100% CONSTRUCTION DOCUMENTS

PROJECT MANUAL
for
GERMANTOWN ATHLETIC CLUB NATATORIUM AND LOCKER ROOM RENOVATION

1801 Exeter Road
Germantown, TN 38138

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Memphis, Tennessee 38117
901-767-3924

May 1, 2026

SECTION 00 01 07
SEALS PAGE

ARCHITECT
4FDESIGN, PC
5101 WHEELIS DRIVE SUITE 215
MEMPHIS, TN 38117

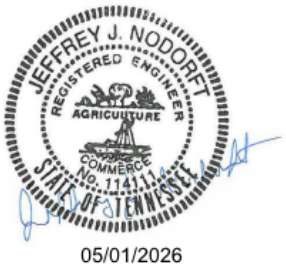
STRUCTURAL
JAMNU H. TAHILIANI & ASSOCIATES, INC.
474 PERKINS EXTENDED SUITE 211
MEMPHIS, TN 38117

PLUMBING/MECHANICAL/ECHANICAL
HNA ENGINEERING
5411 HAYES ROAD
ARLINGTON, TN 38002

05/01/2026

AQUATICS
COUNSILMAN-HUNSAKER
12851 MANCHESTER ROAD SUITE 120
ST. LOUIS, MO 63131

END OF SECTION



05/01/2026

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1.02 RELATED REQUIREMENTS

A. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 ALLOWANCES SCHEDULE

A. Signage: $3000.00

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 01 23 00
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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Women's Locker Room Renovation

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E. Alternate No. 5 - Pool Dehumidification

END OF SECTION

SECTION 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUBSTITUTIONS:

A. Substitute products should not be ordered and shall not be installed without written approval or acceptance from Designer. Contractor assumes all risks associated with premature ordering and installation of substitute products.

B. The specifically named manufacturers, products, and systems, and descriptive characteristics used in the Contract Documents normally serve only to establish a level of quality and a performance standard. Unless specific restriction is placed upon an item in the specifications, Contractor may submit proposals for substitutions. The Owner reserves the right to disallow substitutions. Contractor assumes risks associated with possible rejection of proposals for substitution submitted during the life of the contract.

C. Delays caused by tardiness of Contractor in preparing and forwarding submittals do not constitute an acceptable basis for consideration of substitute products. Delays due to factors which were in effect prior to project bidding do not constitute an acceptable basis for consideration of substitute products.

1.02 SUBSTITUTION REQUEST FORM:

A. Requests for substitutions shall be submitted to Designer on the form exhibited as Section 01 25 33, or in a similar format which provides the same or more information.

B. When making requests for substitutions, Contractor assumes the following responsibilities:
   1. To have personally investigated the proposed substitute product and determined it is equal or superior in all respects to that specified;
   2. To provide the same warranty for substitute that Contractor would for that specified;
   3. To provide complete cost data, and waive all claims for additional costs related to substitution which subsequently become apparent; and
   4. To coordinate installation of the accepted substitute, making such changes as may be required for Work to be complete in all respects.

END OF SECTION

SECTION 01 25 33
PRODUCT SUBSTITUTION REQUEST FORM

To:	**Project:**
Attn:	
Specified Item:	**Proposed Substitute:**

1. The following are attached (Mark all that apply):

- ☐ **Complete Description**
- ☐ **Laboratory Tests**
- ☐ Information on the availability of maintenance services and replacement materials for proposed substitute(s)
- ☐ **Catalog**
- ☐ **Spec Data**
- ☐ Names, addresses, and phone numbers of fabricators and suppliers for proposed substitute(s)

2. This substitution will have the following effects on dimensions, guages, weights, etc.:

3. This substitution will have the following effects on wiring, piping, ductwork, etc.:

4. This substitution will have the following effects on other trades:

5. This substitution will have the following effect on construction Schedules:

6. The proposed substitute(s) differs from the specified product(s) in quality and performance as follows:

7. Manufacturers guarantees for the substitute(s) and the specified product(s) are (check one):

☐ **the same** ☐ **different** (if different, explain below)

8. If the proposed substitution is accepted, it will result in:

☐ **no cost impact** ☐ **a cost increase of**

☐ **a cost decrease of** _____

(If change in cost is indicated, itemization on specified Cost Itemization Form is attached)

9. License fees or royalties are pending on the proposed substitute.

☐ **No** ☐ **Yes** (if yes, explain below)

10. The undersigned or the firm represented shall pay for additional studies, investigations, submittals, redesign, and analysis by the Designer necessitated by this substitution request.

Substitutions must be requested in accordance with applicable Contract requirements. After bidding, substitutions are to be submitted only by Contractor. Substitute products should not be ordered or installed without written acceptance.

Submitted by: **Date:**

Sign here: _____ _____

Name: **Telephone:**

type or print: _____ _____

for:

Name of firm: _____

Address:

Street address: _____

and mailing address if different: _____

City, State, and Zip Code: _____

Designer's Review Comments:

☐ **Accepted** ☐ **Rejected**

☐ **Accepted as noted** ☐ **Rejected (received too late)**

☐ **Rejected (submittal incomplete)**

Additional comments:

For the Designer: **Date:**

Signature here: _____ _____

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Progress photographs.

E. Coordination drawings.

F. Requests for Information (RFI's)

G. Submittals for review, information, and project closeout.

H. Number of copies of submittals.

I. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 00710 General Conditions of the Contract

B. Section 01 74 19 - Construction Waste Management and Disposal

C. Section 01 70 00 - Execution & Closeout Requirements

D. Section 01 78 00 - Closeout Submittals

1.03 PROJECT COORDINATION

A. Project Coordinator: responsibilities are under the jurisdiction of the Construction Manager/General Contractor.

B. Coordinate both the procedural timing and the listing (naming and sequencing) of reports/activities required by provisions of this section and other sections, to afford consistency and logical coordination between submitted reports or lists. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to entities involved in the work including Designer and Owner. In particular, provide close coordination of progress schedule, schedule of values, listing of subcontracts, schedules of submittals, progress reports, and payment requests.

C. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for storage of materials & Vehicular access, traffic, and parking facilities.

D. During construction, coordinate use of site and facilities through the Project Coordinator.

E. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

F. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.

G. Coordinate field engineering and layout work under instructions of the Project Coordinator.

H. Make the following types of submittals to Designer through the Project Coordinator:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Manufacturer's instructions and field reports.
   6. Applications for payment and change order requests.
   7. Progress schedules.

8. Coordination drawings.
9. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Designer will schedule a meeting after Notice of Award.

B. The Pre-Construction Conference shall be attended by the Contractor's:
   1. (Office) Job Manager
   2. (Field) Job Superintendent
   3. Major subcontractors' representatives
   4. Major suppliers' representatives
   5. Others, as desired

C. Agenda:
   1. Execution of Owner -General Contractor Agreement.
   2. Relation to coordination of Prime Contractor.
   3. Designation of responsible personnel.
   4. Submission of executed bonds and insurance certificates.
   5. Distribution of Contract Documents.
   6. Submission of list of Subcontractors, schedule of values, and progress schedule.
   7. Designation of personnel representing the parties to ContractOwner and .
   8. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures and close out documents.
   9. Handling of materials to permit inspection.
   10. Scheduling.
   11. Distribution of Submittals
   12. Sequence of critical work. Review of schedules
   13. Trades whose work will require pre-start up and workmanship review meetings.
   14. Use of Premises
      a. Access to site
      b. Field Office and Storage Areas
      c. Owner's Requirements
   15. Major equipment deliveries and priorities
   16. Storage of material off - site
   17. Construction waste management, recycling, and disposal
   18. Security procedures affecting owner's property
   19. Payment procedures after substantial completion
   20. Additional items and subjects requested by the owner, Designer and General Contractor

D. Designer (or designated construction administrator) will act as chairperson of the meetings. Chairperson will distribute and forward Records of meeting minutes and distribute copies within four (4) days after meeting to participants, with One (1) copy to General Contractor, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Designer (or designated construction administrator) to schedule and administer meetings throughout progress of the Work at maximum bi-weekly intervals.

B. General: In addition to specific coordination meetings for each element of work and other regular project meetings for other purposes, hold a general progress meeting each month. Require each entity then involved in planning, coordination or performance of work to be properly represented at each meeting. Review each entity's present and future needs including interface requirements, time, sequences, deliveries, access, site utilization, temporary facilities

and services, hours of work, hazards and risks, house-keeping, change orders, and documentation of information for payment requests. Discuss whether each element of current work is ahead of schedule, on time, or behind time in relation to updated progress schedule. Determine how behind-time work will be expedited, and secure commitments from entities involved in doing so. Discuss whether schedule revisions are required to ensure that current work and subsequent work will be completed within Contract Time. Review everything of significance which could affect progress of the work

C. Designer (or designated construction administrator) will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

D. Attendance Required:
   1. (Office) Job Manager
   2. (Field) Job Superintendent
   3. Subcontractors' representatives, as befits the agenda
   4. Suppliers' representatives, as befits the agenda
   5. Others, as appropriate

E. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on progress schedule and coordination.
   12. Other business relating to Work. Other current business

F. Designer (or designated construction administrator) to distribute record meeting minutes and distribute copies within (4) Four days after meeting to participants, with (1) One copy to General Contractor, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Within 7 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within (21) Twenty One days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.04 SCHEDULE OF VALUES

A. General: Prepare schedule of values and submit within 10 days of Notice to Proceed, as required by General Conditions, in coordination with the preparation of progress schedule. Correlate line items with other administrative schedules and forms required for the work, including progress schedule, payment request form, listing of subcontractors, schedule of allowances, schedule of alternates, listing of products and principal suppliers and fabricators, and schedule of submittals. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of payment requests and progress reports. Break down principal subcontract amounts into several line items. Round off the nearest whole dollar, but with total

equal to Contract Sum. Submit copies of schedule of values to Designer and Owner on AIA Form G703 - Continuation Sheet.

3.05 PAYMENT REQUESTS

A. General: Except as otherwise indicated, sequence of progress payments is to be regular, and each must be consistent with previous applications and payments. It is recognized that certain applications involve extra requirements, including initial application, application at times of substantial completion, and final payment application.
   1. Waivers of lien: Each progress payment must be submitted with Contractor's waiver and Subcontractor's waivers as may be required by Owner.
   2. Waiver Forms: Submit and execute in a manner, acceptable to the Owner.

B. Application Preparation: Except as otherwise indicated, complete every entry provided for on the form, including notarization and execution by authorized persons. Incomplete applications will be returned by Architect, without action. Entries must match current date of schedule of values and progress schedule and report. Listing must include amount of change orders issued prior to first date of the "period of construction" covered by application. Also attach form breaking application down by CSI Divisions.

C. ~~Stored materials~~
   ~~1. Materials stored on-site but not yet incorporated into the work may be claimed for payment.~~
   ~~2. Materials suitably stored off-site may be claimed for payment provided that the following is attached to each copy of application.~~
      ~~a. A statement identifying where materials are stored, and that materials are tagged to identify them for use in the project.~~
      ~~b. Copies of bills of sale for materials claimed.~~
      ~~c. A certificate of insurance covering materials claimed, recognizing Owner's right to make claims.~~
   3. Application at time of Substantial Completion: Following issuance of Designer's final "certificate of substantial completion" and also in part as applicable to prior certificates on portions of completed work as designed, a payment application may be prepared and submitted by Contractor. The principal administrative actions and submittals which must proceed or coincide with such special applications can be summarized as follows, but not necessarily by way of limitation.
      a. Occupancy permits and similar approvals or certificates by governing authorities and franchised services, assuring Owner's full access and use of completed work.
      b. Warranties, guarantees, maintenance agreements and similar provisions of contract documents
      c. Test/adjust/balance records, maintenance instructions, meter readings, start-up performance reports, and similar change-over information germane to Owner's occupancy, use, operation and maintenance of completed work.
      d. Final cleaning of the work.
      e. Application for reduction (if any) of retainage.
      f. Advise to Owner on coordination of shifting insurance coverages, including proof of extended coverages as required.
      g. Listing of Contractor's incomplete work, recognized as exceptions to Designer's certificate of substantial completion.
   4. Final Payment Application: the administrative actions and submittals which must preceded or coincide with submittal of final payment application can be summarized as follows, but not necessarily by way of limitation:
      a. Completion of project closeout requirements.
      b. Completion of items specified for completion beyond time of substantial completion (regardless of whether payment application was previously made).
      c. Assurance, satisfactory to the Owner, that unsettled claims will be settled and that work not actually completed and accepted will be completed without undue delay.

d. Transmittal or required project construction records to Owner.
e. Proof, satisfactory to Owner, that taxes, fees and similar obligations of Contractor have been paid.
f. Removal of temporary facilities, services, surplus materials, rubbish and similar elements.
g. Change over of door locks and other Contractor's access provisions to Owner's property.

5. Application Transmittal: Submit four (4) executed copies of each payment application, one copy of which is completed with waivers of lien and similar attachments. Transmit each copy with a transmittal form listing those attachments, and recording appropriate information related to application in a manner acceptable to Designer. Transmit to Designer (one additional copy to Owner) by means ensuring receipt within 24 hours.

3.06 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.

B. As-built documents are to be updated by the Superintendent and forwarded to the owner in the close out documents for their use and record. As-Built documents are to be kept on site and reviewed periodically by the Designer or designated construction administrator.

3.07 REQUESTS FOR INFORMATION (RFI'S)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified or on the contractor's letterhead in numerical order.
1. Designer will return RFI's submitted to Designer by other entities controlled by Contractor with no response.
2. Coordinate and submit RFI's in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project Name
2. Project Number/SBC Number
3. Date
4. Name of Contractor
5. Name of Designer and Construction Manager
6. RFI number, numbered sequentially
7. RFI subject
8. Specification section number and title and related paragraphs, as appropriate
9. Drawing number and detail reference, as appropriate
10. Field dimensions and conditions, as appropriate
11. Contractors suggested resolution, If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature
13. Attachments: Include sketches, descriptions, measurements, photos, product data, shop drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. Designer's and Construction Manager's Action: Designer and Construction Manager will review each RFI, determine action required, and respond. Allow fourteen (14) working days for Designer's response for each RFI.

D. If Contractor believes the RFI response warrants change in Contract Time or Contract Sum, notify Designer and Construction Manager in writing within Ten (10) days of receipt of the RFI response.

3.08 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:

1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

B. Submit to Designer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with Submittal Procedures article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.09 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. Sustainable Design Guidelines submittals and reports.
3. Certificates.
4. Test reports.
5. Inspection reports.
6. Manufacturer's instructions.
7. Manufacturer's field reports.
8. Other types indicated.

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. All other items required by specifications for closeout.
6. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.11 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
1. Electronic submittals in PDF format preferred.

B. Documents for Information:
1. Electronic submittals in PDF format preferred. If paper, submit only 2 copies.

C. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.

D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Designer
1. After review, produce duplicates.
2. Retained samples will not be returned to General Contractor unless specifically so stated.

3.12 SUBMITTAL PROCEDURES

A. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.

B. Transmit each submittal with a copy of approved submittal form.

C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

D. Identify Project, General Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

E. Apply General Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

F. Deliver submittals to Designer at business address.

G. Schedule submittals to expedite the Project, and coordinate submission of related items.

H. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

I. Provide space for general Contractor and Designer review stamps.

J. When revised for resubmission, identify all changes made since previous submission.

K. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

END OF SECTION

SECTION 02 40 00
DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes the following:
   1. Demolition of interior walls, ceilings, lights, finishes, fixtures, and infrastructure per the included drawings and phasing instructions.

1.02 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2009.

1.03 MATERIAL OWNERSHIP

A. Except for materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.04 JOB CONDITIONS

A. The Contractor shall visit the construction site so as to compare existing conditions with conditions shown on the drawings and stated in the specifications. No allowance will subsequently be made in behalf of the Contractor by reason of any omission on his part to include the cost of all items of work, either labor or material, which are required to attain the completed work.

B. Blasting and burning shall not be allowed under any circumstances.

C. All materials of demolition, except as hereinafter stated, to become property of Contractor and shall be removed from Owner's property at no expense to Owner.

D. Comply with federal, state and local hauling and disposal regulations.

E. Take appropriate action to check the spread of dust to avoid the creation of a nuisance in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as flooding or pollution. Comply with all dust regulations imposed by local air pollution agencies.

F. Traffic: Minimize interference with adjoining roads, streets, walks and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

1.05 SUBMITTALS

A. Submit for review a written dust control plan outlining the methods and means of verification. The Owner has the right to suspend work should dust control effect life safety issues.

B. Prior to beginning any demolition work provide a video that depicts the present conditions of the facility to remain. This video will be used as the basis as to whether the features to remain have been defaced or damaged by the demolition operations.

1.06 PROTECTION

A. Protect existing utilities, fire mains, sewers, drainage structures, pavements and walks that are to remain in place.

B. Ensure safe passage of personnel around demolition area. Conduct operations so as to prevent damage to adjacent buildings, structures or other facilities as well as injury to persons.

C. Provide temporary barricades and security of the site to protect the general public from injury due to demolition work.

D. Conduct demolition operations and removal of debris to ensure minimum interference with streets, drives, walks and other adjacent facilities that are occupied or in use. Do not close or obstruct streets, drives, walks or other facilities that are occupied or in use without permission from authorities having jurisdiction. Provide alternate safe routes around closed or obstructed traffic ways if required by governing regulations.

1.07 CODES, REGULATIONS AND STANDARDS

A. Disposal of demolished materials off site shall comply with the applicable local, state and federal ordinances. All work shall be accomplished in a manner that conforms to the Applicable Provisions of the Occupational Safety and Health Act.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain area of building that are being disturbed.

3.02 SALVAGE

A. Items of salvageable value to the Contractor may be removed from the structure as work progresses. The salvageable items shall be removed and transported from the site with no storage or sale of such items allowed on the site. No salvage item shall be solicited, sold, barter or traded on or adjacent to The City of Germantown property during or after the demolition duration.

3.03 EXAMINATION

A. Verify existing site conditions prior to starting work. Any discrepancies shall be noted on the project record drawings and reported to the Owner, Architects, and Engineers.

B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.04 PROTECTION

A. Locate, identify, and protect utilities indicated to remain from damage.

B. Notify appropriate utility company to disconnect utilities.

C. Maintain and protect above and below grade utilities indicated to remain.

3.05 UTILITIES

A. The Contractor shall be responsible for all damage occasioned by his failure to exercise reasonable care to protect existing utilities designated to remain during all demolition and new construction.

