150-psig minimum pressure rating.
   3. Float: Replaceable, corrosion-resistant metal.
   4. Mechanism and Seat: Stainless steel.
   5. Size: NPS 3/8 minimum inlet.
   6. Inlet and Vent Outlet End Connections: Threaded.

2.15 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device: See schedule on drawings.
   1. Standard: ASSE 1018.
   2. Pressure Rating: 125 psig minimum.
   3. Body: Bronze.
   4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
   5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
   6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device: See schedule on drawings.
   1. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
   2. Size: NPS 1-1/4 minimum.
   3. Material: Chrome-plated, cast brass.

2.16 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems: See schedule on drawings.
   1. Standard: ASSE 1044.
   2. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
   3. Cabinet: Recessed-mounted steel box with stainless-steel cover.
   4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.

      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.

5. Vacuum Breaker: ASSE 1001.
6. Number Outlets: See drawings.
7. Size Outlets: NPS 1/2.

2.17 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Flex Pression Ltd.
2. Flex-Hose Co., Inc.
3. Flexicraft Industries.
4. Flex-Weld, Inc.
5. Hyspan Precision Products, Inc.
6. Mercer Gasket & Shim, Inc.
7. Metraflex Company (The).
8. Proco Products, Inc.
9. Tozen Corporation.
10. Unaflex.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.18 WATER METERS

A. Displacement-Type Water Meters:

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

   a. AALIANT.
   b. ABB.
   c. Carlon Meter.
   d. Mueller Co.
   e. Schlumberger Limited.
   f. Sensus.

2. Description:

   a. Standard: AWWA C700.

b. Pressure Rating: 150-psig working pressure.
c. Body Design: Nutating disc; totalization meter.
d. Registration: In gallons or cubic feet as required by utility company.
e. Case: Bronze.
f. End Connections: Threaded.

B. Compound-Type Water Meters:

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

a. AALIANT.
b. ABB.
c. Badger Industries, Inc.
d. Hays Fluid Controls.
e. Master Meter, Inc.
f. McCrometer, Inc.
g. Mueller Co.
h. Schlumberger Limited.
i. SeaMetrics, Inc.
j. Sensus.

2. Description:

a. Standard: AWWA C702.
b. Pressure Rating: 150-psig working pressure.
c. Body Design: With integral mainline and bypass meters; totalization meter.
d. Registration: In gallons or cubic feet as required by utility company.
e. Case: Bronze.
f. Pipe Connections: Flanged.

C. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

C. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. 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.

F. Install Y-pattern strainers for water on supply side of each control valve water pressure-reducing valve solenoid valve and pump.

G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

H. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

I. Install water-hammer arresters in water piping according to PDI-WH 201.

J. Install air vents at high points of water piping.

K. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

L. 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.

M. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

A. 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 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.

2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Carbonated-beverage-machine backflow preventers.
5. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
6. Water pressure-reducing valves.
7. Calibrated balancing valves.
8. Primary, thermostatic, water mixing valves.
9. Manifold, thermostatic, water mixing-valve assemblies.
10. Primary water tempering valves.
11. Outlet boxes.
12. Supply-type, trap-seal primer valves.
13. Trap-seal primer systems.

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 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer 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.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 13 13

FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure and pressure couplings.
3. Expansion joints and deflection fittings.
4. Backwater valves.
5. Cleanouts.
6. Encasement for piping.
7. Manholes.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Expansion joints and deflection fittings.
2. Backwater valves.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles to horizontal scale of not less than 1 inch equals 50 feet and to vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

D. Field quality-control reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.1 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI-Trademark, Shielded Couplings:

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

a. ANACO-Husky.
b. Dallas Specialty & Mfg. Co.
c. Fernco Inc.
d. Mission Rubber Company, LLC; a division of MCP Industries.
e. Stant.
f. Tyler Pipe; a subsidiary of McWane Inc.

2. Description: ASTM C 1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Shielded Couplings:

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

a. ANACO-Husky.
b. Clamp-All Corp.
c. Dallas Specialty & Mfg. Co.

d. Mission Rubber Company, LLC; a division of MCP Industries.
e. Stant.
f. Tyler Pipe; a subsidiary of McWane Inc.

2. Description: ASTM C 1277 and ASTM C 1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Shielded Couplings:

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

a. MG Piping Products Company.

2. Description: ASTM C 1277 with ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. Unshielded Couplings:

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

a. ANACO-Husky.

2. Description: ASTM C 1277 and ASTM C 1461, rigid, sleeve-type, reducing- or transition-type mechanical coupling, with integral, center pipe stop, molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.2 ABS PIPE AND FITTINGS

A. ABS Sewer Pipe and Fittings: ASTM D 2751, with bell-and-spigot ends for gasketed joints.

1. NPS 3 to NPS 6: SDR 35.
2. NPS 8 to NPS 12: SDR 42.

B. Gaskets: ASTM F 477, elastomeric seals.

2.3 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Sewer Piping:

1. Pipe: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

B. PVC Profile Sewer Piping:

1. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.

3. Gaskets: ASTM F 477, elastomeric seals.

C. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

D. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.4 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Concrete Pipes: ASTM C 443, rubber.
3. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
5. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

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

a. Dallas Specialty & Mfg. Co.
b. Fernco Inc.
c. Logan Clay Pipe.
d. Mission Rubber Company, LLC; a division of MCP Industries.
e. NDS Inc.
f. Plastic Oddities.

2. Description: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

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

a. Cascade Waterworks Mfg. Co.
b. Dallas Specialty & Mfg. Co.
c. Mission Rubber Company, LLC; a division of MCP Industries.

2. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

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

a. Fernco Inc.
b. Logan Clay Pipe.
c. Mission Rubber Company, LLC; a division of MCP Industries.

2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

F. Nonpressure-Type, Rigid Couplings:

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

a. ANACO-Husky.

2. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling, molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:

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

a. EBAA Iron, Inc.
b. Romac Industries, Inc.
c. Star Pipe Products.

2. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:

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

a. Dresser, Inc.
b. EBAA Iron, Inc.
c. JCM Industries, Inc.
d. Smith, Jay R. Mfg. Co.

2. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained- type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated.

C. Ductile-Iron Deflection Fittings:

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

a. EBAA Iron, Inc.

2. Description: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

2.6 BACKWATER VALVES

A. Cast-Iron Backwater Valves:

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

a. Josam Company.
b. Smith, Jay R. Mfg. Co.
c. Tyler Pipe; a subsidiary of McWane Inc.
d. Watts; a Watts Water Technologies company.
e. Zurn Industries, LLC.

2. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
3. Horizontal type; with swing check valve and hub-and-spigot ends.
4. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
5. Terminal type; with bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves:

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

a. Canplas LLC.
b. IPS Corporation.
c. NDS Inc.
d. Plastic Oddities.
e. Sioux Chief Manufacturing Company, Inc.
f. Zurn Industries, LLC.

2. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.7 CLEANOUTS

A. Cast-Iron Cleanouts:

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

    a. Josam Company.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.
    d. Tyler Pipe; a subsidiary of McWane Inc.
    e. Watts; a Watts Water Technologies company.
    f. Zurn Industries, LLC.

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Light Duty Medium Duty Heavy Duty and Extra-Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.8 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) or high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm) minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

E. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
6. Install PVC cellular-core sewer piping according to ASTM D 2321 and ASTM F 1668.
7. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
8. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
9. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Install force-main, pressure piping according to the following:

1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
2. Install piping with 36-inch minimum cover.
3. Install PVC pressure piping according to AWWA M23 or to ASTM D 2774 and ASTM F 1668.
4. Install PVC water-service piping according to ASTM D 2774 and ASTM F 1668.

G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:

1. Hubless cast-iron soil pipe and fittings.
2. Expansion joints and deflection fittings.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
5. Join PVC cellular-core sewer piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
6. Join PVC corrugated sewer piping according to ASTM D 2321.
7. Join PVC profile sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
8. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

9. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

B. Join force-main, pressure piping according to the following:

1. Join PVC pressure piping according to AWWA M23 for gasketed joints.
2. Join PVC water-service piping according to ASTM D 2855.
3. Join dissimilar pipe materials with pressure-type couplings.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

a. Shielded flexible or rigidcouplings for pipes of same or slightly different OD.
b. Unshielded, increaser/reducer-pattern, flexible or rigidcouplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."

B. Connect force-main piping to building's sanitary force mains specified in Section 221316 "Sanitary Waste and Vent Piping." Terminate piping where indicated.

3.6 IDENTIFICATION

A. Comply with requirements in Section 31200 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
    b. Option: Test concrete gravity sewer piping according to ASTM C 924.

7. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig .

    a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
    b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

8. Manholes: Perform hydraulic test according to ASTM C 969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.8 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Waste, Force-Main Piping: 50 psig.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

1.5 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.

1.6 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.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

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 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. CISPI, Hubless-Piping Couplings:

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

a. ANACO-Husky.
b. Dallas Specialty & Mfg. Co.
c. Fernco Inc.

a. Matco-Norca.
b. MIFAB, Inc.
c. Mission Rubber Company, LLC; a division of MCP Industries.
d. Stant.
e. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C 1277 and CISPI 310.

3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:

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

a. ANACO-Husky.
b. Clamp-All Corp.
c. Dallas Specialty & Mfg. Co.
d. MIFAB, Inc.
e. Mission Rubber Company, LLC; a division of MCP Industries.
f. Stant.
g. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C 1277 and ASTM C 1540.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. Cast-Iron, Hubless-Piping Couplings:

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

a. MG Piping Products Company.

2. Standard: ASTM C 1277.

3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 GALVANIZED-STEEL PIPE AND FITTINGS

A. Cast-Iron Flanges: ASME B16.1, Class 125.

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.

2.4 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."

2.5 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."

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

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

1) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Froet Industries LLC.
4) Mission Rubber Company, LLC; a division of MCP Industries.
5) Plastic Oddities.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

5. Pressure Transition Couplings:

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

1) Cascade Waterworks Mfg. Co.
2) Dresser, Inc.
3) EBAA Iron, Inc.
4) Ford Meter Box Company, Inc. (The).
5) JCM Industries, Inc.
6) Romac Industries, Inc.
7) Smith, Jay R. Mfg. Co.
8) Viking Johnson.

b. Standard: AWWA C219.
c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d. Center-Sleeve Material: Manufacturer's standard.
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

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

1) A.Y. McDonald Mfg. Co.
2) Capitol Manufacturing Company.
3) Central Plastics Company.
4) HART Industrial Unions, LLC.
5) Jomar Valve.
6) Matco-Norca.
7) Watts; a Watts Water Technologies company.
8) Wilkins.
9) Zurn Industries, LLC.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 150 psig.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

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

1) Capitol Manufacturing Company.
2) Central Plastics Company.
3) Matco-Norca.
4) Watts; a Watts Water Technologies company.
5) Wilkins.
6) Zurn Industries, LLC.

b. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 150 psig.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

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

1) Advance Products & Systems, Inc.
2) Calpico, Inc.
3) Central Plastics Company.

4) Pipeline Seal and Insulator, Inc.

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

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

1) Elster Perfection Corporation.
2) Grinnell Mechanical Products.
3) Matco-Norca.
4) Precision Plumbing Products.
5) Victaulic Company.

b. Description:

1) Standard: IAPMO PS 66
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig at 225 deg F.
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

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 to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. 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."

K. 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.

L. 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.

M. 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; 2 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.

N. 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."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Install underground ABS and PVC piping according to ASTM D 2321.

P. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

Q. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

R. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

S. Install force mains at elevations indicated.

T. Plumbing Specialties:

1. Install backwater valves in sanitary waster 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. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main 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."

U. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

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. 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 hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. 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.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

F. 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.

G. 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. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. 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 and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot 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. 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. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. 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.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

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. Hubless, cast-iron soil pipe and fittings and sovent stack fittings; CISPI, heavy-duty hubless-piping couplings; and coupled joints.
3. 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. Hubless, cast-iron soil pipe and fittings and sovent stack fittings; CISPI, heavy-duty hubless-piping couplings; and coupled joints.
3. 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. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty hubless-piping couplings; and coupled joints.

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. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty hubless-piping couplings; and coupled joints.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Solid wall, Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
2. Solid wall, Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Solid-wall, Cellular-core PVC pipe; PVC socket fittings; and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

J. Underground sanitary-sewage force mains NPS 4 and smaller shall be any of the following:

1. Hard copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Ground rods.
2. Ground rings.
3. Grounding arrangements and connections for separately derived systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Harger Lightning & Grounding.
4. ILSCO.
5. O-Z/Gedney; a brand of Emerson Industrial Automation.
6. Siemens Power Transmission & Distribution, Inc.
7. Thomas & Betts Corporation, A Member of the ABB Group.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

C. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

F. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
1. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

2

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Requirements:

1. Section 26 05 48.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design hanger and support system.

B. Seismic Performance: Hangers and support shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Component Importance Factor: 1.5.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame Rating: Class 1.

2. Self-extinguishing according to ASTM D 635.

2.2 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; a part of Atkore International.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. Thomas & Betts Corporation, A Member of the ABB Group.
e. Unistrut; an Atkore International company.

2. Material: Galvanized steel.
3. Channel Width: 1-5/8 inches.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
6. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored 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 made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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

1) Hilti, Inc.
2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
3) MKT Fastening, LLC.

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 where used.

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

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Hilti, Inc.
3) ITW Ramset/Red Head; Illinois Tool Works, Inc.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are 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.

2.3 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 Section 05 50 00 "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 support for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. 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 using spring friction action for retention in support channel.

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, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to 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 thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS SP-58, 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 comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 50 00 "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 larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

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: Comply with requirements in Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. 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 AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, serving communications systems.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For floor boxes.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Allied Tube & Conduit; a part of Atkore International.
2. Anamet Electrical, Inc.
3. O-Z/Gedney; a brand of Emerson Industrial Automation.
4. Robroy Industries.
5. Thomas & Betts Corporation, A Member of the ABB Group.
6. Western Tube and Conduit Corporation.
7. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

a. Material: Steel.
b. Type: Setscrew.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Anamet Electrical, Inc.
2. CANTEX INC.

3. RACO; Hubbell.
4. Thomas & Betts Corporation, A Member of the ABB Group.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660.

E. Fittings for LFNC: Comply with UL 514B.

F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

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

1. Cooper Technologies Company.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman; a brand of Pentair Equipment Protection.
5. Hubbell Incorporated.
6. Milbank Manufacturing Co.
7. O-Z/Gedney; a brand of Emerson Industrial Automation.
8. RACO; Hubbell.

9. Robroy Industries.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation, A Member of the ABB Group.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

K. Gangable boxes are prohibited.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC IMC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC,.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicate. on Drawings.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

U. Expansion-Joint Fittings:

1. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

Z. Locate boxes so that cover or plate will not span different building finishes.

AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

CC. Set metal floor boxes level and flush with finished floor surface.

DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 20 00 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 31 20 00 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 20 00 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Grout.
3. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

B. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.

b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.3 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

END OF SECTION

SECTION 26 05 48.16

SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Restraint channel bracings.
2. Restraint cables.
3. Seismic-restraint accessories.
4. Mechanical anchor bolts.
5. Adhesive anchor bolts.

B. Related Requirements:

1. Section 26 05 29 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Delegated-Design Submittal: For each seismic-restraint device.

1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints and for designing vibration isolation bases.

a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

3. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated that is a nationally recognized testing laboratory as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

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

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If pre-approved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: As specified by the project structural engineer.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: As specified by the project structural engineer.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second):.
4. Design Spectral Response Acceleration at 1.0-Second Period.

2.2 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut; an Atkore International company.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

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

1. Kinetics Noise Control, Inc.
2. Loos & Co., Inc.
3. Vibration Mountings & Controls, Inc.

B. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. B-line, an Eaton business.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. TOLCO; a brand of NIBCO INC.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

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

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.6 ADHESIVE ANCHOR BOLTS

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

1. Hilti, Inc.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.

B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receiveseismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."

B. Equipment and Hanger Restraints:

1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole

and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.

C. Seismic controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Identification for conductors.
2. Warning labels and signs.
3. Instruction signs.
4. Equipment identification labels, including arc-flash warning labels.
5. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

C. Comply with ANSI Z535.4 for safety signs and labels.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

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

2.2 COLOR AND LEGEND REQUIREMENTS

A. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

A. Self-Adhesive Labels:

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

a. Brady Corporation.
b. Ideal Industries, Inc.
c. Panduit Corp.

2. Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

a. Nominal Size: 3.5-by-5-inch.

3. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.4 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

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

a. Ideal Industries, Inc.
b. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

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

a. Brady Corporation.
b. Carlton Industries, LP.

C. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

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

    a. Carlton Industries, LP.
    b. Seton Identification Products.

D. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.5 Signs

A. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

    a. For signs up to 20 sq. inches, minimum 1/16-inch-.
    b. For signs larger than 20 sq. inches, 1/8 inch thick.
    c. Engraved legend with white letters on a dark grey background.
    d. Punched or drilled for mechanical fasteners.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.

2.6 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ideal Industries, Inc.
2. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.3 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless

otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Power-transfer switches.
b. Controls with external control power connections.

G. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.