B. If demolition of any other construction requires the planned disconnection of any utility service to areas being used by others, the utility outages shall be scheduled at least five work days in advance of service disconnection. Planned service disconnections shall be held to an absolute minimum.

C. Contractor shall coordinate with City of Germantown Property Maintenance, MLGW and BellSouth for the shutoff and disconnection of utilities to the site prior to beginning demolition. Do not interrupt existing utilities serving other facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities.

D. Place markers to indicate location of disconnected services. Identify service lines and capping locations on As Built Project Record Drawings.

E. If demolition or any other construction results in the accidental disconnection of any utility service to areas being used by others, the service shall be immediately restored at the Contractor's expense and on a schedule agreed upon by the Consultant.

3.06 DEMOLITION

A. Pollution Controls:
   1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding or pollution.
   2. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

B. Filling Voids:
   1. Completely fill below grade areas and voids resulting from demolition of structures.
   2. Use satisfactory soil materials for all fill and backfill materials.
   3. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, trash or debris.
   4. Place fill material in horizontal layers and compact each layer to 95% standard proctor.

3.07 DAMAGE TO EXISTING STRUCTURES, UTILITIES, ETC.

A. All structures, utilities and adjacent materials disturbed or damaged as a result of construction work under this contract shall be repaired or replaced by the Contractor as soon as possible in a manner satisfactory to the Owner. All cost shall be borne by the Contractor.

3.08 DISPOSAL

A. Disposal: Remove surplus obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

3.09 CLEANUP

A. The Contractor shall, at all times during the progress of the work, remove and keep the area surrounding the site clear of all rubbish. All material and debris shall be removed daily.

B. Remove and transport materials and debris in a manner that will prevent spillage on the site, streets or adjacent areas. If spillage does occur it must be cleaned up immediately.

C. Comply with federal, state and local hauling and disposal regulations.

END OF SECTION

Section 04 2000

Unit Masonry Assemblies

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Concrete unit masonry
2. Installation requirements for pre-cast concrete trim.
3. Reinforcement and anchorages.
4. Concealed flashing.
5. Cavity and masonry void insulation.
6. Building in of items and anchors shown as built into or embedded in masonry.

1.1 RELATED SECTIONS

A. Division 03: Architectural Precast Concrete for product requirements.

B. Division 05: Structural Steel Framing, for furnishing and installing connections attached to structural-steel framing; Metal Fabrications, for loose steel lintels and anchors for fabrications embedded in masonry.

C. Division 07: Joint Sealants, for exterior and interior applications.

D. Division 08: Hollow Metal Frames, for door openings set into masonry.

E. Division 15: Plumbing items built into or embedded in masonry, penetrations, and sleeves.

F. Division 23: Mechanical items built into or embedded in masonry, penetrations, and sleeves.

G. Division 26: Electrical items built into or embedded in masonry, penetrations, and sleeves.

1.2 SUBMITTALS – ACTION

H. Comply with requirements of applicable Division 01 Sections.

I. Product Data:

1. Each type of masonry unit; include information on compressive strength for CMU.
2. Manufactured reinforcement, ties, anchors, and metal accessories.
3. Insulation.
4. Flashing.

5. Masonry cement.

J. Shop Drawings:

1. Face brick and thin brick special shapes.

2. Reinforcement for engineered masonry; prepare drawings

K. Samples – Selection:

1. Colored Mortar: Available standard colors.

L. Samples – Verification:

1. Face Brick: Full size units of each type of exposed masonry unit; demonstrate full range of variation in colors and textures for each type.

M. Colored Mortar: Cured samples that demonstrate color and texture using same sand mortar ingredients to be used in the Work.

1.3 SUBMITTALS – INFORMATIONAL

A. Pre-installation conference records.

B. Reports by independent testing and inspecting agency.

1.4 QUALITY ASSURANCE

A. Reference Standard: Comply with TMS 402-2016 – Building Code for Masonry Structures except as otherwise indicated.

1. Definitions stated in the Contract Documents take precedence over those stated in Part 1.1.2.

2. Notwithstanding publication dates listed in Section 1.3, comply with reference standards in effect as of date of Contract, unless otherwise required by law. Reference standards withdrawn or discontinued by their publishers shall not govern the Work.

B. Fire Resistance Rated Assemblies: Provide materials and construction identical to assemblies with fire resistance ratings determined per ASTM E119 by UL or other agency acceptable to authorities having jurisdiction, by equivalent concrete masonry thickness, or other means acceptable to authorities having jurisdiction.

C. Single Source Responsibility For Masonry Units: Obtain exposed masonry units of uniform texture and color, or uniform blend within ranges accepted for these characteristics, from one source and by single manufacturer for each different product required.

D. Single Source Responsibility For Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Preinstallation Meeting: Conduct meeting per requirements of Section 01310. Schedule meeting after mockups have been constructed.

1.5 MOCK-UPS

A. Comply with requirements of applicable Division 01 Sections.

1. Typical first floor.

2. Typical upper floor with one standard size fixed wood window.

B. Include:

1. Pre-cast concrete trim (all shapes).

2. Steel stud and sheathing backup.

3. Vertical veneer expansion joint.

4. Veneer anchors.

5. Flashing.

6. Weep vents, mortar dropping collector, flashing.

7. Sealant.

C. Location: As directed by Architect.

D. Size: Minimum 8 ft high by 8 ft long.

E. Provide suitable foundations and bracing needed for strength and stability to maintain mockup in undamaged condition.

F. Demonstrate materials and techniques proposed for use in the Work.

G. Clean exposed faces using materials and procedures proposed for final Work.

H. Revise materials and techniques as needed to achieve specified requirements, including appearance characteristics.

I. Accepted mockup shall serve as comparison standard for the Work. Maintain mockup in clean, undamaged condition.

J. Acceptance of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; esthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

K. Acceptance of mockups does not constitute approval of deviation from Contract Documents.

L. When directed by Architect, demolish and remove mock-ups from site.

1.6 DELIVERY, STORAGE, HANDLING

A. Comply with requirements of applicable Division 01 Sections.

B. Protect masonry units and mortar materials from absorbing moisture before installation. Dry units that become wet.

C. Store cementitious materials on elevated platforms, under cover, in dry location.

D. Protect bulk materials from contamination.

E. Maintain graded aggregates without mixture with other sizes or other materials.

F. Prevent metal accessories from rusting, and from accumulating dirt and oil.

1.7 PROJECT CONDITIONS

A. Protect tops of walls, projections, and sills with waterproof covers while construction is not in progress. Extend covers minimum 24 inches down both sides and secure against displacement by adverse weather.

1. Where one wythe of multi-wythe walls is completed in advance of other wythes, secure cover minimum 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, soil, and other substances from staining masonry surfaces to be left exposed or to receive paint or coatings. Remove mortar, grout, and soil from such surfaces immediately.

1. Move scaffolding boards near masonry when not in use in order to prevent rain from splashing off boards onto masonry.

2. Protect bottoms of walls from rain splashed mud and mortar spatters.

3. Protect sills, ledges, and projections from mortar and grout droppings.

4. Protect finish surfaces of windows, doors, and other non-masonry construction from mortar and grout droppings.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not lay masonry units that are rain-soaked or frozen.

B. Remove masonry damaged by freezing conditions.

C. Cold Weather Procedures: Comply with ACI 530.1 Article 2.3.2.2 when ambient temperature or masonry unit temperature is below 40 deg F.

D. Hot Weather Procedures: Comply with ACI 530.1 Article 2.3.2.3 when ambient temperature is above 100 deg F or above 90 deg F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 STANDARD CONCRETE MASONRY UNITS (CMU)

A. Manufacturer: Obtain concrete masonry units from one manufacturer.

B. Hollow Loadbearing CMU: ASTM C90.

C. Unit Compressive Strength: Minimum 1900 psi.

D. Weight Classification: Lightweight units of nominal 95 pcf density manufactured with expanded shale aggregate produced by rotary kiln process, graded to uniform texture, and conforming to ASTM C331.

E. Curing: Steam treatment.

F. Block Size: Nominal 8 by 16 inch face dimensions for exterior back-up typically and nominal 6 by 16 inch face dimensions for all other, unless specifically otherwise indicated.

G. Exposed Faces: Manufacturer's standard color and texture.

H. Special Shapes: Furnish special shapes where shown or needed for bond beams, lintels, corners, jambs, control joints, headers, bonding, and other special conditions.

2.2 PRECAST CONCRETE TRIM

A. Specified in Division 03: Precast Architectural Concrete.

2.3 MORTAR AND GROUT

A. Mortar Color:

1. Exterior Brick: Match existing color, texture and joint style on adjacent UT Cancer Research Facility located at 19 South Manassas Street, at the southwest corner of Madison Avenue and Manassas Street, and as indicated on Drawings.

2. Interior and Concealed Masonry: Standard gray.

B. Masonry Cement: ASTM C91.

C. Portland Cement-Lime Mix: Packaged blend of ASTM C150 Type I or Type III portland cement and ASTM C207 Type S hydrated lime.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable; free of staining substances and substances that adversely affect set or bond strength.

G. Water Repellent Admixture: Liquid water repellent mortar admixture intended for use with CMU that contains water repellent by manufacturer of integral water repellent used in CMU.

H. Cold Weather Admixture: Non-chloride, noncorrosive, accelerating admixture conforming to ASTM C494 Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Accelguard 80; Euclid Chemical Co.

2. Morset; W.R. Grace

2.4 REINFORCING STEEL

A. Reinforcing Bars: ASTM A615, Grade 60 deformed billet bars, except #2 and #3 bars shall be Grade 40.

2.5 JOINT REINFORCEMENT, TIES, AND ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products from a single manufacturer.

1. AA Wire Products Co.

2. Dur-O-Wal, Inc.

3. Heckmann Building Products, Inc.

4. Hohmann & Barnard, inc.

5. Masonry Reinforcing Corp. Of America.

6. National Wire Products Industries.

7. Southern Construction Products.

B. Base Wire: Hot-dip galvanized carbon steel wire; ASTM A153 Class B-2 zinc coating.

C. Joint Reinforcement Fabrication: ACI 530.1 Article 3.2.1.1.2; 10 ft flat units.

1. Width: As needed to provide minimum 5/8 inch mortar cover in exterior joints, 1/2 inch in interior joints.

2. Supply factory fabricated corner and tee intersection units.

D. Single Wythe Joint Reinforcement: Ladder type; 0.1875 inch side rods, 0.1483 inch cross rods; hot dip galvanized after fabrication.

E. Multiple Wythe Joint Reinforcement: Ladder type; 0.1875 inch side rods, 0.1483 cross rods; hot dip galvanized after fabrication.

1. Cross Rod Spacing: Maximum 16 inches.

2. Number of Side Rods: One for each face shell of hollow masonry units more than 4 inches in width, plus one side rod for each wythe of masonry 4 inches or less in width.

F. Veneer Anchors: Seismic type units consisting of metal anchor section and connector section designed to engage continuous wire embedded in the veneer mortar joint.

1. Anchorage Section: Formed steel strap with minimum 2 fasteners and self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and to prevent moisture from penetrating sheathing at pronged legs and screw holes.

2. Connector Section: Trapezoidal or rectangular shapes formed from galvanized wire with connector for positive connection of continuous horizontal wire. Use wire thickness recommended by manufacturer for tie sizes, but not less than 3/16 inch diameter. Size wire tie to extend at least halfway through veneer but with at least 3/4 inch cover on outside face.

3. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0677 inch thick steel sheet, galvanized after fabrication.

4. Fabricate wire connector sections from 0.1875 inch diameter hot-dip galvanized steel wire.

5. Continuous Wire: 0.1875 inch diameter hot-dip galvanized steel wire.

6. Galvanizing: Class B2.

G. Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene washer.

1. Size: As recommended by veneer anchor manufacturer, but not less than #10 diameter by length required to penetrate steel stud flange by minimum 3 exposed threads.

2. Organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.

2.6 ACCESSORIES

A. Through-Wall Flashing: Stainless Steel: 0.0156 inch thick formed with interlocking ribs at 3-inch intervals along length of flashing to provide integral mortar bond.

1. Provide lap and corner sealant recommended by flashing manufacturer for Project applications.

B. Membrane Flashing: Butyl or rubberized asphalt laminated with polyethylene facing.

1. Perm-A-Barrier; Grace Construction Products.

2. Waterproofing Membrane 104AHT; Royston Laboratories, Inc.

3. Polyken 620 Series; Polyken Technologies.

C. Core Cavity Weep System: Concrete unit masonry core weep system to allow for water to weep from the lowest point of the core and cavity of the wall.

1. Heckman Building Products No. 367.

D. Compressible Joint Filler: Compressible filler strips suitable for use with sealant specified in Section 07900; ASTM D1056, Type 2 (closed cell), Class A, Grade 1; compressible to 35 percent; formulated from neoprene or urethane.

1. Size fillers for 30–40 percent installed compression.

2. Size fillers so that edges are 1/2 inch from exterior masonry faces.

E. Control Joint Strips for CMU: Solid rubber strips with Shore A hardness of 60 to 80; designed to fit standard sash block and to maintain lateral stability in masonry walls; sizes and configurations as needed.

F. Bond Breaker Strips: ASTM D226, Type I #15 asphalt roofing felt.

G. Weep Vents: One-piece, flexible extrusion manufactured from UV-resistant polypropylene copolymer, designed to weep moisture from masonry cavity to exterior, sized to fill head joints with outside face held back 1/8 inch from exterior face; Dur-O-Wal, Inc. "Cell Vent" or similar product.

1. Colors: Standard colors selected by Architect.

H. Mortar Dropping Collector:

1. Mortar Net; AA Wire Products Company.

2. Mortar Break; Advanced Building Products, Inc. (distr. By York Flashings).

2.7 MASONRY CLEANERS

A. Job Mixed Detergent Solution: 1/2 cup dry measure "Spic and Span" or other tetrasodium polyphosphate cleaner and 1/2 cup dry measure laundry detergent dissolved in 1 gallon of water.

B. Proprietary Cleaner: At Contractor's option, proprietary cleaners may be proposed for use, subject to Architect's approval.

2.8 MIXES

A. Admixtures: Do not use admixtures unless specifically permitted. Request prior permission of Architect to use air-entraining agents, accelerators, retarders, water repellent agents, and anti-freeze compounds.

1. Admixtures containing calcium chloride or other free chloride ions will not be permitted.

2. If cold-weather admixture is permitted, use same quantity in all mortar, regardless of weather, to ensure uniform color.

B. Keep sand uniformly damp at all times.

C. Mixing: Combine and thoroughly mix mortar ingredients in mechanical batch mixers; comply with referenced ASTM standards for mixing time and water content.

D. Color: Mix mortar to produce colors of uniform appearance.

E. Mortar Mix: ASTM C270, Proportion Specification.

F. Mortar Types:

1. Type M: Masonry below grade, in contact with earth.

2. Type S: Reinforced, engineered masonry.

3. Type N: Masonry veneer, all uses where another type is not indicated.

G. Ready-Mix Mortar: At Contractor's option, ready-mixed mortar with set-controlling admixtures conforming to ASTM C1142 and Project requirements may be used instead of site-mixed mortar.

H. Grout Mix: ASTM C476; mix to consistency to completely fill grout spaces.

1. Use fine grout in spaces less than 2 inches in horizontal dimension.

2. Use coarse grout in spaces 2 inches or more in least horizontal dimension.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that foundations are within tolerances specified in ACI 530.1 Where those tolerances are exceeded, do not install masonry until corrective measures acceptable to the Architect have been completed.

B. Verify that items to be built into masonry are in proper locations and complete with anchors.

3.2 PREPARATION

A. Provide temporary bracing needed for support and stability during installation. Maintain temporary bracing until permanent construction provides permanent bracing and stability.

B. Coordinate placement of anchors and other built in items.

C. Comply with requirements of applicable Division 01 Sections

3.3 INSTALLATION –COURSING

A. Lay out walls in advance for accurate spacing and alignment.

B. Establish lines, levels, and coursing indicated. Protect masonry from displacement.

C. Match coursing, bonding, and joints of existing masonry.

D. Maintain masonry courses to uniform dimensions. Form vertical and horizontal joints of uniform 3/8 inch thickness.

E. Fitting: Use full-size units where possible. Cut units to provide continuous pattern and to fit adjacent work. Produce clean, sharp, unchipped edges.

1. Cut brick with motor-driven saws.

2. Use dry cutting saws for CMU.

3.4 INSTALLATION –PLACING AND BONDING

A. Lay units that have variation in color in random arrangement without discernible pattern. Mix units from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

B. Do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs unless noted otherwise.

C. Stopping and Resuming Work: Rack back one-half unit length in each course; do not tooth unfinished edges. Clean exposed surfaces of set masonry, and wet in-place clay masonry units before resuming work. Remove insecure masonry units and mortar before laying fresh masonry.

D. Wet clay brick which have ASTM C67 initial rates of absorption (suction) of more than 30 grams per 30 sq inches per minute. Wet units to be nearly saturated but surface dry when laid.

E. Lay solid brick-size masonry units in full bed of mortar with full head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.

1. Lay brick on flashing without mortar in bed joints.

2. At cavity walls, slope beds toward cavity to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against cavity face of brick.

F. Hollow Concrete Masonry Units:

1. Apply full mortar coverage on horizontal and vertical face shells.

2. Bed webs in mortar in starting courses on foundations. Where cells are not grouted, spread full mortar bed, including areas under cells.

3. Bed webs in mortar in all courses of piers, columns, and pilasters, and where adjacent to spaces that are to be filled with grout.

G. Precast Concrete Trim:

1. Clean soiled precast surfaces with fiber brush and soap powder, and rinse thoroughly with clean water.

2. Wet precast joint surfaces thoroughly before setting.

3. Set precast units in full bed of mortar with vertical joints filled.

4. Fill dowel, anchor, and similar holes solid.

H. Fill collar joints between wythes solid with mortar or grout.

I. Buttering corners of joints and excessive furrowing of mortar joints are not permitted.

J. Remove excess mortar as work progresses.

K. Interlock each course of each wythe at corners and intersections.

L. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace the units in fresh mortar.

M. Tool joints when mortar is thumbprint hard. For exposed masonry tool joints at same consistency throughout the work to ensure color uniformity.

N. Cut mortar joints flush where wall tile or other adhesively-applied finish is scheduled, and where bitumen dampproofing is indicated.