1. Comply with NFPA 70E and ANSI Z535.4.
2. Comply with Section 26 05 74 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.

H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label Stenciled legend 4 inches high.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of an engraved, laminated acrylic or melamine label.

b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Emergency system boxes and enclosures.
h. Motor-control centers.
i. Enclosed switches.
j. Enclosed circuit breakers.
k. Enclosed controllers.
l. Variable-speed controllers.
m. Push-button stations.
n. Power-transfer equipment.
o. Contactors.
p. Remote-controlled switches, dimmer modules, and control devices.
q. Battery-inverter units.
r. Battery racks.
s. Power-generating units.
t. Monitoring and control equipment.
u. UPS equipment.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V or less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Accessory components and features.

1.3 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
7. Include schematic and wiring diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Seismic Qualification Certificates: For switchboards, overcurrent protective devices, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to be included in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

a. Routine maintenance requirements for switchboards and all installed components.
b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.
2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type but no less than one of each size and type.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards.

C. Handle and prepare switchboards for installation according to NECA 400.

1.9 FIELD CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F.
b. Altitude: Not exceeding 6600 feet.

1.10 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

B. Manufacturer's Warranty: Manufacturers agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
2. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 SWITCHBOARDS

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

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Power Transmission & Distribution, Inc.
4. Square D; by Schneider Electric.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 2.

F. Comply with NFPA 70.

G. Comply with UL 891.

H. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Panel mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

I. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48.16 "Seismic Controls for Electrical Systems."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.

    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

J. Indoor Enclosures: Steel, NEMA 250, Type 1.

K. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

L. Barriers: Between adjacent switchboard sections.

M. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

N. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity,
3. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
4. Tin-plated aluminum feeder circuit-breaker line connections.
5. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
6. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
7. Disconnect Links:

    a. Isolate neutral bus from incoming neutral conductors.
    b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.

8. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

O. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

P. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

2.3 SURGE PROTECTION DEVICES

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

1. Advanced Protection Technologies Inc. (APT).
2. Eaton Electrical Sector; Eaton Corporation.
3. General Electric Company.

4. Siemens Power Transmission & Distribution, Inc.
5. Square D; by Schneider Electric.

B. SPDs: Comply with UL 1449, Type 2.

1. SPDs with the following features and accessories:

a. Integral disconnect switch.
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
e. Surge counter.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V or 1200 V for 208Y/120 V.
3. Line to Line: 2000 V for 480Y/277 V or 1000 V for 208Y/120 V.

E. SCCR: Equal or exceed 100 kA.

F. Nominal Rating: 20 kA.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

a. Instantaneous trip.
b. Long- and short-time pickup levels.
c. Long- and short-time adjustments.

4. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.

c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

B. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

1. Fixed circuit-breaker mounting.
2. Two-step, stored-energy closing.
3. Full-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:

a. Instantaneous trip.
b. Time adjustments for long- and short-time pickup.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements in Section 26 05 48.16 "Seismic Controls for Electrical Systems" or manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NECA 400.

1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
3. Protect from moisture, dust, dirt, and debris during storage and installation.
4. Install temporary heating during storage per manufacturer's instructions.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.

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

3.2 INSTALLATION

A. Install switchboards and accessories according to NECA 400.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 " Cast-in-Place Concrete."

1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after switchboard is anchored in place.
2. 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.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to switchboards.
6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."

E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, surge protection devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

H. Comply with NECA 1.

3.3 CONNECTIONS

A. Comply with requirements for terminating feeder bus specified in Section 26 25 00 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

B. Comply with requirements for terminating cable trays specified in Section 26 05 36 "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

C. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.

D. Support and secure conductors within the switchboard according to NFPA 70.

E. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Acceptance Testing:

a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
b. Test continuity of each circuit.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Perform the following infrared scan tests and inspections, and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Switchboard will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. SPD: Surge protective device.

G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Key interlock scheme drawing and sequence of operations.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
3. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48.16 "Seismic Controls for Electrical Systems."

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

F. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Kitchen Areas: NEMA 250, Type 4X,.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Height: 84 inches maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Finishes:

    a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel.

G. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.

    a. Plating shall run entire length of bus.
    b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.3 POWER PANELBOARDS

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

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: As indicated in the drawings.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers or Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

G. Branch Overcurrent Protective Devices: Fused switches where indicated in the drawings.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only as indicated on the drawings.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

a. RMS sensing.
b. Field-replaceable rating plug or electronic trip.
c. Digital display of settings, trip targets, and indicated metering displays.
d. Multi-button keypad to access programmable functions and monitored data.
e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
f. Integral test jack for connection to portable test set or laptop computer.
g. Field-Adjustable Settings:

1) Instantaneous trip.
2) Long- and short-time pickup levels.
3) Long- and short-time adjustments.
4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Subfeed Circuit Breakers: Vertically mounted.
9. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
h. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
i. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
j. Multipole units enclosed in a single housing with a single handle.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 26 28 13 "Fuses."
2. Fused Switch Features and Accessories:

a. Standard ampere ratings and number of poles.
b. Mechanical cover interlock with a manual interlock override, to prevent the opening of the cover when the switch is in the on position. The interlock shall prevent the switch from being turned on with the cover open. The operating handle shall have lock-off means with provisions for three padlocks.

2.6 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407.

D. Equipment Mounting:

1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

J. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

K. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

M. Install filler plates in unused spaces.

N. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

O. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

P. Mount spare fuse cabinet in accessible location.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Perform optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Tamper-resistant receptacles.
4. Weather-resistant receptacles.
5. Snap switches and wall-box dimmers.
6. Communications outlets.
7. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Eaton (Arrow Hart).
2. Hubbell Incorporated; Wiring Device-Kellems.
3. Leviton Manufacturing Co., Inc.
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

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

    a. Eaton (Arrow Hart).
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

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

    a. Eaton (Arrow Hart).
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

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

    a. Eaton (Arrow Hart).
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

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

    a. Hubbell Incorporated; Wiring Device-Kellems.
    b. Pass & Seymour/Legrand (Pass & Seymour).

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

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

a. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2.6 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

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

1) Eaton (Arrow Hart).
2) Hubbell Incorporated; Wiring Device-Kellems.
3) Leviton Manufacturing Co., Inc.
4) Pass & Seymour/Legrand (Pass & Seymour).

2. Two Pole:

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

1) Eaton (Arrow Hart).
2) Hubbell Incorporated; Wiring Device-Kellems.
3) Leviton Manufacturing Co., Inc.
4) Pass & Seymour/Legrand (Pass & Seymour).

3. Three Way:

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

1) Eaton (Arrow Hart).
2) Hubbell Incorporated; Wiring Device-Kellems.
3) Leviton Manufacturing Co., Inc.
4) Pass & Seymour/Legrand (Pass & Seymour).

4. Four Way:

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

1) Eaton (Arrow Hart).
2) Hubbell Incorporated; Wiring Device-Kellems.
3) Leviton Manufacturing Co., Inc.
4) Pass & Seymour/Legrand (Pass & Seymour).

2.7 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.8 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, die-cast aluminum with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening

2.9 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:
   a. Enclosed controllers.
   b. Enclosed switches.

2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

   a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in electronic format suitable for use in coordination software and in PDF format.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 77 00"Closeout Procedures," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in electronic format suitable for use in coordination software and in PDF format.
4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Bussmann, an Eaton business.
2. Edison; a brand of Bussmann by Eaton.
3. Littelfuse, Inc.
4. Mersen USA.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC.
2. Type RK-5: 600-V, zero- to 600-A rating, 200 kAIC.
3. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
4. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK5, time delay.
2. Large Motor Branch (601-4000 A): Class L, time delay.
3. Other Branch Circuits: Class J, time delay.
4. Control Transformer Circuits: Class CC, time delay, control transformer duty.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Architect.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Manufacturer's field service report.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 77 00 "Closeout Procedures," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.8 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.11 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

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

1. ABB Inc.
2. Eaton.
3. General Electric Company.
4. Siemens Industry, Inc.
5. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 NONFUSIBLE SWITCHES

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

1. Eaton.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Site clearing, preparation and grading.
2. Building excavating andbackfilling.
3. Trenching, backfilling and compacting for utilities.
4. Excavation and grading for site paving, curbs and sidewalks.
5. Finish grading.

1.2 DEFINITIONS

A. Native or natural soils: Undisturbed soils present at site in their natural state or conditions. Materials which are essentially free of vegetation or organic matter and do not include trash or other deleterious materials.

B. Existing fill soils: Materials present at site that have been disturbed, possibly transported, and are not in their natural undisturbed state.

C. Imported fill soils: Materials transported onto site.

D. Granular material: A sandy type of soil whose particles are coarser than cohesive material and which do not stick to each other.