O. Isolate top joints of non-load-bearing masonry walls from horizontal structural framing members and slabs or decks with compressible joint filler except where firestopping is required.

P. Isolate masonry from shelf angles above with horizontal pressure relief joints formed with compressible joint filler.

Q. Isolate masonry from vertical structural members with minimum 1 inch clearance. Fill joint with glass fiber boards.

3.5 INSTALLATION – BUILT-IN WORK

A. As work progresses, build in metal door and opening frames and other built-in items.

B. Build in items plumb and level, accurately located and aligned.

C. Fill spaces in door frames and around other built-in items solid with mortar or grout. Rod mortar or grout to ensure that there are no voids and to form tight interface with masonry.

D. Bed anchors for opening frames in adjacent mortar joints.

E. Where built-in items are to be embedded in cores of hollow masonry units, place metal lath in joint below before grouting.

F. Fill cores in hollow CMU with grout 24 inches under bearing plates, beams, lintels, and similar items, unless otherwise indicated.

G. Exterior Door Frames: Insert extruded polystyrene board insulation around perimeter of frame in thickness indicated, but not less than 3/4 inch to act as thermal break between frame and masonry.

3.6 INSTALLATION – CAVITIES

A. Keep cavities behind veneer and weeps clear of mortar and debris.

B. Fill bottoms of cavities above flashings with mortar droppings collector. Set collector units in contact with adjacent units and without gaps that would allow mortar to collect in bottom of cavity.

3.7 INSTALLATION – CONTROL AND EXPANSION JOINTS

A. Do not form continuous span through movement joints unless provisions are made to prevent in-plane restrain of wall or partition movement.

B. Build in joint fillers of width to permit installation of sealant at proper depth. Maintain uniform slot depth.

C. Keep control and expansion joints free of mortar.

D. Where indicated, install continuous control joint strips in slots to maintain alignment of wall.

E. Obtain prior approval of Architect for additional control and expansion joints requested by Contractor.

F. CMU Control Joints: Install interlocking units designed for control joints. Install bond breaker strips at joint. Keep head joints free and clear of mortar.

G. Brick Expansion Joints: Form open joint of width indicated, but not less than 3/8 inch for installation of sealant and backer rod. Maintain joints free and clear of mortar.

H. Horizontal Pressure Relief Joints: Provide joints below shelf angles, structural framing members, precast concrete, other construction materials subject to deflection or creep, and where indicated.

1. Insert compressible filler into joints.

3.8 INSTALLATION – STRUCTURAL BONDING OF MULTI-WYTHE MASONRY

A. Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bond tie between wythes.

B. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

1. Provide continuity with horizontal joint reinforcement at corners using factory fabricated L units in addition to masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes.

1. Provide continuity with horizontal joint reinforcement by using factory fabricated T units.

3.9 INSTALLATION – HORIZONTAL JOINT REINFORCEMENT

A. Install reinforcement in first and second horizontal joints above and below openings. Extend reinforcement 16 inches beyond opening jambs.

B. Install reinforcement continuous in first and second horizontal joints below tops of walls.

C. Lap reinforcement ends minimum 6 inches.

D. Use factory fabricated L and T units for corners and intersections. Cut and bend reinforcement per manufacturer recommendations for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

E. Interrupt horizontal joint reinforcement at control and expansion joints.

F. Embed side rods in mortar with minimum 5/8 inch coverage at exterior faces of masonry, minimum 1/2 inch elsewhere.

3.10 INSTALLATION – VENEER OVER STUD FRAMING

A. Masonry Veneer Over Stud Framing: Fasten each anchor section through sheathing to studs with minimum 2 screws.

B. Embed tie sections in masonry.

C. Locate anchor section relative to course where tie section is embedded to allow maximum vertical differential movement of tie up and down.

D. Space anchors as indicated, but not more than 16 inches o/c vertically and 24 inches o/c horizontally with at least 1 anchor for each 2.66 sq ft of wall area. Install additional anchors within 12 inches of openings and at intervals around perimeter not exceeding 8 inches.

3.11 INSTALLATION – ANCHORAGE TO STRUCTURE

A. Anchor masonry to structural members with flexible anchors where masonry abuts or faces concrete structural members. Where masonry abuts structural steel members, anchor masonry with steel straps as indicated.

B. Space anchors as noted, but not more than 24 inches o/c vertically or 36 inches o/c horizontally.

C. Secure anchor sections to structural members. Position anchor sections so ties are centered on anchor section.

D. Provide open space of minimum 1 inch in width between masonry and structural member, unless otherwise indicated. Keep space open and free of mortar or other rigid materials.

E. Embed tie sections in masonry joints with minimum 5/8 inch mortar coverage.

F. Fasten lateral braces rigidly and securely to overhead structure.

3.12 INSTALLATION – LINTELS

A. Provide minimum 8 inch bearing at each jamb, unless shown otherwise.

B. Exterior Masonry: Install loose steel lintels. Provide bond breaks and minimum 1/2 inch clearance space at each end of steel lintels to allow unrestrained linear expansion.

C. Interior Concrete Unit Masonry: Install precast lintels or reinforced unit masonry lintels where shown or where openings in CMU more than 16 inches wide are shown without other support.

D. Reinforced Unit Masonry Lintels:

1. Place reinforcement bars in single, unspliced lengths.

2. Provide minimum 1/2 inch clearance between bars and face of masonry.

3. Support and secure reinforcement against displacement; maintain bars within 1/2 inch of dimensioned positions.

4. Provide temporary supports until lintels have attained sufficient strength to bear imposed loads.

3.13 INSTALLATION – FLASHING AND WEEPS

A. Install flashing at following locations to divert infiltrated water to exterior:

1. Below first course on foundation.

2. Lintels.

3. Shelf angles.

4. Ledges and other obstructions.

5. Where indicated.

B. Remove projections which could puncture flashing. Remove loose particles and substances which could impair bond.

C. Place flashing on sloping bed of mortar and cover with mortar.

D. Turn up back of flashing minimum 8 inches and seal watertight to sheathing, concrete, or masonry backup.

E. Extend flashing through exterior face of masonry and turn down to form drip. At lintels, turn flashing down over outer edge of angle or window trim.

1. Exception: If self-adhesive flashing is used, treat outer edges per manufacturer recommendations.

F. Install opening sill and lintel flashing in single, unpieced lengths extending 4 inches beyond opening jambs, and turn up ends 2 inches to form end dam pans.

G. Extend flashing at shelf angles minimum 4 inches into masonry at each end.

H. Lap ends 6 inches and seal watertight. Seal penetrations, corners, and other joints watertight.

I. Extend sheet metal flashing 1/2 inch beyond face of masonry at exterior and turn down to form drip.

J. Install weep vents in veneer at 32 inches o/c horizontally at following locations:

1. Above shelf angles and lintels.
2. Above through-wall flashing.
3. At bottoms of walls.
4. At tops of walls.
5. Where noted.

3.14 INSTALLATION – GROUTED COMPONENTS

A. Remove wastes, loose mortar particles, and other substances from spaces that are to receive grout.

B. Clean reinforcing of loose rust and other substances that impair bond.

C. Lap splices minimum 48 bar diameters.

D. Support bars and secure them against displacement. Maintain position within 1/2 inch of dimensioned position.

E. Fill spaces with grout and consolidate to form full contact interface with reinforcement and masonry free of air bubbles and other voids. Place and consolidate grout without displacing reinforcing.

F. At bearing locations, fill cores in hollow masonry units with grout minimum 3 courses below unless noted otherwise.

3.15 INSTALLATION – ENGINEERED REINFORCED MASONRY

A. Temporary Formwork and Shores: Provide formwork and shores to support reinforced masonry elements during construction.

1. Make formwork sufficiently tight to prevent leakage of mortar and grout.
2. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
3. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Lay masonry units with core cells and voids for reinforcing vertically aligned, clear of mortar, and unobstructed.

C. Place mortar in masonry unit bed joints back 1/4 inch from edges of grout spaces, beveled back and upward.

D. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

E. Place and maintain reinforcing bars within 1/2 inch of dimensioned positions.

F. Support vertical reinforcement in position at tops and bottoms of cells, and at maximum 192 bar diameter intervals between.

G. Wet surfaces of clay brick that will be in contact with grout.

H. Fill spaces with grout and consolidate to form full contact interface with reinforcement and masonry free of air bubbles and other voids. Place and consolidate grout without displacing reinforcing.

I. Low Lift Grouting:

1. Place first lift of grout to height of 16 inches and consolidate.

2. Place subsequent lifts in 8 inch increments and consolidate each lift.

J. Pour Heights For Fine Grout:

Minimum widths of grout spaces of 3/4 inch or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches:	Maximum 12 inches.
Minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2 by 3 inches:	Maximum 60 inches.
Minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches:	Maximum 12 ft.
Minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 3 inches:	Maximum 24 ft.

K. Pour Heights For Coarse Grout:

Minimum widths of grout spaces of 1-1/2 inches or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches:	Maximum 12 inches.
Minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches:	Maximum 60 inches.
Minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 3 by 3 inches:	Maximum 12 ft.
Minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 4 inches:	Maximum 24 ft.

L. Cleanout Holes: Provide cleanout holes minimum 3 inches in least dimension for grout pours over 60 inches in height.

1. Provide cleanout holes at each vertical reinforcing bar.

2. At solid grouted masonry, provide cleanout holes at not more than 32 inches o/c.

3.16 FIELD QUALITY CONTROL

A. Comply with requirements of applicable Division 01 Sections.

B. Provide testing by qualified independent testing agency.

C. Testing Frequency: Each 5,000 sq ft of walls or fraction thereof.

D. Mortar Composition and Properties: Evaluate per ASTM C780.

E. Grout: Sample and test compressive strength per ASTM C1019.

F. Evaluation of Quality Control Tests: Absent other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality control tests meet minimum indicated requirements.

3.17 ADJUSTING

A. Remove and provide new replacement units for masonry units which are loose, chipped, broken, cracked, stained, or otherwise damaged, and damaged units, and for units which do not match adjacent units as intended. Install new units in fresh mortar without visible signs of replacement.

B. Remove masonry units disturbed after laying. Clean and reset them in fresh mortar. Do not shift units by pounding or other means which have already been set.

C. Point voids and holes (except weeps) full with mortar that matches adjacent joints in appearance. Prepare sealant joints for application of sealant.

3.18 CLEANING

A. In-Progress Cleaning: Perform dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: Perform cleaning after mortar has cured minimum 2 weeks in warm weather, 3 weeks in cold weather.

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on mock-up panel, leaving one half uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with final cleaning.

C. Cleaning Method - Face Brick: Bucket and brush method described in BIA "Technical Note #20."

1. Do not use muriatic acid in any form.

2. Proprietary masonry cleaners may be used if approved in advance by Architect.

3. If proprietary cleaner is used, neutralize surfaces per manufacturer recommendations.

D. Cleaning Method - CMU: Remove mortar spots and dropping by dry brushing at end of each day's work and after final pointing. Comply with recommendations in NCMA Tek Bulletin #45.

E. Cleaning Method – Stone Trim: Comply with recommendations in the Indiana Limestone Handbook of the Indiana Limestone Institute of America.

3.19 PROTECTION

A. Provide protection boards at exposed outside corners vulnerable to chipping and other damage from construction operations.

END OF SECTION

Section 05 5000

Metal Fabrications

PART 1 - GENERAL

1.1 SUMMARY

1.2 SECTION INCLUDES:

A. Steel framing and supports for floor and ceiling mounted toilet partitions.

B. Steel framing and supports for countertops.

C. Steel framing and supports for mechanical and electrical equipment.

D. Steel framing and supports for applications where framing and supports are not specified in other Sections.

E. Shelf angles.

F. Metal ladders.

G. Miscellaneous steel trim

H. Metal bollards.

I. Loose bearing and leveling plates for applications where they are not specified in other Sections.

J. Metal areaway gratings.

K. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.3 RELATED SECTIONS:

A. Division 03: Concrete, for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.

B. Division 04: Unit Masonry, for installing loose lintels, anchor bolts, and other items built into unit masonry.

C. Division 05: Structural Steel Framing; Metal Stairs; Decorative Metal Railings.

D. Division 09: Painting, for exterior fabrications; High-Performance Architectural Coatings, for exterior fabrications.

1.4 PERFORMANCE REQUIREMENTS

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

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

1.5 ACTION SUBMITTALS

A. Comply with requirements of applicable Division 01 Sections.

B. Shop Drawings: Show fabrication and installation details for each required metal fabrication except loose lintels, bearing plates, shelf angles and edging angles.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.6 QUALITY ASSURANCE

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

B. Provide certification that welders to be employed on the Work have satisfactorily passed AWS qualification tests. Certifications shall be current within last 12 months.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

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

2. AWS D1.2, "Structural Welding Code - Aluminum."

3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.7 PROJECT CONDITIONS

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

1.8 COORDINATION

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

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.9 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of applicable Division 01 Sections.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

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

2.2 FERROUS METALS

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

B. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: Minimum 1-5/8 by 1-5/8 inches, as indicated.

2. Material: Galvanized steel, ASTM A 653, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.

C. Steel Tubing: Cold formed, ASTM A500; or hot rolled, ASTM A501.

1. For exterior installations or where so noted, use tubing with hot dip galvanized coating per ASTM A53.

D. Steel Pipe: ASTM A53; weight as needed for structural loads, but not less than standard weight (schedule 40).

1. Finish: Galvanized for exterior applications or where indicated.

E. Steel Dowels and Rods: ASTM A36 stainless steel.

F. Concrete Inserts: Anchors of type indicated below fabricated from corrosion resistant materials capable of sustaining without failure the load imposed within a safety factor of 4, as determined by testing per ASTM E488 by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel.

2. Provide bolts, washers and shims as needed; hot dip galvanized coating per ASTM A153.

2.3 FASTENERS

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

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

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

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

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

E. Machine Screws: ASME B18.6.3.

F. Lag Screws: ASME B18.2.1.

G. Wood Screws: Flat head, ASME B18.6.1.

H. Plain Washers: Round, ASME B18.22.1.

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

J. Post-Installed Anchors: [Torque-controlled expansion anchors].

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

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

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

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

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

E. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. The Volatile Organic Compounds (VOC) content of all Paint must conform to Tennessee Sustainability Guidelines

1. Finish Paint VOC limit is 50 g/L less water
2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates VOC limit is 250 g/L less water

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch

embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches oc, unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches OC, unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as indicated.

1. Comply with ANSI A14.3 unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

B. Steel Ladders:

1. Space side rails 18 inches apart unless otherwise indicated.
2. Space side rails of elevator pit ladders 12 inches apart.
3. Side rails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
4. Rungs: 3/4-inch- diameter steel bars.
5. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.

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

1) IKG Industries, a division of Harsco Corporation; Mebac.
2) SlipNOT Metal Safety Flooring, a W. S. Molnar company; SlipNOT.

7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
    a. Size brackets to support design live and dead loads and to hold centerline of rungs clear of wall minimum 7 inches. Exception: ladders for elevator pits may have 4-1/2 inch clearance.
    b. Extend rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If adjacent structure does not extend above top rung, goose-neck the extended rails back to structure to provide secure ladder access.
8. Galvanize exterior ladders, including brackets and fasteners.
9. Shop prime interior ladders, brackets, and fasteners

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
    1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

2.10 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe 1/4-inch wall thickness steel shapes, as indicated on Drawings.

B. Cap bollards with 1/4-inch thick steel plate.

C. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch thick steel plate welded to bottom of sleeve. Makes sleeves not less than 8 inches deep and 3/4-inch large than OD of bollard.

D. Prime bollards with primer specified in Division 09: High-Performance Paint Coatings.

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.12 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches solid bearing unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.13 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 DIAMOND PLATE DOOR PROTECTION

A. Fabricate diamond plate from 1/4-inch stainless steel, or, aluminum plate.

B. Grind and ease all edges smooth.

C. Fabricate countersunk holes for screw fastener attachment to doors.

2.15 METAL GRATINGS

A. Gratings: Welded or pressure-locked steel bar gratings conforming to "Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads" published in ANSI/ NAAMM MBG 531 "Metal Bar Grating Manual".

1. Grating Mark: W-7-4 or P-7-4; bearing bars 7/16 inch o/c and cross bars 4 inches OC.
2. Bearing Bar Size: 1-1/2 inches by 3/16 inch.
3. Traffic Surface: Plain.
4. Finish: Hot-dip galvanized after fabrication.

B. Fabricate cutouts in gratings for indicated penetrations. Arrange layout of cutouts to allow grating removal without disturbing items that penetrate the grating.

1. Provide hinged access panels as indicated on Drawings.

C. Edge band openings in grating that interrupt 4 or more bearing bars with bars of same material and size as bearing bars.

D. Do not notch bearing bars at supports to maintain elevation.

E. Provide hot-dip galvanized steel anchorage devices suitable for Project applications.

2.16 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.17 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.

1. Iron and Steel Hardware: ASTM A153.
2. Base Material and Fabrications: ASTM A123.
3. Assembled Steel Products: ASTM A123.

B. Apply finishes after welding is complete, but before assembly with mechanical fasteners

C. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

D. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

E. Surface Preparation for Priming: Remove scale, rust, dirt, and other loose materials that would impair paint bond before applying primer.
   1. Exterior Fabrications: SSPC-SP6, 'Commercial Blast Cleaning'.
   2. Interior Fabrications: SSPC-SP3, 'Power Tool Cleaning'.
   3. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 'Solvent Cleaning'.

F. Shop Priming - Method: Apply primer immediately after surface preparation. Comply with SSPC-PA1, 'Paint Application Specification No. 1' to provide uniform dry film thickness of 2.0 mils for each coat. Apply one shop coat to fabrications, except apply 2 coats of paint to surfaces inaccessible after assembly or erection.
   1. Use painting methods that result in full coverage of joints, corners, edges and exposed surfaces.
   2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

G. Stainless Steel: Polished finish.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with requirements of applicable Division 01 Sections.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

D. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

F. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

H. Gratings: Attach with mechanical vandal-resistant anchors.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING PIPE BOLLARDS

A. Cast pipe bollards into concrete or set in pipe sleeves. Plumb bollards in all directions.

1. Sleeve Installation: Fill annular space between bollard and sleeve solid with grout.

B. Fill bollards solidly with concrete per requirements of Division 03: Cast-in-Place Concrete.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLATION – SUPPORTS FOR OVERHEAD DOORS AND OPERABLE PARTITIONS.