F. Finished Grade: Floor level for interior footings, and the lowest adjacent grade (either floor level or outside grade) within 5'-0" of foundations for perimeter wall or exterior column footings.

G. Building Area: The area within the building footprint plus 5 feet beyond the perimeter of the footprint.

H. Uncontrolled Fill: Any existing fill that was not properly placed, observed and tested.

I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.3 SUBMITTALS

A. Test Reports:
1. Submit test results for imported fill materials to be used (if required), directly to the testing laboratory with a copy to Architect in accordance with Section 01 45 00.
2. Test results shall clearly indicate:
a. Types of materials and composition.
b. Hardness
c. Compactability.
d. Presence of organic contaminants, whether or not below EPA action levels.

e. Presence of hazardous and/or regulated wastes and contaminants, whether or not below EPA action levels.
f. Suitability for proposed usage.

3. Testing laboratory shall notify Architect of non-conforming fill material submittals.

B. As-Built Drawings:
1. Maintain previously recorded utilities and accurately record location of:
a. Newly encountered utilities remaining.
b. Rerouted utilities.
c. New utilities by horizontal dimensions, elevations or inverts, and slope gradients.
2. Submit in accordance with Section 01 77 00.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable Federal, State and local ordinances, including Uniform Standard Specifications for Public Works' Construction, Off-Site Improvements, Mohave County Area, Arizona, latest edition (USSPWC). Where geotechnical report, General Structural Notes, or notes on drawings state more restrictive requirements, the requirements of the geotechnical report, General Structural Notes, or notes on drawings shall govern.

B. Earthwork shall be performed in accordance with guidelines presented in Chapter 12 of the 2018 International Building Code, except where specific recommendations are specified in this Section.

C. Staking: Staking shall be performed by a Civil Engineer or Land Surveyor currently registered in the state where the Project is located. One person only shall be responsible for staking the Project; however, additional staff may be used (under direct supervision of responsible person) for larger projects.

D. Observation of Geotechnical Engineer: Every phase of the earthwork shall be performed under observation and testing directed by the Geotechnical Engineer.

1.6 SITE CONDITIONS

A. Soil Report:
1. In lieu of a geotechnical report, the foundation has been designed in conformance with Chapter 18 of the IBC. The design values listed in the Foundation Notes section of sheet S001 are found in Table 1806.2 and are allowed by the city for general conditions if the soils are not expansive according to the specifications in section

B. Existing Conditions:
1. Bidders are expected to visit the site to form their own conclusions as to the character of the Work under this Section.
2. Due to previous and existing site development, special attention shall be given to locating and removing existing subsurface remnants of former facilities, backfilled zones, and soils disturbed by demolition operations.

C. Environmental Requirements: Place, spread or roll fill materials during favorable weather conditions. When the Work is interrupted by rain, do not resume fill operations until evidence is furnished which establishes that moisture content and density of the previously placed fill are as specified.
1. Surface drainage: Provide and maintain positive surface drainage during excavation. Prevent infiltration of water into utility or foundation excavations from whatever sources as may exist.
2. Dust control: Comply with requirements of governing authorities. Use whatever means necessary to control dust on and near the Work and on and near off-site borrow, storage and spoil areas, if such dust is caused by the Contractor's operations during performance of the Work, or if resulting from the conditions in which the Contractor leaves the site. Thoroughly moisten surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other Work on the site.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fill Materials:
1. On-site soils, meeting the criteria established in the Earthwork Section of the Geotechnical Exploration Report, may be used in required fills.
2. Existing pavements which are properly broken up, as determined by the geotechnical Engineer, may be suitable for use in required fills.
3. Imported Fill: Shall be suitable for its intended use and compatible with on-site soils. All imported material shall be approved by the Geotechnical Engineer prior to importing. In general, imported fill shall be granular and non-expansive, with a maximum solubility of 0.50 percent and a maximum sulfate content of 0.10 percent.
4. Retaining Wall Backfill (6-12 inches immediately behind retaining walls): Select free-draining granular materials.

B. Under-Slab Fill: Type II material conforming to Section 704.03.04 of the Uniform Standard Specifications for Public Works' Construction, Off-Site Improvements, Mohave County, Area, Arizona, latest edition (USSPWC).

C. Utility Bedding and Backfill for Utilities: material shall conform to Section 207 "Structure backfill", Section 208 "Trench Excavation and Backfill" and Section 704 "Base Aggregates" of the Uniform Standard Specifications for Public Works' Construction, Off-Site Improvements, Mohave County, Area, Arizona, latest edition (USSPWC).

D. Warning Tape:
1. Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.

2. Provide detectable warning tape with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2'-6" deep for non-metallic utility pipes, conduit or other underground services outside of building line.
3. Tape Colors: Provide tape colors to utilities as follows:
   a. Red: Electric.
   b. Yellow: Gas, oil, steam, and dangerous materials.
   c. Orange: Telephone and other communications.
   d. Blue: Water systems.
   e. Green: Sewer systems.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify survey data. Stake out work and verify as to location and elevation. Carefully maintain benchmarks, monuments, and other reference points; if disturbed or destroyed, replace as directed.

B. Site Clearing: Strip and remove existing vegetation, debris, uncontrolled fill, all loose, soft, or disturbed natural soils, and other deleterious materials from proposed building areas, adjacent walks and slabs, and in areas to be paved. Extend excavations at least 5 feet beyond the areas to be improved in plan view.

C. All exposed surfaces shall be free of mounds and depressions which would prevent uniform compaction.

D. Unexpected fills or existing underground facilities encountered during site clearing shall be removed and the excavation thoroughly cleaned and backfilled.

E. All excavations shall be observed by the Geotechnical Engineer prior to backfill placement.

F. Excavations resulting from demolition and removal of existing improvements shall be properly filled in accordance with recommendations of the Geotechnical Exploration Report.

G. All material derived from demolition of existing structures shall be removed from the site. Materials derived from demolition of existing structures are not allowed for use in any fills.

H. Existing Utilities:
1. Identify known below grade utilities. Stake and flag locations.
2. Identify and flag above grade utilities.
3. Maintain, re-route, extend and protect as required existing utilities remaining which pass-through Work area as indicated.
4. Notify utility company to remove and relocate utilities obstructing the Work.
5. Pay costs for this Work, except that covered by utility company.

I. Unknown Utilities and Concealed Conditions:
1. Upon discovery of unknown utility or concealed conditions which are unrecorded on the Contract Documents, discontinue affected Work and notify Architect in writing.
2. Should additional work be required to remove, maintain, re-route, extend or protect unknown utilities or other conditions, the Contractor will be paid for the Work in accordance with the provisions of the General Conditions.

3.2 SUBGRADE

A. Prepare subgrade at building areas to proper elevation to receive under-slab fill.

B. Prepare subgrade at paved areas to proper elevation to receive base course materials. See Section 32 12 16.

C. Grade as required to bring entire remainder of site to finished grade as indicated on drawings.

3.3 EXCAVATION - GENERAL

A. Excavate for foundations and footings to provide vertical walls and corners square. Keep entire excavation free from loose material. Conform to dimensions and elevations indicated with allowances for erection of forms, shoring, waterproofing, and inspection of footings.

B. Material to be excavated shall be non-classified and shall include earth or other materials encountered in excavating.

C. The use of explosives will not be permitted.

D. Drawings show predetermined elevations or depths for bottoms of footings. Should additional depth of excavation be necessary, the Contractor will be paid for the Work in accordance with the provisions of the General Conditions.

E. Shore and brace excavations if necessary to prevent cave-ins. Remove shoring before backfilling is completed, but not until permanent supports are in place.

F. If excavation is carried below depth indicated, backfill with properly placed and compacted fill material (material as specified) over properly prepared subgrade, or increase foundation depth as required without extra compensation.

G. Remove excess excavated material from the grounds and legally dispose of same.

H. Protect utility services uncovered by excavation.
   1. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.
   2. Accurately locate and record abandoned and active utility lines rerouted or extended, on Project Record Documents.

3.4 EXCAVATION - UTILITIES

A. Trenching:
   1. General:
      a. Perform trenching required for the installation of items where the trenching is not specifically described in other Sections of these Specifications.
      b. Excavate for underground utilities, including water, steam, condensate, natural gas pipelines, fire protection lines, sewers, electrical lines, cables, ducts and other electrical items.