A. Provide temporary bracing or supports needed for erection loads and stability until permanent supports and connections are completed.

B. Anchor support framing to existing building structure in manner to safely transfer loads from operable partition components to existing structure, to provide stability, and to prevent vibration of assembly during partition operation.

C. Install framing to form rigid, stable assemblies.

D. Provide permanent connections that will not loosen or need adjustment during normal use.

3.6 INSTALLATION – DIAMOND PLATE DOOR PROTECTION

A. Attach diamond plate to doors as scheduled in Division 08 Door and Hardware Schedules and as recommended by door manufacturer.

3.7 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 00 Painting and/or Section 09 96 00 High Performance Coatings.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough opening framing for doors, windows, and roof openings.

B. Sheathing.

C. Roofing nailers.

D. Preservative treated wood materials.

E. Fire retardant treated wood materials.

F. Communications and electrical room mounting boards.

G. Concealed wood blocking, nailers, and supports.

H. Miscellaneous wood nailers, furring, and grounds.

I. Plywood subflooring at spinning platform.

1.02 RELATED REQUIREMENTS

A. Section 05 11 90 - Structural Steel

B. Section 05 50 00 - Metal Fabrications

C. Section 07 52 00 - Modified Bituminous Membrane Roofing

D. Section 09 21 16 - Gypsum Board Assemblies

E. Section 10 28 00 - Toilet Accessories

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association; 2012.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2012.

F. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.

G. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

H. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

J. AWPA C9 - Plywood -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association; 2003.

K. AWPA C20 - Structural Lumber -- Fire Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.

L. AWPA C27 - Plywood -- Fire-Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.

M. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

N. PS 1 - Structural Plywood; 2009.

O. PS 20 - American Softwood Lumber Standard; 2010.

P. SPIB (GR) - Grading Rules; 2014.

Q. WWPA G-5 - Western Lumber Grading Rules; 2011.

1.04 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials.

B. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Southern Pine, unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Plywood subflooring at spinning platform: Plywood must meet underlayment manufacturer's criteria for compatibility.

2.02 DIMENSION LUMBER

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: Kiln-dry or MC15.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Roof Sheathing: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Span Rating: 24/0.

B. Wall Sheathing: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Span Rating: 24/0.

C. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.

D. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, 5/8 inch Type X fire resistant.

E. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

F. Other Applications:

1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
2. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length to achieve full penetration of sheathing substrate.
3. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
1. Manufacturers:
a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
b. Hoover Treated Wood Products, Inc: www.frtw.com.
c. Koppers, Inc: www.koppers.com.
d. Substitutions: Approved by Owner
2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
b. Treat all exterior rough carpentry items.
c. Do not use treated wood in direct contact with the ground.
3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
b. All interior rough carpentry items are to be fire retardant treated.
c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
1. Manufacturers:
a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
b. Viance, LLC: www.treatedwood.com.
c. Osmose, Inc: www.osmose.com.

d. Substitutions: Approved by Owner

2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
   a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   b. Treat lumber exposed to weather.
   c. Treat lumber in contact with roofing, flashing, or waterproofing.
   d. Treat lumber in contact with masonry or concrete.
   e. Treat lumber less than 18 inches above grade.
3. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
   a. Treat plywood in contact with roofing, flashing, or waterproofing.
   b. Treat plywood in contact with masonry or concrete.
   c. Treat plywood less than 18 inches above grade.
4. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.
   a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
   b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Wood blocking attachment to comply with Factory Mutual Bulletin 1-49 and ANSI/SPRI ES-1.

B. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Tackboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

10. Shelving

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

C. NRCA (National Roofing Contractors Association) suggests the following guidelines when encountering treated wood:
   1. Carbon steel, aluminum and electroplated galvanized steel fasteners and connectors should not be used in contact with treated wood. Type 304 or Type 316 stainless-steel fasteners and connectors are recommended for maximum corrosion resistance.
   2. Fasteners with proprietary anti-corrosion coatings may be acceptable for use with treated wood. When considering the use of such proprietary coated fasteners and connectors, consult fastener manufacturers for specific information regarding the performances of their products in treated wood and any precautions or special instructions that may be applicable.
   3. Aluminum fasteners, flashings and accessory products should not be used in direct contact with any treated wood. ACQ-treated wood is not compatible with aluminum.
   4. Uncoated metal and painted metal flashings and accessories, except for 300-series stainless steel, should not be used in direct contact with treated wood. Metal products, except stainless steel, may be used if separated from treated wood by a spacer or barrier, such as single-ply membrane or self-adhered polymer-modified bitumen membrane material.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Use sheathing clips between roof framing members.
   2. Provide solid edge blocking between sheets.
   3. Nail panels to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
   1. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.
   4. Size: 48 by 96 inches, installed horizontally at ceiling height.

3.06 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.07 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.08 CLEANING

A. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

1.02 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

D. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

E. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

F. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, accessories, to a minimum scale of 1-1/2 inch to 1 ft.

D. Samples: Submit two samples of finish plywood, 6x6 inches in size illustrating wood grain and specified finish.

E. Samples: Submit two samples of wood trim 6 inches long with finish.

F. Sustainability Submittals
   1. Tennessee Sustainable Guideline required submittals.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Custom grade.

B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

C. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum three years of documented experience.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire retardant requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

1.07 PROJECT CONDITIONS

A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

B. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

A. Softwood Lumber: _____ species, _____ sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
   1. Grading: In accordance with rules certified by ALSC; www.alsc.org.

B. Hardwood Lumber: hard white maple species, plain sawn, maximum moisture content of 6 percent , of quality suitable for transparent finish.

C. Refer to Section 09 06 00 Finish Schedule.
   1. Grading: In accordance with NHLA G-101 Grading Rules; www.nhla.org.

2.04 SHEET MATERIALS

A. Hardwood Plywood: HPVA HP-1, Grade AA, Type VC ; Veneer core, type of glue recommended for application; hard white maple face species, plain cut, book match.

B. Hardboard: ANSI A135.4 Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

2.05 ADHESIVE

A. Adhesive: Type recommended by manufacturer to suit application .Must meet Tennessee Sustainable Guidelines for low emitting materials.

2.06 FASTENINGS

A. Fasteners: Of size and type to suit application.

B. Concealed Joint Fasteners: Threaded steel.

2.07 ACCESSORIES

A. Lumber for Shimming, Blocking; Softwood lumber of SYP species.

B. Primer: Alkyd primer sealer.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.08 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Shop prepare and identify components for book match grain matching during site erection.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.09 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent: Nitrocellulose lacquer (formerly TR-1).
   2. Opaque: Nitrocellulose lacquer (formerly OP-1).

E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

C. See Section _____ for installation of recessed wood blocking.

3.02 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

C. Install hardware in accordance with manufacturer's written instructions.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plastic laminate casework

B. Specially fabricated cabinet units.

C. Cabinet hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 06 20 00 - Finish Carpentry

C. Section 12 36 00 - Countertops

D. Section 09 06 00 - Finish Schedule

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

C. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

D. ANSI A135.4 - American National Standard for Basic Hardboard; 2004.

E. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

F. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

G. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2006, 8th Ed., Version 2.0.

H. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).

1.04 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

B. Product Data: Provide data for hardware accessories.

C. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

D. Samples: Submit actual samples of grommet colors.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated.

1.06 PRE-INSTALLATION MEETING

A. Convene not less than one week before starting work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 PANEL MATERIALS

A. Shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

B. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.

C. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S); use for drawer bottoms, dust panels, and other components indicated on drawings.

2.03 LAMINATE MATERIALS

A. Laminate Manufacturers: Refer to Section 09 06 00 Finish Schedule
   1. Formica Corporation: www.formica.com.
   2. Panolam Industries International, IncNevamar: www.nevamar.com.
   3. Wilsonart: www.wilsonart.com.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications and as follows:
   1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, colors as scheduled, finish as scheduled.
   2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, colors as scheduled, finish as scheduled.

C. Substitutions: Approved by Owner
   1. Substitutions shall meet the original specification material characteristics including but not limited to durability, recycled content, color, texture, pattern and sheen.

2.04 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Laminating adhesives used to fabricate on-site shall contain no added urea-formaldehyde resins.

C. Edge Banding: Same plastic laminate as cladding on horizontal and vertical surfaces unless otherwise indicated on the drawings.

D. Concealed Edge Banding: PVC edge banding on all sides

E. Door and Drawer Edge: Same plastic laminate as cladding on horizontal and vertical surfaces

F. Cabinet Body Edge: Same plastic laminate as cladding on horizontal and vertical surfaces

G. Fasteners: Size and type to suit application.

H. Concealed Joint Fasteners: Threaded steel.

I. Grommets:Grommets for cut-outs
   1. Manufacturer: Mockett; www.mockett.com - Flip Top Series
      a. Material to be plastic unless indicated otherwise on the drawings
      b. 2 1/2" round grommet with removable cap
      c. Grommet colors as selected by Designer from at least 9 colors.

2.05 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch spacing adjustments.

C. Drawer and Door Pulls: "U" shaped wire pull, brushed chrome, 4 inch centers.

D. Cabinet and Drawer Locks: Keyed cylinder, two keys per lock, master keyed, Satin Nickel with satin finish.
   1. All cabinets and drawers to have locks
   2. Must meet or exceed ANSI/BIFMA Grade 1.

E. Catches: Magnetic.

F. Drawer Slides:
   1. Type: Full extension.
   2. Static Load Capacity: Commercial grade. (100 Lb static load rating)
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Features: Provide self closing/stay closed type.
   6. Manufacturers:
      a. Knape & Vogt Manufacturing Company: www.knapeandvogt.com.
      b. Substitutions: Approved by Owner

G. Hinges: European style concealed self-closing type, steel with polished finish.
   1. Manufacturers:
      a. Blum, Inc: www.blum.com.
      b. Substitutions: Approved by Owner

H. Sliding Door Track Assemblies: Upper and lower track of satin anodized aluminum, with matching shoe equipped with nylon rollers.

2.06 FABRICATION

A. Cabinet Style: Flush overlay.

B. Cabinet Doors and Drawer Fronts: Flush style.

C. AWI/AWMAC Architectural Woodwork Quality Standards Illustrated Custom Quality

D. Open Shelving: All exposed surfaces including all edges to be High Pressure Decorative Laminate (HPDL)

E. Concealed shelving: All exposed surfaces to be white melamine and all edges to receive PVC edge banding.

F. Drawer Fronts to be 3/4" minimum with 1/2" minimum sub front

G. Drawer Sides and Backs Edgebanded HPDL or thermoset decorative overlay on particleboard core with minimum 1/2" thickness

H. Cabinet ends, divisions, bottoms and tops to be a minimum of 3/4" thick

I. Provide an attached toe-kick with applied base that clears the finished floor by 1" were indicated on the drawings.

J. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

K. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

L. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

M. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

N. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.07 FACTORY FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1500, Nitrocellulose Lacquer, Transparent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation in metal stud walls.

B. Rigid insulation board inside cavity walls.

C. Mineral Fiber Sound Attenuation Batt Insulation in interior wall, and ceiling construction for sound control.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry

B. Section 06 10 00 - Rough Carpentry

C. Section 07 84 00 - Firestopping

D. Section 09 21 16 - Gypsum Board Assemblies

E. Section 09 81 10 - Acoustical Treatment - Partitions/Ceilings

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, vapor retarders, or water-resistive barriers.

B. Air Barrier: Air-tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.

1.04 REFERENCE STANDARDS

A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 BATT INSULATION

A. Batt Insulation: ASTM C 665; preformed batt; friction fit, conforming to the following:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. Formaldehyde Content: Zero.
   5. Thermal Resistance: see drawings for R-values

6. Thickness: see drawings for thickness.
7. Facing: Unfaced.
8. Manufacturers:
    a. CertainTeed Corporation: www.certainteed.com/#sle.
    b. Johns Manville: www.jm.com/#sle.
9. Substitutions: Refer to Section 01 25 13 Product Substitution Procedures and Section 01 25 33 Product Substitution Request Form

2.02 RIGID INSULATION BOARD IN CAVITY WALLS

A. Extruded Polystyrene Foam Insulation:
    1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E 84.
    2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
    3. Board Size: 48 x 96 inch (1220 x 2440 mm)
    4. Board Thickness: see drawings for thickess
    5. Board Edges: Square
    6. Thermal Resistance (R-value) at 25 degrees F (-3.9 degrees C): see drawings for R-values
    7. Compressive Strength: 25 psi (173 kPa).
    8. Water Absorption, maximum: 0.3 percent, volume.
    9. Manufacturers:
        a. Dow Chemical Co: www.dow.com
        b. Owens Corning Corp: www.owenscorning.com
        c. Pactiv Building Products: www.pactiv.com/green-guard.com
        d. Substitutions: Refer to Section 01 25 13 Product Substitution Procedures and Section 01 25 33 Product Substitution Request Form

2.03 MINERAL FIBER SOUND ATTENUATION BATT INSULATION

A. Mineral Fiber Sound Attenuation Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit; unfaced; flame spread index of 0 (zero) when tested in accordance with ASTM E84.
    1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
    2. Thermal Resistance: see drawings for R-values
    3. Thickness: as shown on drawings.
    4. Manufacturers:
        a. Thermafiber, Inc.; SAFB: www.thermafiber.com/#sle.
        b. CertainTeed: www.certainteed.com
        c. Owens Corning: www.owenscorning.com.
        d. Substitutions: Refer to Section 01 25 13 Product Substitution Procedures and Section 01 25 33 Product Substitution Request Form

2.04 ACCESSORIES

A. Seam Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide or as recommended by weather barrier manufacturer.

B. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

C. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

D. Wire Mesh: Galvanized steel, hexagonal wire mesh.

E. Adhesive: Type recommended by insulation manufacturer for application.

F. Sealants: As recommended by weather barrier manufacturer.

G. Primers: Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 RIGID INSULATION BOARD INSTALLATION

A. Apply emulsified asphalt as adhesive to face of inner wythe of cavity wall:
   1. Full bed 1/8 inch (3 mm) thick.

B. Install boards to fit snugly between wall ties.
   1. Place membrane surface against adhesive.

C. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

E. Place 6 inch (150 mm) wide rubberized asphalt sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor retarder and air seal.

3.03 BATT AND MINERAL FIBER INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Staple or nail facing flanges in place at maximum 6 inches on center.

F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

G. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

H. Tape seal tears or cuts in vapor retarder.

I. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 90 05
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

B. Acoustical sealant.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry

B. Section 07 52 00 - Modified Bituminous Membrane Roofing

C. Section 07 84 00 - Firestopping

D. Section 08 80 00 - Glazing

E. Section 09 21 16 - Gypsum Board Assemblies

F. Section 09 30 00 - Tiling

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

E. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

F. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam (Closed-Cell); 2005 (Reapproved 2011).

G. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements; 1991 (Reapproved 2011).

H. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov; current edition.

I. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

B. Pre-installation Meeting: Convene at least one week prior to beginning the work of this section, but not before all submittal requirements are met and mock up is approved.

C. Attendance required for Representatives of:
   1. General Contractor
   2. Subcontractor.
   3. Sealant Manufacturer Technical Field Representative.
   4. Plumbing Contractor
   5. Masonry subcontractor
   6. Sitework subcontractor.
   7. Plumbing subcontractor
   8. Owner / Designer

1.05 SUBMITTALS

A. Product Data: Provide data indicating sealant chemical characteristics.

B. Samples: Submit two samples, of each material 6 inches x 3/4 inches in size illustrating sealant colors for selection.

C. Submit comprehensive color selections for ALL proposed sealants

D. Shop Drawings: Submit shop drawings for precompressed foam joints showing all joint splices, joint sizes and anticipated movement

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Warranty: Submit manufacturer "Intent to Warrant Statement" including compatibility of products to be installed and completed Warranty forms completed in Owner's name and registered with manufacturer.

G. Statement of compliance from Manufacturer's Technical Field Representative

1.06 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 15 years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.07 MOCK-UP

A. Provide mock-up of sealant joints in conjunction with comprehensive mock up under provisions of Section 01400 Quality Control and as described in Section 04 2000 and on the drawings.

B. Provide additional mockups necessary for field testing of each type of sealant to be installed in the building envelope.

C. Construct mock-up with specified sealant types and with other components noted.

D. Locate where directed.

E. Mock-up shall remain at the Site as the Standard and required level of Quality and Workmanship of the installation as well as the Standard for methods to be employed..

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.09 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.10 WARRANTY

A. Installer Warranty: Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

C. Manufacturer's Warranty
   1. Installed Silicone material 20 years.
   2. Installed Polyurethane material 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silicone Sealants: General purpose and as indicated.
   1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   2. Dow Corning ; www.dowcorning.com.
   3. Tremco Commercial Sealants and Waterproofing; www.tremcosealants.com.
   4. Substitutions: Approved by Owner

B. Polyurethane Sealants: Exterior concealed weatherproofing applications and limited interior applications only.
   1. Bostik Inc: www.bostik-us.com.

2. Pecora Corporation: www.pecora.com.
3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
4. Tremco Commercial Sealants and Waterproofing; www. tremcosealants.com
5. Substitutions: Approved by Owner

C. Polyurethane Sealants: Continuous water immersion applications only.
1. Pecora Corporation: www.pecora.com.
2. BASF Construction Chemicals-Building Systems: www.chemrex.com.
3. W.R. Meadows, IncNone - N/A: www.wrmeadows.com.
4. Tremco Commercial Sealants and Waterproofing; www. tremcosealants.com
5. Substitutions: Approved by Owner
6. Tremco Commercial Sealants and Waterproofing; www. tremcosealants.com .