2. Width:
   a. Make trenches open vertical construction with sufficient width to provide free working space at both sides of the trench and around the installed item as required for caulking, joining, backfilling, and compacting.
   b. Provide for a minimum net clearance of 6 inches and a maximum net clearance of 12 inches on each side of the barrel of the pipe and to allow the backfill to be placed and properly compacted. Exceptions to these clearances will occur at encasement or special construction.
3. Depth:
   a. Trench as required to provide the elevations shown on the Drawings.
   b. Where elevations are not shown on the Drawings or specified in other sections of the specifications, trench to sufficient depth to give a minimum of 18" of fill above the top of the pipe, measured from the adjacent finished grade.
   c. Where the bottom of excavation is found to be soft and cannot support the pipe, the depth shall be extended until solid bearing is reached. Backfill to pipe foundation grade with granular material or earthfill and thoroughly compact to assure a firm foundation for the pipe.
   d. Where excavation is in rock, or caliche, cut to depth of at least 8 inches below pipe invert elevations.
4. Trench Bottoms:
   a. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit.
   b. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
   c. Remove stones and sharp objects to avoid point loading.
   d. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   e. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
5. Do not disturb any portion of or remove support from a piping system that has thrust blocks or other constraints against movement while the system is in service.
6. Correction of faulty grades: Where trench excavation is inadvertently carried below proper elevations, backfill with pipe bedding material and compact to provide a firm and unyielding subgrade or foundation without additional compensation.
7. Trench bracing:
   a. Properly brace and support trenches in accordance with requirements of governing authorities.
   b. Brace, sheet, and support trench walls in such a manner that the ground alongside the excavation will not slide or settle, and that existing improvements of every kind, whether on public or private property, will be protected from damage.
   c. Arrange bracing, sheeting, and shoring so as not to place stress on portions of the completed Work until the general construction thereof has proceeded far enough to provide sufficient strength.
8. Repairs and replacement: In the event of damage to such improvements, immediately make repairs and replacements necessary to the approval of the Architect without additional compensation.
9. Removal of trench bracing: Exercise care in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse and caving of the excavation faces being supported.

10. Grading and stockpiling trenched material: Control the stockpiling of trenched material in a manner to prevent water running into the excavations. Do not obstruct surface drainage but provide means whereby storm water is diverted into existing gutters, other surface drains, or temporary drains.

B. Crossing Protection
1. Provide adequate temporary crossover for pedestrian and vehicular traffic including guard rails, lamps and flags, as required by agencies having jurisdiction and as directed.
2. Remove provisions for crossing protection when they are no longer needed.

C. Underpinning: Where excavation work is required under or adjacent to existing footings, under-pin as required to prevent damaging existing construction.

3.5 FOUNDATION FOR PIPES

A. General: Grade the trench bottoms to provide a smooth, firm, and stable foundation free from rockpoints throughout the length of the pipe.

B. Foundation material: Place a minimum of 6" of the specified pipe bedding fill material in the bottom of the trench.

C. Subsurface conditions: In areas where soft, unstable materials are encountered at the surface upon which cohesionless material is to be placed, remove the unstable material and replace it with material approved by the Architect. Make sufficient depth to develop a firm foundation for the item being installed.

D. Overexcavation: If the need for such overexcavation has been occasioned by an act or failure to act on the part of the Contractor, make the overexcavation and replacement without additional compensation.

E. Bearing: At each joint in pipe, recess the bottom of the trench as required into the firm foundation in such a manner as to relieve the bell of the pipe of all load and to ensure continuous bearing of the pipe barrel on the firm foundation.

F. Shaping: Accurately shape pipe subgrade and fit the bottom of the trench to the pipe shape. Use a drag template shaped to conform to the outer surface of the pipe if other methods do not produce satisfactory results.

3.6 BEDDING FOR PIPES

A. General: Place the specified pipe bedding fill material in the trench, simultaneously on each side of the pipe for the full width of the trench, to a maximum depth of 3 feet and a minimum depth of one foot above the outside diameter of the pipe barrel. Water consolidation shall not be allowed

B. Densification: Take special care to provide firm bedding support on the underside of the pipe and fittings for the full length of the pipe.

C. Alternate bedding: Other bedding procedures and materials may be used if prior written approval has been obtained from the Civil Engineer through the Architect.

3.7 UNDER-SLAB FILL

A. Place under-slab fill to the thickness and grade indicated, smooth and even, free of voids. Compact to specified density. Grade to a tolerance of 1/4 inch in 10 feet.

3.8 BACKFILLING - GENERAL

A. After completion of the foundations, walls and other construction, and removal of forms, clean the excavations of trash and debris.

B. Place the backfill symmetrically against each side of the walls to prevent eccentric loading. Place backfill in horizontal 6-inch (150mm) layers with the proper moisture content for the required degree of compaction.

3.9 BACKFILLING - UTILITIES

A. Backfill pipe and conduit trenches in a manner to prevent disturbance to the pipes or conduits. Fill under and around pipes thoroughly to a point approximately 12 inches above the top of the pipe and compact. Backfill remainder of trench in 6-inch layers and compact.

B. Backfill utility trenches in accordance with recommendations of the Geotechnical Exploration Report.

C. Backfilling prior to approvals: Do not allow or cause portions of the work performed or installed to be covered up or enclosed by work of this Section prior to required inspections. Should any of the work be so enclosed or covered up before it has been inspected, uncover such work at no additional compensation.

D. Backfill simultaneously on both sides of utility to prevent displacement.

E. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to level of bottom of footings.

F. Provide 4-inch-thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 COMPACTION

A. Place and compact fills in accordance with recommendations of the Geotechnical Exploration Report.

B. Utilize mechanical compaction equipment in grading operations. In no case shall water settling, or "jetting" be employed. Vibratory compaction equipment employed shall be subject to the approval of the Architect to ensure that vibrations will not be created that will affect existing construction or slopes.

3.11 FINISH GRADING

A. After construction and final clean-up of exterior, and removal of debris, grade building site to slopes and elevations directed.

B. Leave graded areas raked smooth.

C. Remove excess material from the site.

3.12 FIELD QUALITY CONTROL

A. Earthwork, footings depths, and excavations for foundations shall be inspected by the Geotechnical Engineer to verify allowable soil bearing and low settlement and swell potential, and to make any additional recommendations.

B. Tests: Inspection and testing of earthwork shall be performed by a testing laboratory in accordance with Section 01 45 00.
   1. Provide free access to Work and cooperate with appointed firm.
   2. Tests of materials may be performed to ensure conformance with specified requirements.
   3. Provide one field density test of under-slab fill for every 2,000 square feet of building area.
   4. Provide two field density tests of backfill at locations and elevations directed.
   5. Provide one field density test of prepared subgrade for every 2,000 square feet of site and building area.
   6. Soil compaction which does not meet the specified requirements shall be recompacted and reworked as directed by the Geotechnical Engineer through the Architect.

3.13 PROTECTION

A. Protect newly graded areas from traffic and erosion, keep areas free of trash and debris. Repair and establish grades in any areas settled, rutted or eroded.

END OF SECTION

SECTION 31 10 00

SITE PREPARATION

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Temporary Facilities and Control - Section 01 50 00.

1.02 WORK INCLUDED

A. Protecting of utilities, structures, sidewalks, roads, drives, buildings, lawns, trees, shrubs, and landscape work adjacent to or to remain on the site.

B. Miscellaneous excavating and back-filling as required.

C. Removing from the site all protective installations after all other operations have been completed.

1.03 PROTECTION

A. The Contractor shall erect all protective barriers, fences, and warning devices, as may be required to protect the construction site, utilities, and persons to avoid injury, damage, or unauthorized persons from entering construction area during the period of construction.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 CLEARING

A. All clearing, grubbing, and removal shall be accomplished prior to other site work, preparation, footing, building, and utility excavations, construction, all surface vegetation and their roots, ground covers, debris, rubbish, rocks, asphalt paving, concrete walks, curbing and foundations, and existing uncontrolled fill, etc. Protect all existing utilities that need to remain.

3.02 DISPOSAL

A. The Contractor shall dispose of all demolished or deleterious material, rubble, debris, concrete rubble, asphalt surfacing, vegetation, and waste at his expense, off the site.

B. Under no conditions shall rubble or such materials be used as backfill or fill.

3.03 HAULING

A. All transportation required to haul and dispose of all items.

B. All transportation required to haul and dispose of all items required will be furnished by the Contractor.

3.04 BLASTING

A. Blasting with explosives will not be allowed.

3.05 PROTECTION OF EXISTING UTILITIES

A. The existing utilities that are shown on the drawings or the locations of which are made known to you, the Contractor, prior to excavating or clearing, shall be protected from damage. If damaged, they shall be repaired immediately at no expense to the Owner.

B. Unknown Lines: In the event lines not shown on the drawings are damaged, and whose existence was not made known, a report thereof be made. If it is determined that repairs are to be made by the Contractor, an adjustment in payment will be made to cover costs at the rates determined.

C. Responsibility: The Contractor shall be responsible for maintaining all utilities and services, and providing for the safety of all utilities encountered.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILL UTILITIES

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork - Section 31 00 00.

B. Electrical - Division 26.

1.02 PROTECTION

A. Guardrails, Barricades, Lights, etc.: Maintain protective measures by means of barricades as are necessary to warn pedestrians and vehicles.

B. Excavation Drainage: Operate pumping equipment as required to keep the excavation free of surface water and ground water and sub-grades dry, firm and undisturbed until approval of the utility installation has been received from the Owner's Representative. When the sub-grade has been distributed by water, remove disturbed material down to firm undisturbed material after the water is brought under control. Replace disturbed sub-grade in trenches by mechanically tamped sand or gravel.

C. Shoring, Sheeting and Bracing: Prevent banks of excavations and trenches from movement or settling by shoring, sheeting, bracing or sloping to angle or repose as required to protect workmen, adjacent paving, structures, property and utilities.

1. Extend shoring and bracing to the bottom of the excavation.

1.03 EXCAVATING

A. Excavation and trenching shall conform to Safety and Health Standards for construction: April 18, 1971 - May 31, 1972; Occupational Safety and Health Administration - U.S. Department of Labor OSHA 2061, Pages 11, 12 and 13; Paragraphs 1926.651, Specific Excavation Requirements, and 1926.652, Specific Trenching Requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fill material shall consist of soils that conform to MAG Specification 601.

B. The plasticity index of the material, as determined in accordance with ASTM D423 and D424, shall not exceed 15.

C. The fill material shall be free from roots, grass, other vegetable matter, clay lumps, rocks larger than 6 inches, or other deleterious materials.

D. Compaction:

1. Compaction of the fill shall be accomplished to obtain a density of not less than 90 percent of maximum dry density. If fill is located under a structure or pavement area, density should be 95 percent.

PART 3 - EXECUTION

3.01 GENERAL

A. All excavation of every description and of whatever substances encountered shall be performed to the depths indicated or as otherwise specified. During excavation, material suitable for back-filling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins.

B. All excavated materials not required or suitable for backfill shall be removed and tested as indicated or as directed.

C. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if, in the opinion of the Owner's representative, the pipe, cable, or duct can be safely and properly installed and backfill can be properly tamped in such tunnel section. Excavation shall comprise all materials encountered, including rock and filled-in material of whatsoever nature involved.

3.02 TRENCH EXCAVATION

A. Trenches shall be of the necessary width for proper laying of pipe, cables, or ducts. The banks of pipe trenches shall be as nearly vertical as practicable. Care shall be taken not to over excavate.

B. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pie sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints and as hereinafter specified. Bell holes and depressions for joints shall be dug after the trench bottom has been graded, and, in order that the pipe rest on the prepared bottom for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joint. Stones shall be removed as necessary to avoid bearing. Where rock excavation is required in trenches for pipe, the rock shall be excavated to a minimum over-depth of 6 inches below the trench depths indicated or specified. Except as hereinafter specified for wet or otherwise unstable material, over-depths shall be back-filled as and with materials specified for back-filling the lower portion trenches. Wet or otherwise unstable material encountered beyond the depths indicated on the drawings or specified herein shall be removed and replaced with satisfactory material as directed, and the contract price will be adjusted accordingly. Special requirements relating to specific utilities are as follows:

1. Water Supply and Distribution Lines: Unless otherwise indicated,

trenches shall be graded to avoid high points with the necessity of placing vacuum and relief valves in the water lines. Unless otherwise indicated, trenches shall be of a depth to provide a minimum cover over the top of the pipe of 2-2 1/2 feet in unpaved areas and 3-feet under paved areas, and to avoid interference of the water lines with other utilities.

3.03 BACKFILLING

A. The trenches shall not be back-filled until all required pressure tests are performed and until the utilities systems as installed conform to the requirements specified in the several sections covering the installation of the various utilities.

B. Lower Portion of Trenches: Backfill material shall be deposited in 6-inch maximum thickness layers and compacted with suitable tampers to the density of the adjacent soil or graded as hereinafter specified until there is a cover of not less than 2 feet over sewers and 1 foot over other utility lines. The backfill material in this portion of the trench shall consist of a selected material at a moisture content that will facilitate compaction, free from stones larger than 3 inches in any dimension and hard clods and frozen conglomerates larger than 6-inches in any dimension, except that where the pipe is coated or wrapped for protection against corrosion the backfill material shall be free from stones larger than 1-inch in any to damage the coating or wrapping of pipes.

C. Remainder of Trench: Except for special materials for pavements, the remainder of the trench shall be back-filled with material that is free of stones larger than 6-inches or 1/2 the layered thickness, whichever, is smaller, in any dimension. Backfill material shall be deposited in layers not exceeding the thickness specified, and each layer shall be compacted to the minimum density specified as applicable to the particular area except that in areas other than under drives and parking areas, including shoulders and other paved areas subject to vehicular movement. Degree of compaction shall be as specified in Paragraph 2.01, above.

1. Under Pavement and Structures: Six-inch layers, 95% of maximum density for soils up to the elevation at which the requirements for pavement sub-grade material and compaction control.

2. Under Other Areas: One-foot layers, density equal to the adjacent soil.

3.04 INSPECTION AND TESTS

A. Field Inspection and Testing: The Owner shall employ the services of a registered, licensed inspection and testing firm to supervise all controlled fill. The geotechnical engineer shall provide continuous on-site inspection by experienced personnel during construction of controlled earthwork. The Contractor shall notify the engineer at least two working days in advance of any field operations of the controlled earthwork, or of any resumption of operations after stoppages. Tests of fill materials and embankments will be made at the following suggested minimum rates:

1. One field density test for each 1,000 square yards of original ground surface prior to placing fill.

2. One field density test for each 150 cubic yards of original ground surface prior to placing fill.

3. One moisture-density curve for each type of material used, as indicated by sieve analysis and plasticity index.

B. Report of Field Density Tests: The geo-technical engineer shall submit the results of field density tests required by these specifications to the Contractor. The Contractor will provide copies of the reports to the Architect and the Project Manager on a weekly basis. The Contractor shall immediately report any discrepancies to the Architect and Project Manager.

C. Costs of Tests and Inspections: The costs of tests, inspection, and engineering, as specified in this section of the specifications, shall be borne by the Owner.

END OF SECTION

SECTION 31 31 00

SOIL TREATMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pretreatment to provide chemical barrier to protect buildings and contents against attack by subterranean termites.
2. Treatment of site and areas as indicated to remove vegetation growth.

1.2 SUBMITTALS

A. Product Data: Submit label indicating Manufacturer's chemical analysis of treatment materials prior to application. Submit evidence of EPA approval and State registration.

B. Test Reports: Submit reports of field tests for termitetreatment.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: Registered applicator with 5 years' experience and licensed by the Arizona Department of Agriculture.

B. Regulatory Requirements: Chemicals shall be approved for use and registered by Environmental Protection Agency (EPA) and the Arizona Department of Agriculture.

1.4 DELIVERY, STORAGE AND HANDLING

A. Conform to Manufacturer's instructions and Governmental Agencies' requirements.

B. Deliver materials to Project in original sealed and labeled containers of Manufacturer.

1.5 SITE CONDITIONS

A. Do not apply chemicals in inclement weather or when there is a possibility of rain.

1.6 WARRANTY

A. Upon completion of soil treatment, and as a condition of final acceptance, provide Owner with written unlimited warranty providing:
1. Application was made at concentration, rate, and method in compliance with Specifications contained herein.
2. Warrants effectiveness of the soil treatment against subterranean termite infestation for a period of not less than 5 years from acceptance and completion date of Project.
3. Warrants effectiveness of soil treatment against vegetation growth for a period of six (6) months.

B. Upon evidence of subterranean termite activity within warranty period, re-treat area to stop infestation of affected areas and repair termite caused damage to building at no cost to Owner.
   1. Re-treatment under warranty sufficient to prevent termites from attacking building or its contents during remainder of initial warranty period, plus one additional year for each time re-treatment under warranty is required.
   2. Complete re-treatment of the building shall be as specified herein and shall be rendered upon the third recurrence of subterranean termites in the same structure within 5-year period from the date of project acceptance.
   3. Damage caused by infestations and by re-treatment shall be repaired at no cost to the Owner.

C. Upon evidence of vegetation growth re-treat area at no cost to Owner.

D. Draft warranty in favor of Owner, successors or assigns.
   1. Pre-printed FHA or VA guarantee forms shall not be acceptable.
   2. The Owner and the applicator reserve the option to renew termite protection on an annual basis after the expiration of the warranty.