D. Polysulfide Sealants: Continuous water immersion applications only.
1. Pecora Corporation: www.pecora.com
2. BASF Construction Chemicals, Inc.: www.chemrex.com
3. Substitutions: Approved by Owner

E. Acrylic Sealants: Interior, concealed use only.
1. Tremco Commercial Sealants and Waterproofing : www.tremcosealants.com.
2. Sherwin-Williams Company: www.sherwin-williams.com.
3. BASF Construction Chemicals, Inc: www.chemrex.com.
4. Substitutions: Approved by Owner

F. Butyl Sealants: not permitted, unless approved in writing.

G. Acrylic Emulsion Latex Sealants: Interior concealed use only
1. Bostik Inc: www.bostik-us.com.
2. Pecora Corporation: www.pecora.com.
3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
4. Hilti, Inc.None - N/A: www.us.hilti.com.
5. Substitutions: Approved by Owner

H. Epoxy Sealants:
1. Pecora Corporation: www.pecora.com.
2. Substitutions: Approved by Owner

I. Epoxy Joint Filler:
1. W.R. Meadows, Inc: www.wrmeadows.com.
2. Substitutions: Approved by Owner

J. Preformed Compressible Foam Sealers: Basis of Design
1. EMSEAL® Joint Systems, LtdSEISMIC : www.emseal.com.
2. Substitutions: Approved by Owner

K. Other acceptable Manufacturers
1. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
2. Tremco Global Sealants: www.tremcosealants.com/#sle.
3. Substitutions: Approved by Owner

2.02 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

C. Type S-1 - General Purpose Exterior Sealant: Silicone; ASTM C 920, Grade NS, Class 50, Uses M, G, and A; single component.
1. Color: Custom as selected by Designer.

2. Basis of Design Product: DOW CORNING® 795 SILICONE BUILDING SEALANT manufactured by Dow Corning Corporation; www.dowcorning.com.
3. Applications: Use for:
    a. Control, expansion, and soft joints in masonry.
    b. Joints between concrete and other materials.
    c. Joints between metal frames and other materials.
    d. General building joints at the exterior.
    e. Other exterior joints for which no other sealant is indicated.
4. Polyurethane Products:
    a. Bostik Inc: www.bostik-us.com/#sle.
    b. Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant: www.pecora.com/#sle.
    c. Pecora Corporation; DynaTrol II General Purpose One Part Polyurethane Sealant: www.pecora.com.
    d. Pecora Corporation; DynaTrol II General Purpose Two Part Polyurethane Sealant: www.pecora.com/#sle.
    e. Substitutions: Approved by Owner
5. Polysulfide Products:
    a. Pecora Corporation: www.pecora.com/#sle.
    b. BASF Construction Chemicals-Building Systems: www.chemrex.com.
    c. Substitutions: Approved by Owner

D. Type S-1a - General Purpose Exterior Sealant: Silicone, dirt and mildew resistant; ASTM C 920, Grade NS, Class 50, Uses M, G, and A; single component.
1. Color: Custom as selected by Designer.
2. Basis of Design Product: DOW CORNING® 756 SMS BUILDING SEALANT manufactured by Dow Corning Corporation; www.dowcorning.com.
3. Applications: Use for:
    a. Control, expansion, and soft joints in masonry.
    b. Joints between concrete and other materials.
    c. Joints between metal frames and other materials.
    d. General building joints at the exterior.
    e. Other exterior joints for which no other sealant is indicated.

E. Type S-2 - General Purpose Interior Sealant: One part Latex Cure RTV Silicone ; ASTM C 920, Grade NS, Class 50, single component, paintable.
1. Color: Colors as selected.
2. Basis of Design Product: DOW CORNING PAINTABLE SEALANT manufactured by Dow Corning Corporation.
3. Applications: Use for:
    a. Interior wall and ceiling control joints.
    b. Joints between door and window frames and wall surfaces.
    c. Other interior joints for which no other type of sealant is indicated.
4. Products:
    a. Bostik Inc: www.bostik-us.com/#sle.
    b. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com/#sle.
    c. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com/#sle.

F. Type S-3 - Bathtub /Sink / Plumbing Fixture / Tile Sealant: White, or Clear silicone; ASTM C 920, Uses I, M and A; single component, mildew resistant.
1. Basis of Design Product: DOW CORNING® 786 SILICONE MILDEW RESISTANT SEALANT manufactured by Dow Corning.
2. Applications: Use for:

a. Joints between plumbing fixtures and Bath floor and wall surfaces / tile .
b. Joints between kitchen and bath countertops and wall surfaces.

3. Products:
   a. Bostik Inc: www.bostik-us.com/#sle.
   b. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com/#sle.
   c. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: www.pecora.com/#sle.
   d. Tremco Global Sealants: www.tremcosealants.com/#sle.
   e. Substitutions: Approved by Owner

G. Type S-4 - Acoustical Sealant for Concealed Locations:
1. Composition: Acrylic latex emulsion sealant.
2. Applications: Use for concealed locations only:
   a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
3. Products:
   a. Bostik Inc: www.bostik-us.com/#sle.
   b. Pecora Corporation; AIS-919 Acoustical and Insulation Latex Sealant: www.pecora.com.
   c. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com/#sle.
   d. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com/#sle.
   e. Tremco Global Sealants: www.tremcosealants.com/#sle.
   f. Substitutions: Approved by Owner

H. Type S-5 - Epoxy Concrete Floor Joint Filler: Self-leveling, pourable, semi-rigid sealant intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Single or multi-part,100 percent solids by weight.
2. Hardness: 85, minimum, after 7 days, when tested in accordance with ASTM D2240, Shore A.
3. Color: To be selected by Architect from manufacturer's standard colors.
4. Joint Width, Minimum: 1/8 inch.
5. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.
6. Applications: Use for:
   a. Control joints in concrete slabs and floors not filled with filler placed in form.
   b. Construction joints in concrete slabs and floors.
7. Products:
   a. Nox-Crete; DynaFlex 502: www.nox-crete.com/#sle.
   b. W.R. Meadows, Inc; Rezi-Weld Flex: www.wrmeadows.com/#sle.
   c. Substitutions: Approved by Owner

I. Type S-6 - Polyurea Concrete Floor Joint Filler: Self-leveling, pourable, semi-rigid sealant intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Single or multi-part,100 percent solids by weight.
2. Hardness: 75, minimum, after 7 days, when tested in accordance with ASTM D2240 Shore A.
3. Color: To be selected by Architect from manufacturer's standard colors.
4. Joint Width, Minimum: 1/8 inch.
5. Joint Width, Maximum: 3/4 inch.
6. Joint Depth: Provide product suitable for joints from 1/8 inch to 1-1/2 inches in depth excluding space for backer rod.

7. Applications: Use for:
    a. Control joints in concrete slabs and floors not filled with filler placed in form.
    b. Construction joints in concrete slabs and floors.
8. Products:
    a. Adhesives Technology Corporation; Crackbond JF-311: www.atcepoxy.com/#sle.
    b. ARDEX Americas; ARDISEAL RAPID PLUS: www.ardexamericas.com/#sle.
    c. Nox-Crete; DynaFlex JF-85: www.nox-crete.com/#sle.
    d. Substitutions: Approved by Owner

J. Type S-7 - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
1. Approved by manufacturer for wide joints up to 1-1/2 inches.
2. Color: Colors as selected.
3. Basis of Design Product: SL-1 manufactured by Sonneborn a BASF company.
4. Applications: Use for:
    a. Expansion joints in floors.
5. Products:
    a. Bostik Inc: www.bostik-us.com/#sle.
    b. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com/#sle.
    c. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com/#sle.
    d. Substitutions: Approved by Owner

K. Type S-8 - Acoustic Sealant: ASTM C834, Grade NS, Class 12-1/2, Uses M, A, O; non-staining, non-bleeding, non-sagging.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Product: SHEETROCK® Brand Acoustical Sealant manufactured by USG Corporation© .
3. Movement Capability: Plus and minus 12-1/2 percent.
4. Service Temperature Range: -13 to 180 degrees F.
5. Shore A Hardness Range: 25 to 50.
6. Applications: Use for:
    a. Sealing drywall edge to structure, framing tracks, drywall edge to door frames ceiling mouldings, etc..
7. Products:
    a. Sherwin-Williams Company; Shermax Urethanized Elastomeric Sealant: www.sherwin-williams.com.
    b. Substitutions: Approved by Owner

L. Type S-9 - Butyl Sealant: ASTM C 311, ASTM C 920, ASTM C 1085, Grade NS, Class 12 1/2, Uses NT, O; single component, solvent release, non-skinning, non-sagging.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Basis of design Product: Tremco Butyl Sealant manufactured by Tremco Commercial Sealants and Waterproofing.
3. Movement Capability: Plus and minus 12-1/2 percent.
4. Service Temperature Range: -13 to 180 degrees F (-25 to 82 degrees C)
5. Shore A Hardness Range: 10 to 30.
6. Applications: Use for:
    a. Bedding Thresholds.
    b. Limited, concealed metal to metal flashing and gutter joints.
7. Products:
    a. Bostik Inc: www.bostik-us.com/#sle.
    b. Pecora Corporation: www.pecora.com/#sle.
    c. Tremco Global Sealants: www.tremcosealants.com/#sle.
    d. Substitutions: Approved by Owner

M. Type S-10 - Nonsag Polysulfide Sealant: ASTM C920, Grade NS, Class 25, Uses NT, I, M, A, G , O; two component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Movement Capability: Plus and minus 25 percent.
   3. Service Temperature Range: -40 to 180 degrees F.
   4. Shore A Hardness Range: 20 to 35.
   5. Applications: Use for:
   6. Products:
      a. Pecora Corporation: www.pecora.com/#sle.
      b. BASF Construction Chemicals-Building Systems: www.chemrex.com.
      c. W.R. Meadows, Inc; Deck-O-Seal Gun Grade: www.wrmeadows.com/#sle.
      d. Substitutions: Approved by Owner

N. Type S-11 - Self-Leveling Polysulfide Sealant: ASTM C920, Grade P, Class 25, Uses T, I, M, A, O; two component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, self-leveling type.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Movement Capability: Plus and minus 25 percent.
   3. Service Temperature Range: -40 to 180 degrees F.
   4. Shore A Hardness Range: 20 to 35.
   5. Products:
      a. Pecora Corporation: www.pecora.com/#sle.
      b. BASF Construction Chemicals-Building Systems: www.chemrex.com.
      c. W.R. Meadows, Inc; Deck-O-Seal (pourable): www.wrmeadows.com/#sle.
      d. W.R. Meadows, Inc; Deck-O-Seal 125: www.wrmeadows.com/#sle.
      e. Substitutions: Approved by Owner

O. Type S-12 - Nonsag Silicone Sealant: ASTM C920, Grade NS, Class 50, Uses NT, I, M, A, G, O; single component, chemical curing, non-staining, non bleeding, non-sagging type.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Product: NP-1 manufactured by Sonneborn.
   3. Movement Capability: Plus and minus 50 percent.
   4. Service Temperature Range: -40 to 180 degrees F.
   5. Shore A Hardness Range: 20 to 35.
   6. Applications: Use for:
      a. Exterior concealed weather proofing.
         1) Through wall self adhered flexible flashing lap joints, end dams and corners .
   7. Products:
      a. Bostik Inc: www.bostik-us.com/#sle.
      b. Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant: www.pecora.com/#sle.
      c. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com/#sle.
      d. Substitutions: Approved by Owner
         1) Through wall metal flashing lap joints, end dams and corners.
         2) Metal to metal lap joints in gutters, downspouts and metal flashing fabrications
         3) Bedding Threshholds.
         4) Other exterior weatherproofing applications not apparent.

P. Type S-13 - Silicone Sealant: ASTM C920, Grade NS, Class 25, Uses NT, A, G, M , O; single component, solvent curing, non-sagging, non-staining, fungus resistant, non-bleeding.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Movement Capability: Plus and minus 25 percent.
   3. Service Temperature Range: -65 to 180 degrees F.

4. Shore A Hardness Range: 15 to 35.
5. Applications: Use for:
6. Products:
    a. Bostik Inc: www.bostik-us.com/#sle.
    b. Dow Corning Corporation: www.dowcorning.com/#sle.
    c. Substitutions: Approved by Owner

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

E. Exposed Concrete Floor Joints: Test joint filler in inconspicuous area of floor slab. Verify specified product does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

J. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

K. Concrete Floor Joint Filler: Install concrete floor joint filler per manufacturer's written instructions. After floor joint filler is fully cured, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Technical Representative shall visit the site once weekly during time the sealant installation is ongoing.at the building exterior.

B. Manufacturer's Technical Representative shall file observation report, including photo documentation, detailing proper installation and identifying defective or unacceptable installation.

C. Testing: ASTM C 1521: "Tail Procedure" testing shall be performed at the direction of the Owner and Architect and as follows:
   1. Perform minimum of 3 tests each day sealant installation is ongoing.
   2. Testing shall be executed by the Manufacturer's Representative at locations selected by the Owner and Architect.
   3. Contractor shall provide safe access and perform all repairs of tested areas at no cost to the Owner.

3.05 CLEANING

A. Clean adjacent soiled surfaces.

3.06 PROTECTION

A. Protect sealants until cured.

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-rated steel doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry

B. Section 07 90 05 - Joint Sealers

C. Section 08 14 16 - Flush Wood Doors

D. Section 08 7100 - Door Hardware

E. Section 08 8000 - Glazing: Glass for doors; lite kits.

F. Section 09 90 00 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. ASTM C236 - Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box; 1989 (Reapproved 1993).

G. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

I. ASTM E413 - Classification for Rating Sound Insulation; 2010.

J. ASTM E1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).

K. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

L. ITS (DIR) - Directory of Listed Products; current edition.

M. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

N. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2013.

O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.

P. NAAMM HMMA 862 - Guide Specifications for Commercial Security Hollow Metal Doors and Frames; 2013.

Q. NAAMM HMMA 865 - Guide Specifications for Sound Control Hollow Metal Doors and Frames; 2013.

R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

T. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.

U. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

V. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

X. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

B. Shop Drawings: Details of each opening, showing elevations, glazing, louvers, frame profiles, and identifying location of different finishes, if any.

C. Samples: Submit two samples of metal, 6 x 6 inches in size showing factory finishes, colors, and surface texture.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

F. Tennessee Sustainable Guidelines required submittals.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

C. Place units on wood skids and store in manner that will prevent corrosion and damage. Adequately brace frames during construction to ensure no deflection.

D. Store assemblies upright, do not stack flat.

E. Adequately brace frames during construction to ensure no deflection.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:
   1. Assa Abloy : www.assaabloydss.com/#sle.
   2. Republic Doors: www.republicdoor.com.
   3. Steelcraft: www.steelcraft.com.
   4. MPI Metal Products, Inc.; www.metalproductsinc.com
   5. Substitutions: Approved by Owner

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
   1. Accessibility: Comply with ANSI/ICC A117.1.
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Beveled on both edges.
   4. Door Texture: Smooth faces.

5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
7. All interior doors and frames shall be cold rolled steel with primer unless indicated to be galvanized.
8. Galvanizing for Units in Wet Areas and at Laundry Rooms: All components hot-dipped zinc-iron alloy-coated (galvannealed), A60/ZF180.
9. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; where two requirements conflict, comply with the most stringent.

2.03 STEEL FRAMES

A. General:
1. Comply with the requirements of grade specified for corresponding door.
a. ANSI A250.8 Level 1 Doors: 16 gage frames.
b. ANSI A250.8 Level 3 Doors: 14 gage frames.
c. Frames for exterior locations, oversized openings, and rated assemblies: Comply with frame requirements specified in ANSI A250.8 Level 3 Doors: 14 gage frames.
d. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
2. Finish: Same as for door.
3. Back prime frames in exterior locations, wet locations, and grouted frames with bituminous coating.
4. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
5. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
6. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
7. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.
8. A minimum 1/4" joint should be maintained between adjacent veneer masonry.

B. Interior Door Frames , Non-Fire-Rated: Full Face welded type.
1. Finish: Factory primed, for field finishing.

C. Interior Door Frames , Fire-Rated: Full Face welded type.
1. Fire Rating: Same as door, labeled.
2. Finish: Factory primed, for field finishing.

D. Mullions for Pairs of Doors: Removable type, of profile similar to jambs.

E. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

F. Transom Bars: Fixed, of profile same as jamb and head.

2.04 ACCESSORIES

A. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.05 ACCESSORY MATERIALS

A. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.

B. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

C. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10 , door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

B. Coat inside of other frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION

A. Fit hollow metal doors accurately in frames, with clearances specified in SDI-100.

B. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

C. In addition, install fire rated units in accordance with NFPA 80.

D. Coordinate frame anchor placement with wall construction.

E. Grout frames in masonry construction as indicated in drawings, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

F. Coordinate installation of hardware. Provide reinforcement at all hardware attachment locations.

G. Coordinate installation of glazing.
   1. Install glazing stops on secure side of opening

H. Coordinate installation of electrical connections to security and electrical hardware items.

I. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: As specified in ANSI A250.8.

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

C. Adjust Standard Steel door frames for squareness, alignment, twist and plumb to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measure at jambs on a horizontal line parallel to the plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corner of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as required to comply.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; fire rated.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry

B. Section 08 11 13 - Hollow Metal Doors and Frames.

C. Section 08 71 00 - Door Hardware.

D. Section 09 06 00 - Finish Schedule.

E. Section 09 90 00 - Painting and Coating: Site finishing of painted doors.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. ASTM E413 - Classification for Rating Sound Insulation; 2010.

C. ASTM E1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).

D. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

F. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

G. ICC (IBC) - International Building Code; 2012.

H. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

I. LMA (VPS) - Voluntary Product Standards and Typical Physical Properties of Decorative Overlays; Composite Panel Association; 2004.

J. NFC

K. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

L. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

M. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.

N. National Wood Window & Door Association

O. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

P. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Q. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

R. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

S. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.04 SUBMITTALS

A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

B. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

1. Provide the information required by AWI/AWMAC/WI Architectural Woodwork Standards.
2. Include certification program label.

C. Specimen warranty.

D. Shop Drawings: Illustrate comprehensively door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria., identify cutouts for glazing and louvers.

E. Samples: Submit three samples of door construction, 12x12 inch in size cut from top corner of door.

F. Samples: Submit three samples of door veneer, 12 x 12 inch in size illustrating stain color, specified sheen and range of color differential due to variation in grain and natural wood color. .

G. Manufacturer's Installation Instructions: Indicate special installation instructions.

H. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

C. Quality Certification: Provide AWI Quality Certification Program inspection report and quality certification of completed work.
1. Provide labels or certificates indicating that the work complies with requirements of AWS Grade or Grades specified.
2. Prior to delivery to the site provide shop drawings with certification labels.
3. Provide labels on each product when required by certification program.
4. Upon completion of installation provide certificate certifying that the installation and products meet the specified requirements.
5. Arrange and pay for inspections required for certification.
6. Replace, repair, or rework all work for which certification is refused.

D. Installed Fire Rated Door and Transom Panel Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

A. Interior Doors: Provide manufacturer's warranty for the life of the wall assembly.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS FLUSH WOOD DOORS

A. Wood Veneer Faced Doors:Basis of Design
1. Marshfield Door Systems, Inc; Product Signature Series™ : www.marshfielddoors.com.

B. Other Acceptable Manufacturers
   1. Graham Wood Doors: www.grahamdoors.com.
   2. Algoma: www.algomahardwooddoors.com
   3. Substitutions: Approved by Owner

2.02 DOORS AND PANELS

A. All Doors: See drawings for locations and additional requirements.
   1. Quality Level: Custom Grade, in accordance with AWI/AWMAC/WI Architectural Woodwork Standards. Quality Level: Extra Heavy Duty performance, in accordance with WDMA 1.S.1-A and Face Veneer WDMA "A" grade.
   2. Wood Veneer Faced Doors: Select white maple species, plain sliced, with book matched grain for transparent finish, Premium Grade. Grade "A" 5-ply and comply with AWI/WDMA PC5 construction. Doors shall be manufactured by the hot-press method, bonding faces, crossbands and core together in a single operation with Type I glue. Doors manufactured by cold-pressing 2 or 3-ply pre-manufactured door skins to multiple cores in the same press will not be accepted. Factory finish. Water based stain with Ultraviolet-cured polyurethane sealer and top coat that meets the performance standards of AWS finish system 9. Fire Doors shall meet Positive Pressure "Category A" requirements.
      a. All sides to be finished including top of door.
      b. Core: Particleboard core which complies with ANSI A208.1
         1) Crossbands: One piece high density fiberboard.
      c. No added urea formaldehyde resins.
      d. Refer to Finish Schedule for stain color.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at all locations except where pre-hung doors and frames are required.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252, UL 10B, or UBC Standard 7-2-94 ("neutral pressure"); UL or WH (ITS) labeled without any visible seals when door is open. Must be internally blocked with fire retardant material at head for close attachment.
   3. Smoke Doors : In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft of door opening at 0.10 inch w.g. pressure at both ambient and elevated temperatures; with "S" label; if necessary, provide additional gasketing or edge sealing. At all smoke doors, add NGP 5050BL. Length as required.

2.03 DOOR AND PANEL CORES

A. Door Construction
   1. Non-Fire Rated Doors: Thickness 1-3/4”, interior flush wood, bonded, solid core conforming to WDMA I.S. 1-A-04 Quality Standards and the following:
      a. Core: Particle core to comply with standard ANSI A208.1-1999, minimum grade LD-1, conforming to WDMA I.S. 1-A.
      b. Construction: Bonded PC-5, vertical and horizontal edges of solid core doors must be securely bonded to the core with adhesives and then machine calibrated before veneering to achieve minimal telegraphing per section T-1.
      c. ANSI/WDMA I.S. 1-A Aesthetic Grade: Premium
      d. Vertical Edges: Wood or Composite material, one piece, laminated, or veneered. Specific Configuration per manufacturer's standard. Minimum requirements per section P-1, Performance Standards for Architectural Wood Flush Doors, and Section A-9, Fabrication.
      e. Horizontal Edges: Wood or composite material meeting the minimum requirements per Section P-1, Performance Standards for Architectural Wood Flush Doors.
      f. Facing: Wood veneer cut and species as specified shall conform to WDMA I.S. 1-A.
      g. ANSI/WDMA I.S. 1-A Performance Duty Level: Extra Heavy Duty.

h. Adhesives: Glue lines for face veneer assembly, between the various plies of the face, and between the facing and core assembly, are to be Type I or Type II. Glue lines between edging and core in bonded core assemblies are to be Type II minimum. Both adhesive types must meet the requirements specified in WDMA TM-6 Adhesive Bond Durability Test Method.

2. Fire Rated Doors: Smoke and 20 minute Classifications Only. Thickness 1-3/4", interior flush wood, bonded, solid core conforming to WDMA I.S. 1-A-04 Quality Standards and the following:
   a. Core: Particle core to comply with standard ANSI A208.1-1994, minimum grade LD-1, conforming to WDMA I.S. 1-A.
   b. Construction: Bonded PC-5, vertical and horizontal edges of solid core doors must be securely bonded to the core with adhesives and then machine calibrated before veneering to achieve minimal telegraphing per section T-1.
   c. ANSI/WDMA I.S. 1-A Aesthetic Grade: Premium
   d. Vertical Edges: Wood or Composite material, one piece, laminated, or veneered. Specific Configuration per manufacturer's standard. Minimum requirements per section P-1, Performance Standards for Architectural Wood Flush Doors, and Section A-9, Fabrication.
   e. Horizontal Edges: Wood or composite material meeting the minimum requirements per Section P-1, Performance Standards for Architectural Wood Flush Doors.
   f. Facing: Wood veneer cut and species as specified shall conform to WDMA I.S. 1-A. Transparent finish, Grade "A", Book Match, Premium grade.
   g. ANSI/WDMA I.S. 1-A Performance Duty Level: Extra Heavy Duty.
3. Fire-Rated Doors: Thickness 1-3/4", interior flush wood, bonded, solid core conforming to WDMA I.S. 1-A-04 Quality Standards and the following:
   a. Core: Bonded mineral core (FD-5) conforming to WDMA I.S. 1-A.
   b. Construction: UL 10B and WDMA I.S. 1-A Premium grade requirements.
   c. Vertical Edges: Hardwood to match face veneer over fire resistive composite as required by manufacturers fire door authorities, glued to the core.
   d. Horizontal Edges: Fire resistive composite as required by manufacturers fire door authorities, glued to the core.
   e. Facing: Wood veneer cut and species as specified shall conform to WDMA I.S. 1-A "A" grade for Premium grade door construction.
   f. ANSI/WDMA I.S. 1-A Performance Duty Level: Extra Heavy Duty."

2.04 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails.

C. Provide solid blocks at lock edge for hardware reinforcement.
   1. Provide solid blocking for other throughbolted hardware.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
   1. Exception: Doors to be field finished.

F. Provide edge clearances in accordance with the quality standard specified.

G. All doors:
   1. Provide solid blocks at lock edge for hardware reinforcement. Thru-bolting not allowed.
   2. Provide closer blocks at top edge of door to eliminate thru-bolting. Thru-bolting of closers is not allowed.

2.05 FABRICATION

A. Factory fit doors to wood frames to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:

B. Factory finish doors in accordance with specified quality standard:
   1. Transparent Finish: Transparent conversion varnish, Custom quality, satin gloss sheen.

C. Factory finish doors in accordance with approved sample.

D. Seal all door faces and edges with color sealer to match door facing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Field-Finished Doors: Trimming to fit is acceptable.
   1. Adjust width of non-rated doors by cutting equally on both jamb edges.
   2. Trim maximum of 3/4 inch off bottom edges.
   3. Trim fire-rated doors in strict compliance with fire rating limitations.

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

F. Coordinate installation of glazing.

G. Install door louvers plumb and level.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

C. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.

D. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 17 43
SL SERIES FIRE-RATED FRP DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. AF-200 Smooth Composite Fiberglass Door with PP Polypropylene Honeycomb Core.

B. AF-200FR Smooth Fire-Rated Fiberglass Door.

1.02 REFRENCES

A. ASTM D256 – Standard Test Methods for Determining the 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 D2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

G. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

H. CAN / ULC S104 – Standard Method for Fire Tests of Door Assemblies.

I. UL 10B – Standard for Fire Tests of Door Assemblies.

J. UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies.

K. NFPA 80 – Standard for Fire Doors and Other Opening Protectives.

L. NFPA 252 – Fire Tests of Door Assemblies.

1.03 SUBMITTALS

A. Must comply with Section 01 33 00 – Submittal Procedures.

B. Action Submittals/ Informational Submittals.
   1. Product Data.
      a. Submit manufacturer’s product data sheets, catalog pages illustrating the products, description of materials, components, fabrication, finishes, installation instructions, and applicable test reports.
   2. Shop Drawings.
      a. Submit manufacturer’s shop drawings, including elevations, sections, and details indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.
   3. Samples.
      a. Submit manufacturer’s door sample composed of door face sheet, core, framing and finish.
      b. Submit manufacturer’s sample of standard colors for door face and frame.
   4. Testing and Evaluation Reports.
      a. Submit testing reports and evaluations provided by manufacturer conducted by and accredited independent testing agency certifying doors and frames comply with specified performance requirements listed in Section 2.01 C.
   5. Manufacturer Reports.
      a. Manufacturer’s Project References.
         1) Submit list of successfully completed projects including project name, location, name of architect, type, and quantity of doors manufactured.

C. Closeout Submittals.
   1. Operation and Maintenance Manual.
      a. Submit manufacturer's maintenance and cleaning instructions for doors and frames, including maintenance and operating instructions for hardware.
   2. Warranty Documentation.
      a. Submit manufacturer's standard warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications.
   1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years concurrent successful experience.
   2. Door and frame components must be fabricated by same manufacturer.
   3. Evidence of a documented complaint resolution quality management system.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery.
   1. Deliver materials to site in manufacturer's original, unopened, containers and packaging.
   2. Labels clearly identifying opening, door mark, and manufacturer.

B. Storage.
   1. Store materials in a clean, dry area, indoors in accordance with manufacturer's instructions.

C. Handling.
   1. Protect materials and finish from damage during handling and installation.

1.06 WARRANTY

A. Warrant doors, frames, and factory installed hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Standard Period.
   1. Ten years starting on date of shipment.

C. Limited lifetime
   1. Covers failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.

D. Finish
   1. Through color with SpecLite 3® integral surfaseal film FRP sheet: 10 years.
   2. Painted SL-17FR face sheets: 5 years.
   3. Painted FR frames: 3 years.

PART 2 PRODUCTS

2.01 FRP/ALUMINUM HYBRID DOORS

A. Manufacturer.
   1. Special-Lite, Inc.
      a. PO Box 6, Decatur, Michigan 49045.
      b. Toll Free (800) 821-6531, Phone (269) 423-7068, Fax (800) 423-7610.
      c. Web Site www.special-lite.com.
      d. E-Mail info@special-lite.com.
   2. Substitutions:
      1) Substitutions shall meet the original specification material characteristics including but not limited to durability, recycled content, color, texture, pattern and sheen.

2.02 DESCRIPTION

A. AF-200 Smooth Composite Fiberglass Door with PP Polypropylene Honeycomb Core.
   1. Rated for 20 to 90 min maximum duration.
   2. Door Opening Size.
      a. 3’0” x 7’0” single door
   3. Construction.
      a. Door Thickness.
         1) 1-3/4” at door edge.
      b. Stiles.
         1) Pultruded fiberglass with integral channels for securing corner reinforcing clip.
      c. Core.
         1) PP Polypropylene Honeycomb.
         2) 5.0 pcf density.
         3) High strength to weight ratio.
         4) Corrosion, fungi, rot, chemical and moisture resistant.
         5) Sound and vibration dampening.
         6) Energy absorbing and recyclable.
      d. Face Sheet.
         1) Interior and Exterior
            (a) 0.090” thick, Class C, smooth texture, painted FRP sheet.
         2) Attachment of face sheet
            (a) Face sheets to be flame treated to promote durable, long lasting bond.
            (b) Face sheets adhered to stiles, rails, and core using hot melt adhesive evenly coated across all surfaces to produce strong bond and prevent moisture absorption.
      e. Cutouts.
         1) Manufacture doors with cutouts for required vision lites per the manufactures listing.
      f. Hardware.
         1) Pre-machine doors in accordance with templates from specified hardware manufacturers.
         2) Surface mounted closures will be reinforced for but not prepped or installed at factory

B. AF-200FR Smooth Fire-Rated Fiberglass Door.
   1. Door Opening Size.
      a. 3’-0” x 6’-8”
   2. Construction.
      a. Door Thickness.
         1. 1-3/4”.
      b. Stiles.
         1. Single Swing.
            a. Hinge and lock stile, 2” minimum tectonite with Palusol P-100 Intumescent and 0.090” thick fiberglass edge painted to match door face.
         2. Standard Pairs.
            a. Hinge stile, 2” minimum tectonite with Palusol P-100 Intumescent and 0.090” thick fiberglass edge painted to match door face.
            b. Meeting edge, 3” minimum with Palusol P-100 Intumescent and 0.090” thick fiberglass edge painted to match door face.
      c. Rails.
         1. Top rail, 6” minimum tectonite with Palusol P-100 Intumescent and 0.090” thick fiberglass edge painted to match door face.
         2. Bottom rail, 4” minimum for single swing, 4-1/2” minimum for pairs tectonite with 0.090” thick fiberglass edge painted to match door face.

d. Core.
    1. WSCP-412 proprietary mineral core.
    2. 1-1/2” nominal thickness.
    3. 18 pcf minimum density.
    4. 5 pieces maximum for single swing and 3 pieces per leaf maximum for standard pairs.
e. Face Sheet.
    1. 0.090” thick, smooth fiberglass painted with two-part aliphatic polyurethane coating.
    2. Bonded to core with adhesive according to manufactures listing.
f. Cutouts.
    1. Manufacture doors with cutouts for required vision lites per the manufactures listing.
g. Hardware.
    1. Pre-machine doors in accordance with templates from specified hardware manufacturers.
    2. Field apply factory supplied gaskets and seals, full width intumescent and smoke seal required at top of door, smoke seals required on both jambs

2.03 FRAMING

A. Framing
    1. Doors to be placed in existing Hollow Metal frames. All existing openings are to be field verified.

2.04 PERFORMANCE

A. Face Sheet.
    1. Standard Interior and Exterior Class C 0.090” thick, smooth texture, painted FRP sheet.
        a. Flexural Strength, ASTM D790: 14 x 103 psi.
        b. Flexural Modulus, ASTM D790: 0.4 x 106 psi.
        c. Tensile Strength, ASTM D638: 6 x 103 psi.
        d. Tensile Modulus, ASTM D638: 0.4 x 106 psi.
        e. Barcol Hardness, ASTM D2583: 35.
        f. Izod Impact, ASTM D256: 5.0 ft-lb/in.
        g. Water Absorption, ASTM D570: 0.16%/24hrs at 77°F.
        h. Surface Burning, ASTM E84: Flame Spread ≤ 200, Smoke Developed ≤ 450.
        i. Meets USDA/ FSIS requirements.
        j. GreenGuard Certified.
        k. USDA/FSIS Requirements.
            1) FRP face sheet with SpecLite 3® integral surfaseal is a finished outer surface material that is rigid; durable; non-toxic; non-corrosive; moisture resistant; a light, solid color such as white; easily inspected; smooth or an easily cleaned texture.
            2) FRP face sheet with SpecLite 3® integral surfaseal does not contain any known carcinogen, mutagen, or teratogen classified as hazardous substances; heavy metals or toxic substances; antimicrobials; pesticides or substances with pesticidal characteristics.

B. Door Assembly.
    1. PP Polypropylene Honeycomb Core.
        a. Thermal Transmittance, NFRC 100.
            1) Opaque Swinging Door (??? than 50% glass)
                (a) U-Factor = 0.26 Btu/hr·ft²·°F.
            2) Commercially Glazed Swinging Entrance Door (??? than 50% glass)
                (a) U-Factor = 0.44 Btu/hr·ft²·°F.
        b. Air Leakage, NFRC 400, ASTM-E283.

1) Opaque Swinging Door (??? than 50% glass)
   (a) 0.00 cfm/sqft @ 1.57 psf.
   (b) 0.00 cfm/sqft @ 6.24 psf.
2) Commercially Glazed Swinging Entrance Door (??? than 50% glass)
   (a) 0.04 cfm/sqft @ 1.57 psf.
   (b) 0.05 cfm/sqft @ 6.24 psf.

c. STC and OITC, ASTM E90: STC = 31, OITC = 26.

2.05 MATERIALS

A. Fiberglass.
   1. Face Sheet
      a. See 2.04.A

2.06 FABRICATION

A. Factory Assembly.
   1. Door and frame components from the same manufacturer.
   2. Required size for door and frame units, shall be as indicated on the drawings.
   3. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
   4. All cut edges to be free of burs.
   5. Electrical arc welding of doors or frames is not acceptable.
   6. Maintain continuity of line and accurate relation of planes and angles.
   7. Secure attachments and support at mechanical joints with hairline fit at contact surfaces.

B. Shop Fabrication
   1. All shop fabrication to be completed in accordance with manufactures process work instructions.
   2. Quality control to be performed before leaving each department.

2.07 FINISHES

A. Door.
   1. Two-component flexible acrylic urethane Satin topcoat. (STANDARD)
      a. Color. TBD from standard paint colors
      b. Excellent exterior durability.
      c. Unique, high-solids, high-build, multifunctional coating.
      d. Low VOC, Satin coating.
      e. Impact Resistance, ASTM D4226 Minimum 1.2 in/lb/mil
      f. Color retention: ≤1Δ (CIE L.a.b.), Montreal 45° South: 12 months
      g. Very good chemical resistance.

2.08 ACCESSORIES

A. Vision Lites.
   1. Factory Glazing.
   2. Stainless Steel vison kit with 3/16” NGP Firelite NT, clear.
   3. Size as indicated on the drawings.
   4. 60 to 90-minute rated doors.
      a. Maximum 704 inch² in listed and labeled kit for positive pressure applications using listed glazing. Minimum 5” from top or edge of door to lite cutout and minimum 5” from latch cutout to lite cutout.
      b. Maximum 32” high.
      c. Maximum 22” wide.
      d. Multiple lights are allowed when the sum of the areas does not exceed the tested area with the maximum length and width limitations.
   5. 20 to 45-minute rate doors.
      a. Listed metal vison frames and listed glazing are limited to a maximum clear view area of 616 inch² per lite with a maximum of 1232 inch². Lite kits exceeding 100 inch² void

the temperature requirements per NFPA 80 unless temperature resistive glazing is used.

B. Louvers.
   1. Listed and labeled louvers.
   2. Maximum 576 inch².
   3. Maximum width 24”.
   4. Maximum height 24”.

C. Hardware.
   1. All hardware must be listed and labeled for use in mineral core fire doors.
   2. Pre-machine doors in accordance with templates from specified hardware manufactures and hardware schedule.
   3. Factory install hardware.
   4. EPT Units
      a. Allowed between top and middle hinge locations.
      b. 1/16” maximum clearance per side when installing EPT.
      c. Limited to maximum 60 min positive and neutral pressure applications.
      d. Intumescent caulk or strips are required on bottom, top, and side of EPT device.
   5. Hardware Schedule.
      a. Pre-machine doors in accordance with templates from specified hardware manufactures and hardware schedule.
      b. Astragal
         (a) Rated metal astragal required on pairs with 3-point latching, maximum 60 min. duration.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive doors.