PART 2 PRODUCTS

2.1 MATERIALS

A. Termite Treatment: Apply one of the following chemicals as a water emulsion (no oil solutions permitted):
   1. Dragnet SFR (Permethrin), FMC Corporation www.fmc.com
   2. Prelude (Permethrin); Syngenta www.syngentaprofessionalproducts.com
   3. Prevail FT (Cypermethrin); FMC Corporation www.fmc.com
   4. Talstar (Bifenthrin), FMC Corporation. www.fmc.com
   5. Premise (Imidacloprid); Bayer Environmental Science www.bayerprocentral.com , www.nobugs.com
   6. Demon TC or Demon Max (Cypermethrin) Syngenta www.syngentaprofessionalproducts.com
   7. Termidor (Fipronil), Termidor Termite Control; BASF - www.termidorhome.com.

B. Vegetation Treatment:
   1. Pre-Emergent:
      a. Oryzalin (Surflan).
   2. Post-Emergent:
      a. Roundup; Monsantowww.roundup.com
      b. Season Long or Ground Clear; ORTHO www.ortho.com
      c. SeasonPlus Grass and Weed Killer Plus Preventer; Spectracide www.spectracide.com

C. Mix solutions in accordance with Manufacturer's directions to highest concentration allowable by label.

PART 3 EXECUTION

3.1 APPLICATION - TERMITE CONTROL

A. Time of Application:
   1. Notify Architect to be present during application, at least 24 hours prior to application of materials.

2. Apply chemical treatment during normal working hours in order to be subject to observation.
3. Do not treat soil and fill areas that are excessively wet or after heavy rains to avoid surface flow of toxicants.

C. Application: In accordance with Manufacturer's recommendations, and local codes and regulations.
1. Provide applicator trucks with approved measuring flow meters.
2. Apply chemicals on soils and compacted ABC fill materials under entire subsurfaces of concrete floor slabs and slabs abutting building walls in quantities and locations stated on label.

D. Do not disturb aggregate base course and treated soil between application of poison and pouring of concrete.
1. Re-treat soil or compacted fill which has been disturbed after soil poisoning, due to plumbing and electrical changes or omissions.
2. Should rainy weather occur prior to pouring concrete slab over treated ABC, re-treat the complete area at the discretion of Architect, and at no additional cost to Owner.

3.2 APPLICATION - VEGETATION CONTROL

A. Apply chemical to on-site landscape areas and landscaped portions of public street right-of-ways of site.

B. Chemical Control: Prior to planting operations, provide 2 applications over unwanted vegetation.

C. Pre-emergent: Post landscape planting operations. Comply with manufacturers label for application and protection of existing landscape planting.

3.3 FIELD QUALITY CONTROL

A. Tests: Chemical analysis tests shall be made of materials used on the basis of one test for each 10,000 square feet of treated area. Samples and test may be taken of both concentrates and the dilute materials as being applied. See Section 01 45 00 for provisions covering payment for testing.

3.4 PROTECTION

A. Adjacent property, trees and plants shall be protected from injury and damage as result of operations in this Section.

END OF SECTION

SECTION 31 31 16

TERMITE CONTROL

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork – Section 31 00 00.

1.02 SCOPE

A. Provide and install termite control, chemical barrier to protect building and contents against attack by subterranean termites.

1.03 SUBMITTALS

A. Product Data: To include manufacturer specification or formulation.

B. Material List: Application procedure and rate of application.

1.04 QUALITY ASSURANCE

A. Affidavit: On completion of Work under this Specification, submit record of meter readings or other approved data indicating rate of application together with affidavit certifying that treatment has been applied in accordance with Specification requirements.

B. Guarantee: Provide Owner at no additional cost with 5-year written guarantee at new construction. Guarantee to provide for any additional work necessary to satisfactorily control termites in building(s). Upon evidence of subterranean termite activity within guarantee period, re-treat area at no cost to Owner. Re-treatment under guarantee sufficient to prevent termites from attacking building or its contents during remainder of initial guarantee period.

PART 2 - PRODUCTS

2.01 TERMITE CONTROL, CHEMICAL AND CONCENTRATION

A. Product as required by the State of Arizona.

1. Contains above-named chemical in concentration specified.

2. Label registered in State Chemist's Office, Mesa, Arizona; label sets forth names and percentages of active ingredients of formula.

3. Delivered to job site in original sealed and labeled container of manufacturer.

PART 3 - EXECUTION

3.01 NOTIFICATION

A. Notify Architect at least 48 hours in advance of each application. Make no application without authorization of Architects. Make application during normal working hours. Allow minimum 5 hours between time of treatment and placement of concrete for testing.

3.02 PREPARATION OF CHEMICALS

A. As required by the manufacturer and the State of Arizona.

3.03 APPLICATION

A. By firm licensed by Arizona Structural Pest Control Board and under direction of applicator certified by that Board. Application in accordance with manufacturer's recommendations and USDA Bulletin No. 64.

B. Make no application until all preparations for concrete have been completed.

C. Do not disturb treated soil between time of treatment and placement of concrete.

D. Applicator to issue written authorization for Contractor to proceed with placing of concrete, vapor barrier or other Work over treated soil. Copy of authorization endorsed by Contractor and filed with Architect.

3.04 RATE OF APPLICATION

A. As required by the State of Arizona.

END OF SECTION

SECTION 32 12 16
ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY
- A. Section Includes: Offsite asphaltic concrete paving.
- B. Related Sections:
  1. Paving requirements indicated on Civil Drawings.

1.02 SUBMITTALS
- A. Design Mix: Submit design mix-formula for asphalt concrete not less than 7 days in advance of actual placement of material.
- B. Certificates: Submit Certificate of Compliance indicating that materials to be incorporated in Work meet Specification requirements.

1.03 QUALITY ASSURANCE
- A. Comply with Specifications and Civil Drawings.

1.04 DELIVERY, STORAGE AND HANDLING
- A. Transport bituminous mixtures to site in clean trucks and in manner to prevent segregation of materials or inclusion of foreign substances.
- B. Mix to consist of specified aggregate and bitumen.
- C. Asphalt surface course mixture to have minimum temperature of 285 degrees F. and maximum temperature of 350 degrees F.

1.05 SITE CONDITIONS
- A. Physical Requirements for Proper Installation or Application:
  1. Conform to applicable requirements of Bullhead City specifications and Civil Drawings.
  2. Place asphaltic concrete when surface is dry, when the ambient temperature in shade is 40 degrees F. and rising, or above 50 degrees F. if falling.
  3. Do not place asphaltic concrete when weather is foggy, rainy, or when base on which material is to be placed is wet or frozen.

PART 2 PRODUCTS

2.01 MATERIALS
- A. General: Provide materials in accordance with Section 00 31 32 – Geotechnical Report, as indicated on Civil Drawings and as specified herein. Aggregate Base Course:
  1. Base materials: Conform to specifications and Civil Drawings and requirements specified herein. Material to be crushed rock product with a plasticity index not exceeding 5 and comply with grading requirements shown in Table 702.
  2. Aggregate: Clean and free of organic matter and of such a nature that it can be compacted to a dense and firm layer capable of supporting loaded trucks and self-propelled pavers without rutting.
  3. Deliver aggregate to site in thoroughly blended condition and handle in manner to prevent excessive segregation. Do not mix underlying soil or subbase with aggregate base material. Do not mix underlying soil or subbase with aggregate base material.
- B. Prime and Tack Coats:
  1. Prime coat: ASTM D2026, Grade MC-70 or MC-250 liquid asphalt, meeting requirements of Bullhead City specifications and Civil Drawings.
  2. Tack Coat: Mixing type emulsion SS-I-H, as specified in specifications and Civil Drawings, diluted in proportion of approximately 50 percent water and 50 percent emulsion.

C. Asphaltic Concrete Paving:
1. Refer to specifications and Civil Drawings.
2. Asphalt concrete shall be Type 12.5mm or 19mm single course mix as indicated on Drawings. Percentage asphalt range: 5.0 to 6.0.
3. When test procedures determine aggregate is subject to stripping, add dry hydrated lime conforming to requirements of ASTM C207, Type N; Portland cement conforming to Bullhead City specifications and Civil Drawings; or other approved anti-strip agent.

D. Composition and Grading: Comply with specifications and Civil Drawings. Aggregates and mix to be incorporated into Work shall show loss in L.A. Rattler (ASTM C131) (after 500 revolutions) of 40% max.

E. Surface Seal Coat:
1. Emulsified Asphalt: Provide emulsified asphalt Grade SS-1h as specified in Bullhead City specifications and Civil Drawings, diluted with a minimum of one part water to one part of emulsified asphalt.
2. Sand Blotter: In accordance with following sieve analysis:
a. 3/8 inch: 100%
b. No. 4: 90 - 100%
c. No. 200: 0 - 12%

2.02 EQUIPMENT

A. Spreading and Finishing Equipment: Comply with specifications and Civil Drawings.
1. Equipment to be of good condition and capable of performing Work specified in satisfactory manner.
2. Start finish rolling after pavement has cooled sufficiently to permit removal of roller marks and continue in whatever direction is necessary to produce a pavement surface free of indentations.
3. Leveling Course: Comply with pecifications and Civil Drawings.