B. Notify architect of conditions that would adversely affect installation or subsequent use.

C. Do no proceed with installation until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.03 ERECTION

A. Install doors in accordance with manufacturer’s instructions.

B. Install doors plumb, level, square, true to line, and without warp or rack.

C. Anchor frames securely in place.

D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by architect.

E. Set thresholds in bed of mastic and back seal.

F. Install exterior doors to be weathertight in closed position.

G. Repair minor damages to finish in accordance with manufacturer’s instructions and as approved by architect.

H. Remove and replace damaged components that cannot be successfully repaired as determined by architect.

3.04 FIELD QUALITY CONTROL

A. Manufacture’s Field Services.
   1. Manufacturer’s representative shall provide technical assistance and guidance for installation of doors.

3.05 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.06 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.07 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass for exterior windows.

B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealers

B. Section 08 11 13 - Hollow Metal Doors & Frames

C. Section 08 14 16 - Flush Wood Doors

D. Section 08 43 13 - Aluminum Doors & Windows

E. Section 08 44 13 - Glazed Aluminum Curtainwall

F. Section 08 87 13 - Privacy Control Films

G. Section 09 21 16 - Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2011.

E. ASTM C1036 - Standard Specification for Flat Glass; 2006.

F. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 2004.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2010.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

I. ASTM E 774 - Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units; 1997.

J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2009a.

K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

L. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.

M. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 2008.

N. SIGMA TM-3000 - Glazing Guidelines for Sealed Insulating Glass Units; Sealed Insulating Glass Manufacturers Association; 2004.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

B. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Samples: Submit two samples 12 x 12 inch in size of glass units, showing coloration and design.

D. Certificates: Certify that products meet or exceed specified requirements.

E. Manufacturer's Certificate: Certify that all glass glass meets or exceeds specified requirements.

F. Maintenance Materials: Furnish the following for Owner's use , at Owner's Option in maintenance of project.
   1. See Sections 01302 Submittals and Substitutions for additional provisions.
   2. Extra Insulating Glass Units: One of each glass size and each glass type, except for factory glazed window units.

G. Tennessee Sustainable Guidelines required submittals.

1.06 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
      a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
         1) Basic Wind Speed: 90 mph
         2) Importance Factor: III.
         3) Exposure Category: B.
      b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
         1) Load Duration: 60 seconds or less.
      c. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
         1) For monolithic-glass lites heat-treated to resist wind loads.
         2) For insulating glass.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods. Maintain one copy on site.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.08 MOCK-UP

A. See Section 04 20 00 - Unit Masonry for incorporating glazed items in Mock-Up.

B. Locate where directed or indicated on drawings.

C. Mockup may remain as part of the Work.

1.09 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.10 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.11 WARRANTY

A. Sealed Insulating Glass Units: Provide a ten (10) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

1.12 MAINTENANCE PRODUCTS

A. Provide two of each glass size and each glass type.

PART 2 PRODUCTS

2.01 GLAZING TYPES

A. Coordinate work with Section 08 87 13 Privacy Window Films.

B. Coordinate fire rated glazing locations with sprinkler deluge system coverage.

C. Single Vision Safety Glazing:
   1. Applications: All interior glazing unless otherwise indicated.
   2. Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 6mm (1/4 inch), unless otherwise indicated.
   5. Glazing Method: Gasket glazing.

2.02 FLAT GLASS MATERIALS

A. Float Glass Manufacturers:
   1. Zeledyne: www.versaluxglass.com.
   2. AGC Flat Glass North America, Inc: www.na.agc-flatglass.com.
   3. Guardian Industries Corp: www.sunguardglass.com.
   4. Pilkington North America Inc: www.pilkington.com/na.
   5. PPG Industries, Inc: www.ppgideascapes.com.
   6. Substitutions: Approved by Owner

B. Float Glass: All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
   3. Tinted Types: Color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

C. Clear Float Glass: Clear, annealed.
   1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Comply with ASTM C 1048.
   3. 6 mm minimum thick.

D. Safety Glass: Clear; fully tempered.
   1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select) and ASTM C 1048.
   2. Comply with 16 CFR 1201 test requirements for Category II.

3. Where glazing is to be installed in fire-rated partition, provide glazing that is also fire-protection rated in accordance with applicable code.
4. 6 mm minimum thick.
5. Provide this type of glazing in the locations required by code.

E. Sealed Insulating Glass Units for Exterior Storefront
1. Manufacturers:
a. Other Manufacturers:
1) PPG: www.ppg.com
2) Pilkington Building Products: www.pilkington.com
3) Versalux: www.versalux.com
4) Substitutions: Refer to Section 01302 Submittals and Substitutions and Section 01302A Substitution Request Form.
2. Sealed Insulating Glass Units:
a. Locations: Exterior locations requiring acoustical control.
b. Durability: Certified by an independent testing agency to comply with ASTM E2190.
c. Edge Spacers: Aluminum, bent and soldered corners.
d. Edge Seal: Glass to elastomer with supplementary silicone sealant.
e. Purge interpane space with dry hermetic air.
3. Insulating Glass Units: Double pane with dual glass to mastic edge seal.
a. pane: 1/4" (6 mm), clear tempered.
b. 1/2" air space.
c. Inner pane: 1/4" (6 mm) clear tempered.
d. Durability: Certified by an independent testing agency to comply with ASTM E 2190.
e. Comply with ASTM E 774 and E 773, Class CBA.
f. Purge interpane space with dry hermetic air.
g. Total unit thickness of 1 inch minimum.
4. Edge Seal Construction: Aluminum, 5 inches corners.

2.03 GLAZING COMPOUNDS

A. Manufacturers:
1. Bostik Inc: www.bostik-us.com.
2. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
4. Substitutions: Approved by Owner

B. Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; grey color.

C. Butyl Sealant: Single component; Shore A hardness of 10 to 20; black color; non-skinning.

D. Silicone Sealant: Single component; chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; color as selected.

2.04 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; black color.

D. Glazing Clips: Manufacturer's standard type.

2.05 SOURCE QUALITY CONTROL AND TESTS

A. Test samples in accordance with ANSI Z97.1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Prime surfaces scheduled to receive sealant.

C. Install sealants in accordance with ASTM C1193 and FGMA Sealant Manual.

D. Install sealant in accordance with manufacturer's instructions.

3.03 GLAZING METHODS

3.04 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 MANUFACTURER'S FIELD SERVICES

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.06 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.07 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION

SECTION 08 87 13
PRIVACY CONTROL FILMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Privacy control films.

1.02 RELATED SECTIONS

A. Section 08 80 00 - Glazing

1.03 REFERENCES

A. ASTM International (ASTM):
   1. ASTM D1044 - Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test).
   2. ASTM E903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials using Integrating Spheres.

1.04 PERFORMANCE REQUIREMENTS

A. Privacy control film products shall improve privacy and aesthetic characteristics when applied to glass surfaces.

B. Scratch Resistance: Privacy control films shall average less than 11.2 percent increase in haze when tested according to ASTM D1044 using a Teledyne Taber Abrader using CS10F Type III wheels each loaded to 0.5 kg for 100 cycles in a 70 percent vacuum.

C. Scratch resistance and emissivity testing shall be performed by an independent third party agency.

1.05 SUBMITTALS

A. Product Data: Submit for each product specified indicating:
   1. Physical and performance properties.
   2. Preparation and installation instructions and recommendations.
   3. Storage and handling recommendations.

B. Samples: For each type of privacy control film specified, two (2) samples, 12 inches square.

C. Qualification Data: Submit documentation indicating qualifications of privacy control film manufacturer.

D. Operation and Maintenance Data: Submit for privacy control film to include in maintenance manuals.

E. Warranty: Submit sample special warranty specified in this section.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that has a minimum of 15 years of documented experience manufacturing privacy control films similar to that used for this project.

B. Installer Qualifications: A firm that is authorized by privacy control film manufacturer to install film in accordance with guidelines set forth by the manufacturer.

C. Source Limitations: Obtain each type of privacy control film from same manufacturer.

D. Mockups: Build mockups to verify selections made under sample submittals and to evaluate surface preparation techniques and application workmanship.
   1. Construct mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at project site to discuss methods and procedures relating to installation of the privacy control films.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials in manufacturer's protective packaging.

B. Store and protect materials according to manufacturer's written recommendations to prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

1.08 SITE CONDITIONS

A. Ambient Conditions: Maintain temperature, humidity, and ventilation within limits recommended by manufacturer.

1.09 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace films that fail within specified warranty period.
   1. Warranty Period: 5 years from date of original installation.
   2. Warranty coverage limited to owner of property at time of installation.
   3. Manufacturer's obligation is limited to furnishing replacement film for any film covered by limited warranty which manufacturer determines to be defective. Manufacturer will not be liable for installation costs of replacement film or for any special, indirect, incidental or consequential damages.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. As selected by Architect. Refer to Section 09 06 00 Finish Schedule.

2.02 PRIVACY CONTROL FILM ACCESSORIES

A. General: Provide accessories either manufactured by or acceptable to privacy control film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Adhesive: Water-activated, dry-adhesive system that forms a molecular bond between the film and glass.

C. Cleaners, Primers, and Sealers: Types recommended by privacy control film manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements and for conditions affecting performance of privacy control film including glass that is broken, chipped, cracked, abraded, or damaged in any way.

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

3.02 PREPARATION

A. Clean substrates thoroughly prior to installation.

B. Prepare substrates using methods recommended by film manufacturer to achieve the best results for the substrate under project conditions.

C. Protect window frames and surrounding surfaces to prevent damage during installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Install film continuously, but not necessarily in one (1) continuous length. Install with no gaps or overlaps.

C. Make seams non-overlapping and vertical in orientation.

D. Do not remove release liner from film until just before each piece of film is cut and ready for installation.

E. Install film with mounting solution and purified water. Custom cut to the glass with neat, square corners and edges to within 1/8-inch of the window frame.

F. Remove air bubbles, blisters, and other defects. Be careful to remove “fingers” to eliminate any contamination or excess water pockets. It is crucial to remove as much water as possible during installation.

G. A final squeegee pass over the entire pane using a blade with an extended handle design is recommended.

3.04 FIELD QUALITY CONTROL

A. After installation, view film from a distance of 10 feet against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, wrinkles, banding, air bubbles, thin spots or pinholes. Film edges shall be level within 1/16".

B. If installed film does not meet these criteria, remove and replace with new film.

3.05 CLEANING AND PROTECTION

A. Remove excess mounting solution at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended by privacy control film manufacturer.

C. Replace films that cannot be cleaned.

D. Protect installed products until completion of project.

E. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 09 06 00
FINISH SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish Schedule.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Substitutions shall meet the original specification material characteristics including but not limited to durability, recycled content, color, texture, pattern and sheen.

B. Refer to the individual specification section for equal manufacturers.

2.02 FINISH SCHEDULE

(MANUFACTURERS LISTED BELOW ARE THE BASIS OF DESIGN)

FLOORS

A. Porcelain Floor Tile A (12x24) – Daltile, Haddonstone, Horizon, Textured Floor Tile, 12” x 24”, textured finish

B. Porcelain Floor Tile B (Mosaic 2x2) – Daltile, Haddonstone, Horizon, 2” x 2” mosaic, matte finish

C. Epoxy Floor Color A (Typical) – Torginal, Resin Quartz Flooring, Marina QB-1019, 40S Broadcast

D. Epoxy Floor Color B (Accent) – Torginal, Resin Quartz Flooring, Custom Mix: Q1120 - 30%, Q1340 - 65%, & Q1310 - 5%, 40S Broadcast

BASE

A. Porcelain Tile Base A– – Daltile, Haddonstone. Horizon, Cove Base, 6” x 12” S36C9

B. Metal Transition Strip – Schluter Dilex AHK Cove, brushed nickel - floor tile to wall tile and tile base to floor tile

Integral Epoxy Base – To match Epoxy Floor Color A, height to match existing (sloped concrete base)

WALLS

A. Wall Tile A (field tile in outdoor locker room) – Daltile, Color Wheel Linear, Matte Arctic White, 4”x16”

B. Wall Tile B (accent tile in outdoor locker rooms) – Daltile, Color Wheel Classic, Electric Blue, Glossy, 4”x16”

C. Wall Tile C (RR tile in Indoor locker rooms) – Daltile, Haddonstone, Horizon, Vein-Cut Floor Tile, 12” x 24”, Satin Finish / Bullnose Trim 3” x 24” P43F9

D. Wall Tile D (accent tile in Women’s Locker) – Tilebar, Parry, Blue, 3” x 8”, Glossy

E. Wall Tile E (Indoor Pool Grey) – Daltile, Keystones, Suede Gray, Matte, 2x2

F. Paint Color A (Corridor) – Sherwin Williams, Egret White SW7570

G. Paint Color B (White Ceilings) – Sherwin Williams, Extra White SW7006

H. Paint Color C (Indoor Locker Rooms) – Sherwin Williams, Anew Gray SW7030

I. Paint Color D (Accent Blue) – Sherwin Williams, Favorite Jeans SW9147

J. Paint Color E (Accent Dark Gray) – Sherwin Williams, Peppercorn SW7674
K. Paint Color F (Indoor Pool) – Sherwin Williams, Egret White SW7570
L. Paint Color G (Accent Logo Blue) – To match Pantone 2995C
M. Paint Color H (Hollow Metal Frames and Pool Ceiling) - Sherwin Williams, Summit Gray SW7669

MISC.

A. PLAM A – Formica Oiled Legno 8846-58, matte texture
B. Quartz – BPI Prestige Stone, Clemente PS9504
C. Solid Surface Bench Seat – LX Hausys - Hi Macs Price Group 'D' - Color TBD
D. Toilet Partition Type A – Scranton Sandcastle Orange Peel, raised panel style door
E. Toilet Partition Type B – Scranton Shale, Orange Peel, flat panel style door
F. Whirlpool Tile A (Waterline Accent) – Daltile, Keystones, Berry Blend, Matte, 1”x1”
G. Whirlpool Tile B (Top Perimeter Edge) – Daltile, Keystones, Moonshine, Matte, 1”x1”
H. Whirlpool Tile C (Typical Overall) – Daltile, Keystones, Waterfall, Matte, 1”x1”
I. Locker Stain – Stain to match existing Hollman Lockers
J. Architectural Window Film – Reatec from Koroseal
K. Wood Door Stain – To match existing Door Stain
L. Corner Guards – TBD
M. Acoustical Wall Panel Type A Color A – Armstrong Tectum 23 ¾” x 48” x 1” Color Polar
N. Acoustical Wall Panel Type A Color B– Armstrong Tectum 23 ¾” x 48” x 1” Color Custom
O. Acoustical Wall Panel Type A Color C - Armstrong Tectum 23 ¾” x 48” x 1” Color Mist
P. Acoustical Wall Pabel Type A Color D - Armstrong Tectum 23 ¾” x 48” x 1” Color Ocean
Q. Acoustical Wall Panel Type B Color D- Armstrong Tectum 12” x 48” x 1” Color Ocean
R. Acoustical Wall Panel Type C – Armstrong Projectworks Case #2450750

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Metal channel ceiling framing.

C. Cementitious backing board.

D. Gypsum wallboard.

E. Joint treatment and accessories.

F. Mineral Fiber Sound Attenuation Batt Insulation in interior wall, and ceiling construction for sound control.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Thermal and sound batts.

B. Section 07 90 05 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

C. ANSI A108.11- American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

L. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

M. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing Board; 2013.

N. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

O. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2010.

P. GA-216 - Application and Finishing of Gypsum Board; 2013.

Q. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.

R. GA-600 - Fire Resistance Design Manual; 2015.

1.04 SUBMITTALS

A. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience, with minimum 3 years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assemblies as indicated on drawings.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire Rated Partitions: UL Listed Assembly No. U430; 1 hour rating

C. Refer to Drawings, Wall Types, for gauge.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Dietrich Metal Framing: www.dietrichindustries.com.
   3. Marino: www.marinoware.com.

B. Non-Loadbearing Framing System Components: ASTM C645 ; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

C. Exterior Non-Loadbearing Studs and Furring for Application of Gypsum Board.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12 .
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
   4. Deflection and Firestop Track:
      a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Georgia-Pacific Gypsum: www.gpgypsum.com.
   3. Lafarge North America Inc: www.lafargenorthamerica.com.
   4. National Gypsum Company: www.nationalgypsum.com.
   5. Temple-Inland Building Product by Georgia-Pacific, LLC: www.temple.com.
   6. USG Corporation: www.usg.com.
   7. Approved Equal.

B. Gypsum Wallboard: ASTM C 1396/C 1396M. Sizes to minimize joints in place; ends square cut.
   1. Regular Type:
      a. Application: Use for vertical surfaces, unless otherwise indicated.
      b. Thickness: 5/8 inch.
      c. Edges: Tapered.
   2. Fire Resistant Type: Complying with Type X requirements; UL or WH rated.
      a. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
      b. Application: Where required for fire-rated assemblies, unless otherwise indicated.
      c. Thickness: 5/8 inch.
      d. Edges: Tapered.
   3. Ceiling Board: Special sag-resistant type.
      a. Application: Ceilings, unless otherwise indicated.
      b. Thickness: 5/8 inch.
      c. Edges: Tapered.

C. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C1629.
   1. Application: Ramp and Stair 144, Platform 139, and between classrooms.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/A1396M.
   4. Unfaced Type: Interior fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M.
   5. Type: Non-rated or fire-resistance rated Type X, UL or WH listed. As called for on drawings.
   6. Thickness: 5/8 inch.
   7. Edges: Tapered.

D. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M; ends square cut.
   1. Application: Wet Areas without wall tile.
   2. Core Type: Regular.
   3. Thickness: 5/8 inch.
   4. Edges: Tapered.
   5. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.

E. Cement Board
   1. Application: Wet Areas with wall tile or epoxy finish system.
   2. Cementitious Fiber-Mat Reinforced Sheathing: ASTM C 1325, ANSI A118.9, cementitious backer.
   3. Fire Class A, Humidity Resistant, Mold Resistant, Abuse Resistant, Sag Resistant
   4. Thickness: 5/8 inch
   5. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665 preformed glass fiber, friction fit type, unfaced. Thickness: 5 inch.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Finishing Accessories: ASTM C1047 , galvanized steel or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Ready-mixed vinyl-based joint compound.