2.03 MIXES

A. Job-mix formula shall indicate percentage passing for each specified sieve size of mineral aggregate and percent of asphalt to be used for each asphalt concrete mixture to be incorporated on Project. Job-mix formula (gradation), with allowable tolerances for a single test, to be used for job control. Single test variation tolerance is shown in following table. In no event shall less than 2 percent of mineral aggregate pass a No. 200 sieve.
1. No. 4 and larger : $\pm$ 7
2. No. 30: $\pm$ 5
3. No. 200: $\pm$ 2
4. Asphalt, percent by weight of mix: $\pm$ 4

PART 3 EXECUTION

3.01 PREPARATION

A. Backfill curbs prior to paving.

B. Base Preparation: Comply with specifications and Civil Drawings.

3.02 APPLICATION

A. Install asphaltic concrete pavement in accordance with Civil Drawings and soils report.

B. Base Course:
1. Construct aggregate base course on subgrade and compact to a minimum of 95 percent of maximum density in accordance with ASTM D1557.
2. Thickness: As shown on Drawings.
3. See Drawings for extra heavy duty areas requiring extra thickness for aggregate base course and asphaltic concrete.

C. Asphalt Prime Coat:
1. Comply with requirements of specifications and Civil Drawings.
2. Apply to aggregate base course, concrete surfaces joined by asphaltic paving such as concrete curbs and existing paving at cut edges.
3. Apply at rate of 0.35 gallons minimum and 0.4 gallons maximum per square yard.

4. Prime coat to penetrate into aggregate base and be free of puddles before paving operations begin.

D. Tack Coat:
1. Apply tack coat to vertical surfaces of existing pavement, curbs, gutters and construction joints, against which additional material is to be placed, to a new or old pavement to be overlaid, and to other surfaces as designated by Architect.
2. Tack coat to be slow setting type emulsion as specified. If emulsion is applied undiluted, apply at rate of 0.02 to 0.10 gallons per square yard; if emulsion is applied diluted 1:1 with water, apply at rate of 0.05 to 0.10 gallons per square yard, as directed by Architect.
3. Clean surfaces of loose and foreign material prior to application of tack coats.

E. Asphaltic Concrete:
1. Construct asphalt pavement in accordance with applicable requirements of specifications and Civil Drawings.
2. Place asphaltic concrete in thickness as recommended by Soils Report
3. If pavement is constructed in lifts using an asphalt concrete base in the first lifts, base to be thoroughly cleaned by whatever means necessary prior to application of tack coat and placement of surface layer.

F. Compaction: Comply with requirements of specifications and Civil Drawings.
1. Compact asphalt concrete surfacing to a density of 95 percent of 75 blows (ASTM D1559).
2. Measure asphalt density by means of a nuclear density gauge, or core testing. Nuclear gauge method will be preferred.

G. Upon completion, pavement surface to be smooth, dense and of uniform texture and appearance.
1. All areas to properly drain and be free of standing water. Compacted thickness to be not less than 1/4 inch of that shown on Drawings.
2. Finished surface not to vary more than 1/4 inch in a 20 foot distance as determined by a straight-edge placed in any position on finish surface, except across flow lines.

H. Tolerances:
1. Thickness: Compacted thickness shall be within the following tolerances from thickness indicated.
   a. Base Course: Plus or minus 1/2 inch .
   b. Surface Course: Plus or minus 1/4 inch .
2. Surface Smoothness:
   a. Base Course: Plus or minus 1/2 inch, measured using a 10 foot straight-edge placed in any position on finished surface, except across flow lines.
   b. Asphalt Concrete Surface Finish: Minus 1/4 inch from the lower edge of a 25 foot straight-edge laid on the finished surface of the asphalt and parallel with the center line of the road or drive.
   c. Asphalt Concrete Crowned Surface Finish: Plus or minus 1/4 inch, measured with a crowned template.

I. Corrective Requirements for Deficiencies: Comply with specifications and Civil Drawings.

J. Paving Termination:
1. Provide thickened edge at paving terminations that do not have wood header forms or concrete curbs.
2. Pavement termination to be minimum 12 inches wide x 8 inches deep or as shown on Drawings.

K. Surface Seal Coat: Comply with specifications and Civil Drawings.
1. Preparation of Surfaces:
   a. Immediately before applying the emulsion, clean area to be surfaced of dirt and loose material by means of power brooms, supplemented by hand brooms if necessary, except that when the fog seal is applied within 24 hours from the time a bituminous paving is completed. Brooming may be omitted provided condition of surface is approved by

Architect.

b. Do not apply seal coat until an inspection of surfaces has been made by Architect and it is determined that surfaces are suitable for application of emulsion.

2. Application of Asphalt Emulsions:
   a. Mix diluted material well before applying.
   b. Apply by distributor truck equipped with fog nozzles at approximate rate of 0.10 gallon per square yard.
   c. Exact rate of application to be as directed by Architect. Distributor truck shall comply with Bullhead City specifications and Civil Drawings.
3. Sand Blotter:
   a. After asphalt emulsion has cured to such extent that emulsion will not be picked up by traffic, apply sand blotter as directed or required by Architect where there is an excess of asphalt.
   b. After treated area has been opened to traffic, immediately cover excess asphalt emulsion which comes to surface with additional sand.

3.03 FIELD QUALITY CONTROL

A. Smoothness Tests:
   1. Test conformance of crown and grade of pavement as indicated. Finished surface to be smooth and finished within specified tolerances.
   2. Immediately after initial rolling, correct variations by adding or removing material as required. Cut out and replace any spots deficient in thickness with fresh mixture which is properly bonded to existing pavement.
   3. After final rolling, retest surface and correct irregularities in excess of specified tolerance by removing defective Work and replacing with new material.

END OF SECTION

SECTION 33 41 00

SANITARY SEWER AND STORM DRAIN

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The scope of work covered by these specifications shall include the furnishing of all material, labor, and equipment necessary to completely install the sanitary system and appurtenances in accordance with the Contract Drawings. Building plumbing (to 5 feet + outside the building) is covered in Division 15.

B. Applicable portions of the County or State Standard Construction Specifications, latest edition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pipe:

1. PVC: All SDR-35 PVC sanitary piping shall conform to ASTM A74-66, Cast Iron Soil Pipe, Service Weight.

2.02 EXCAVATION

A. General:

1. Contractor shall accomplish all excavation required by the Contract Drawings through whatever materials encountered. All excavation shall be accompanied in accordance with the State Safety Code and other safety requirements.

2. Unauthorized excavation below the required grade line shall be backfilled with approved material and mechanically compacted to 95% of maximum density at the expense of the Contractor.

3. In areas where large boulders, bedrock or other unyielding material is encountered at the bedding elevation, the trench or excavation shall be undercut 6" and backfilled to the proper bedding elevation with maximum 2" granular material.

4. In areas where overburden material is not of sufficient quality to be mixed with other more suitable material during backfill, the Contractor may be required to separate the two qualities of material during excavation to preclude subsequent undesirable mixing. The method of separation could include, but not be limited to, placing the materials on opposite sides of the trench.

PART 3 - EXECUTION

3.01 INSTALLATION OF SYSTEM

A. Pipe to be laid in a trench having a width not to exceed 12 inches on either side of pipe up to the top of pipe. Trench bedding to be shaped to provide contact with at least the lower 1/10 of the circumference of the pipe with the ground. Bedding of the circumference of the pipe with the ground. Bedding to be compacted to not less than 90 percent density.

B. Pipe shall be laid to line and grade starting at the lowest point on the system and construction upstream. Provide drainage away from the bedding operation. All pipes shall be laid true to the designated line and grade. They shall be fitted and matched so that when laid in the work they will form a smooth and uniform invert.

3.02 BACKFILL

A. General:

1. After the lines have been inspected and tested, the trenches and excavations shall be backfilled. Backfill may be accomplished prior to inspection at the Contractor's risk.

B. Sanitary Sewer:

1. Backfill to be classified material. Material to one foot above top of pipe to be 2 inches maximum size, carefully placed and thoroughly compacted around and above pipe to minimum 90 percent density.

C. Restore surfaces to their original contour and elevation, or in areas of new grading to the new design grade. Compact backfill sufficiently to avoid noticeable settlement and soft spots. Soft spots or settled areas to be corrected at Contractor's expense. Replace existing curbs, walks, paving, etc., with new.

End of Section