E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

G. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

2.05 MINERAL FIBER SOUND ATTENUATION BATT INSULATION

A. Mineral Fiber Sound Attenuation Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit; unfaced; flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   2. Thermal Resistance: R of 3.7 per inch.
   3. Thickness: as shown on drawings.
   4. Manufacturers:
      a. Thermafiber, Inc: www.thermafiber.com.
      b. CertainTeed: www.certainteed.com
      c. Owens Corning: www.owenscorning.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as permitted by standard.
   1. Level ceiling system to a tolerance of 1/600.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical

devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install blocking for support of plumbing fixtures, toilet partitions, toilet accessories,, and hardware. Comply with Section 06 1000 for wood blocking.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

G. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

H. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 20 feet apart on walls. Not more than 50 feet on center on ceilings.
   2. At exterior soffits, not more than 20 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations shown on the drawings. Provide vent area specified.

3.06 MINERAL FIBER BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in interior wall and ceiling spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Staple or nail facing flanges in place at maximum 6 inches on center.

F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

3.07 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840 , as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

C. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction. (Non-cumulative).

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Metal channel ceiling framing.

C. Cementitious backing board.

D. Gypsum wallboard.

E. Joint treatment and accessories.

F. Mineral Fiber Sound Attenuation Batt Insulation in interior wall, and ceiling construction for sound control.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Thermal and sound batts.

B. Section 07 90 05 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

C. ANSI A108.11- American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

L. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

M. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing Board; 2013.

N. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

O. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2010.

P. GA-216 - Application and Finishing of Gypsum Board; 2013.

Q. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.

R. GA-600 - Fire Resistance Design Manual; 2015.

1.04 SUBMITTALS

A. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience, with minimum 3 years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assemblies as indicated on drawings.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire Rated Partitions: UL Listed Assembly No. U430; 1 hour rating

C. Refer to Drawings, Wall Types, for gauge.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Dietrich Metal Framing: www.dietrichindustries.com.
   3. Marino: www.marinoware.com.

B. Non-Loadbearing Framing System Components: ASTM C645 ; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

C. Exterior Non-Loadbearing Studs and Furring for Application of Gypsum Board.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12 .
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
   4. Deflection and Firestop Track:
      a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Georgia-Pacific Gypsum: www.gpgypsum.com.
   3. Lafarge North America Inc: www.lafargenorthamerica.com.
   4. National Gypsum Company: www.nationalgypsum.com.
   5. Temple-Inland Building Product by Georgia-Pacific, LLC: www.temple.com.
   6. USG Corporation: www.usg.com.
   7. Approved Equal.

B. Gypsum Wallboard: ASTM C 1396/C 1396M. Sizes to minimize joints in place; ends square cut.
   1. Regular Type:
      a. Application: Use for vertical surfaces, unless otherwise indicated.
      b. Thickness: 5/8 inch.
      c. Edges: Tapered.
   2. Fire Resistant Type: Complying with Type X requirements; UL or WH rated.
      a. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
      b. Application: Where required for fire-rated assemblies, unless otherwise indicated.
      c. Thickness: 5/8 inch.
      d. Edges: Tapered.
   3. Ceiling Board: Special sag-resistant type.
      a. Application: Ceilings, unless otherwise indicated.
      b. Thickness: 5/8 inch.
      c. Edges: Tapered.

C. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C1629.
   1. Application: Ramp and Stair 144, Platform 139, and between classrooms.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/A1396M.
   4. Unfaced Type: Interior fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M.
   5. Type: Non-rated or fire-resistance rated Type X, UL or WH listed. As called for on drawings.
   6. Thickness: 5/8 inch.
   7. Edges: Tapered.

D. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M; ends square cut.
   1. Application: Wet Areas without wall tile.
   2. Core Type: Regular.
   3. Thickness: 5/8 inch.
   4. Edges: Tapered.
   5. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.

E. Cement Board
   1. Application: Wet Areas with wall tile or epoxy finish system.
   2. Cementitious Fiber-Mat Reinforced Sheathing: ASTM C 1325, ANSI A118.9, cementitious backer.
   3. Fire Class A, Humidity Resistant, Mold Resistant, Abuse Resistant, Sag Resistant
   4. Thickness: 5/8 inch
   5. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665 preformed glass fiber, friction fit type, unfaced. Thickness: 5 inch.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Finishing Accessories: ASTM C1047 , galvanized steel or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Ready-mixed vinyl-based joint compound.

E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

G. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

2.05 MINERAL FIBER SOUND ATTENUATION BATT INSULATION

A. Mineral Fiber Sound Attenuation Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit; unfaced; flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   2. Thermal Resistance: R of 3.7 per inch.
   3. Thickness: as shown on drawings.
   4. Manufacturers:
      a. Thermafiber, Inc: www.thermafiber.com.
      b. CertainTeed: www.certainteed.com
      c. Owens Corning: www.owenscorning.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as permitted by standard.
   1. Level ceiling system to a tolerance of 1/600.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical

devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install blocking for support of plumbing fixtures, toilet partitions, toilet accessories,, and hardware. Comply with Section 06 1000 for wood blocking.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

G. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

H. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 20 feet apart on walls. Not more than 50 feet on center on ceilings.
   2. At exterior soffits, not more than 20 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations shown on the drawings. Provide vent area specified.

3.06 MINERAL FIBER BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in interior wall and ceiling spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Staple or nail facing flanges in place at maximum 6 inches on center.

F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

3.07 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840 , as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

C. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction. (Non-cumulative).

END OF SECTION

SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Stone thresholds.

E. Tile accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 10 - Concrete Work

B. Section 07 90 05 - Joint Sealers

C. Section 09 2116 - Gypsum Board Assemblies: Installation of tile backer board.

1.03 REFERENCE STANDARDS

1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
2. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
3. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
4. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
5. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
6. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
7. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
8. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
9. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
10. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
11. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).

B. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).; 2013.1.
1. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).; 2013.1.
2. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).; 2013.1.
3. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).

C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.04 SUBMITTALS

A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, sealants, and accessories. Include instructions for using grouts and adhesives.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
   1. Contractor is responsible for coordinating tile installation with building construction expansion joints, saw cut joints, control joints, and cold joints whether or not cleavage membrane is specified herein. All tile work to be in accordance with referenced standards including tile control joints as required by field conditions.

C. Samples: Submit a sample of each tile illustrating color and sheen for each tile and threshold.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.05 MOCK-UP

A. Construct tile mock-up where indicated by Architect, incorporating all components specified for the location.
   1. Approved mock-up may remain as part of the Work.

1.06 PRE-INSTALLATION MEETING

A. Convene one month before starting work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F for installation and three days following.

1.09 EXTRA MATERIALS

A. Provide 10 sq. ft of each size, color, and surface finish of tile specified, at least 1 box of each type in marked cartons.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: As selected by Architect.
   1. Refer to Section 09 06 00 Finish Schedule.

2.02 TRIM AND ACCESSORIES

A. Tile Trim as indicated. Refer to drawings and Finish Schedule.

B. Provide a transition at all changes in material.

C. Thresholds: Marble, color selected by Architect, honed finish; 2 inches wide by full width of wall or frame opening; 1/2 inch thick; beveled one long edge with radiused corners on top side; without holes, cracks, or open seams. Must have at least 5 colors.

2.03 ADHESIVE MATERIALS

A. Manufacturers: Must be approved by tile manufacturer.
   1. Laticrete: www.laticrete.com
   2. Custom Building Products: www.custombuildingproducts.com
   3. Bostik: www.bostik-us.com
   4. Bonsal American, Inc: www.sakrete.com
   5. Mapei Corporation: www.mapei.com.

B. Adhesives
   1. Refer to TCA Installation Method

2.04 GROUTS

A. Manufacturers:
   1. Mapei: Kerapoxy

B. All grout must meet ANSI A118.3 grout performance standards.

C. Colors: To be selected by architect.

2.05 ACCESSORY MATERIALS

A. Shower Waterproofing Membrane: Provide continuous waterproofing membrane at all floor and wall tile shower locations. Provide membrane, strips and all accessories from a single manufacturer.
   1. Schluter Kerdi waterproofing and vapor-retardant membrane 8 mil thick with a vater vapor permeance of 0.90 perms when tested according to ASTM E96.
      a. Provide Schluter Kerdi Waterproofing accessories
      b. Substitutions: Refer to Section 01 25 13 Product Substitution Procedures and Section 01 25 33 Product Substitution Request Form

B. Must use a Schluter Drain

C. Uncoupling Membrane: Provide at all floor tile locations - uncoupling membrane neutralizes differential movement stresses between substrate and tile for protection against in-plane cracking, waterproofing and vapor management.
   1. Uncoupling Membrane: 1/8 inch thick polyurethane matting with three-dimensional grid structure with dovetail shaped cavities and fleece webbing laminated to the underside to provide a mechanical bond to the substrate adhesive. Install membrane per manufacturers recommendation.
      a. Product: Schluter Systems "DITRA."
      b. Provide continuous uncoupling membrane under all tile.
      c. Substitutions: Refer to Section 01302 and 01302A.
   2. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
   3. Sealant
      a. Fungicidal one-part silicone rubber sealant comparable to Dow Corning 782 or 784.
      b. Color as selected by Architect from the manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that required floor-mounted utilities are in correct location.

E. If not cured properly, excessive moisture and high pH in concrete floor slabs may cause failure in adhesion of floor finish materials and environmental concerns. Due to incompatibility of concrete sealers with finish adhesives and moisture sensitivity of flooring adhesives and materials, Contractor shall follow the finish material manufacturer's written installation recommendations regarding concrete moisture, concrete pH, building humidity, and building temperature levels at the time of installation including but not limited to use of compatible concrete curing compounds and sealers and shall provide and install upgraded adhesives and sealers as recommended by the manufacturer at no additional cost to the Owner. Contractor

shall follow applicable ACI (American Concrete Institute) procedures without exception for type, strength, and moisture content of concrete specified.

F. Using the manufacturer's approved test method the Contractor shall verify moisture content, emission rate, and alkalinity of concrete slab is within approved adhesive and flooring finish manufacturer's recommended range prior to finish installation and shall make such adjustments in adhesives and procedures as recommended by the finish manufacturer at no additional cost to the Owner.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install thresholds where indicated.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
   1. Grout color to be uniform without any color shading over the surface. Grout color to be consistent between areas.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

N. All transitions must comply with ADA.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCA Handbook Method.
   1. On-Ground Concrete TCA Method F115-11
      a. Provide membrane per F-125 (full) full coverage.
      b. Epoxy grout ANSI A118.3.
      c. Adhesive must meet or exceed ANSI A118.4
   2. Above-Ground Concrete TCA Method F115A-11
      a. Provide membrane per F-125 (full) full coverage.

b. Epoxy grout ANSI A118.3.
c. Adhesive must meet or exceed ANSI A118.4

3.05 INSTALLATION - WALL TILE

A. Exterior Walls Masonry or Concrete TCA Method W202E-11
   1. Epoxy grout ANSI A118.3
   2. Adhesive must meet or exceed ANSI A118.4

B. Exterior Walls Wood or Metal Studs Cement Backer Board TCA Method W244E-1
   1. Epoxy grout ANSI A118.3
   2. Adhesive must meet or exceed ANSI A118.4

C. Interior Walls Masonry or Concrete TCA Method W2021-11
   1. Epoxy grout ANSI A118.3
   2. Adhesive must meet or exceed ANSI A118.4

D. Interior Walls Wood or Metal Studs Cement Backer Board TCA Method W244C-1
   1. Epoxy grout ANSI A118.3
   2. Ceramic Tile Maximum Tile size 8"x8" Adhesive
      a. Organic Adhesive to meet or exceed ANSI A136.1 Type I
   3. Porcelain Tile and Ceramic Tile
      a. Adhesive to meet or exceed ANSI A118.4

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

B. Protect finished floor surface from other trades.

END OF SECTION

SECTION 09 30 10
TRANSITION PROFILES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Edge-protection and transition profiles for floors

B. Finishing and edge-protection profiles for stair nosings

1.02 RELATED SECTIONS

A. Division 03 Concrete

B. Section 09 30 00 Tiling

C. Section 09 65 00 Resilient Flooring

D. Section 09 68 00 Carpeting

1.03 REFERENCES

A. Tile Council of North America (TCNA) Handbook for Ceramic Tile Installation

B. American National Standard Specifications for the installation of ceramic tile A108 / A118 / A136.1

1.04 SUBMITTALS

A. Product Data and Samples of each item.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Schluter Systems, L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841. Tel.: (800) 472-4588. Fax: (800) 477-9783. E-mail: specassist@schluter.com. Internet: www.schluter.com.

B. Substitutions: Approved by Owner

2.02 PRODUCTS

A. Edge Protection, Joints and Transition Profiles For Floors
   1. Schluter-RENO-T
      a. Description: T-shaped profile with 1/16 inch (1 mm) thick beveled exposed surface and 11/32 inch (9 mm) tall integrated vertical anchoring leg.
      b. Material and Finish:
         1) EB - Brushed Stainless Steel Type 304 = V2A
      c. Width: 1 inch (25 mm)
   2. Schluter-RENO-U
      a. Description: profile with sloped exposed surface, 5/32 inch (4 mm) tall leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
      b. Material and Finish:
         1) EB - Brushed Stainless Steel Type 304 = V2A
      c. Height: Height as required
   3. Schluter-RENO-V
      a. Description: ball-and-socket hinged profile with sloped exposed surface, tapered leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
      b. Material and Finish:
         1) AE - Satin Anodized Aluminum
      c. Height: Height as required
      d. Ramp Length: as required

B. Schluter - RENO - RAMP
   1. ADA compliant sizes

2. Description: anodized aluminum profile with textured, sloped exposed surface, tapered leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
3. Materials and Finish: AE - Satin Anodized Aluminum

C. Finish and Edge Protection Profiles for Tile Floor Edges that meet Wall below
1. Schluter-RONDEC-STEP
a. Description: anodized aluminum profile with symmetrically-rounded top surface with 1/4 inch (6 mm) radius and vertical leg that together form the exposed surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
b. Material and Finish:
1) AE - Satin Anodized Aluminum
2) Vertical Leg Length:
(a) 1-1/2 inch (39 mm)
3) Height: Height as required

D. Finishing and Edge-Protection Profiles for Stair Nosings
1. Schluter-TREP-G-B
a. Description: roll-formed brushed stainless steel (type 304 = V2A) profile with self-adhesive, non-slip tread, 2-5/32 inch (55 mm) wide exposed surface with rounded leading edge, and integrated trapezoid-perforated anchoring leg.
b. Tread Color:
1) GS - Black
c. Height: Height as required
d. Provide matching end cap.

E. Finish and Outside Corner Edge Protection Profiles for Wall Tile Outside Corners
1. Schluter Schiene
2. Finish - Satin Anodized Aluminum

F. Control Joints in Tile
1. Schluter Dilex-KSN
2. Stainless Steel and Black Thermoplastic Rubber Movement Zone

G. LVT to Carpet/Carpet Tile
1. Ceramic Tool Company CTV Carpet Trim
2. Finish - Anodized Aluminum Clear

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify location ready to receive finishes.

B. Verify location and sizes of finishes associated with work of this section.

C. Verify dimensions all finishes. Coordinate with transitions. Select transition size and style that allows proper installation.

3.02 INSTALLATION

A. Install per manufacturers current technical literature for proper design and installation instructions.

END OF SECTION

SECTION 09 30 50
TILE SETTING MATERIALS AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finishing and edge-protection profiles for walls.

B. Uncoupling membrane.

C. Waterproofing Membrane.

1.02 RELATED SECTIONS

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

B. Section 05 55 00 - Metal Stair Treads and Nosings.

C. Section 06 10 00 - Rough Carpentry.

D. Section 07 90 00 - Joint Protection.

E. Section 09 29 00 - Gypsum Board.

F. Section 09 30 00 - Tiling.

G. Section 10 26 13 - Corner Guards.

H. Section 22 30 00 - Plumbing Equipment.

1.03 REFERENCES

A. CSA B79-08: Floor, Area, and Shower Drains, and Cleanouts for Residential Construction.

B. IAPMO IGC 195: Interim Guide Criteria for Floor Drain with Integrated Bonding Flange.

C. Tile Council of North America (TCNA) Handbook for Ceramic Tile Installation.

D. Terrazzo, Tile and Marble Association of Canada (TTMAC) Specification Guide 09300 Tile Installation Manual.

E. American National Standard Specifications for the installation of ceramic tile A108 / A118 / A136.1.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and finish.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience.

B. Source Limitations for Setting Materials and Accessories: Obtain product of a uniform quality for each application condition from a single manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

D. Preinstallation Conference: Conduct conference at the Project site.
   1. Convene one week prior to commencing work of this section.
   2. Require attendance of installation material manufacturer, tile supplier, tile installer and installers of related work. Review installation procedures and coordination required with related work.
   3. Meeting agenda includes but is not limited to:
      a. Surface preparation.
      b. Tile and installation material compatibility.
      c. Edge protection, transition and pre-fabricated movement joint profiles.
      d. Waterproofing techniques.
      e. Crack isolation techniques.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 COORDINATION

A. Coordinate Work with other operations and installation of floor finish materials to avoid damage to installed materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Schluter Systems, L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841. ASD. Tel: (800) 472-4588. Fax (800) 477-9783. E-mail:specassist@schluter.com. Web:www.schluter.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.02 FINISHING AND EDGE-PROTECTION PROFILES FOR WALLS AND COUNTERTOPS

A. Schluter-SCHIENE
   1. Description: L-shaped profile with 1/8 inch (3.2) wide visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   2. Anchoring Leg:
      a. Provide with straight anchoring leg.
   3. Material and Finish:
      a. EB - Brushed Stainless Steel Type 304 = V2A.
         1) Height as required to coordinate with tile selection and setting system selected.

2.03 UNCOUPLING MEMBRANE

A. Schluter-DITRA
   1. Description: 1/8 inch (3 mm) thick, orange, high-density polyethylene membrane with a grid structure of 1/2 inch by 1/2 inch (12 mm by 12 mm) square cavities, each cut back in a dovetail configuration, and a polypropylene anchoring fleece laminated to its underside. Conforms to definition for uncoupling membranes in the Tile Council of North America Handbook for Ceramic Tile Installation and is listed by cUPC to meet or exceed the requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10 and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467).

2. Waterproofing seaming membrane:
    a. Provide KERDI BAND Seams and Corners material 0.004 inch (0.1 mm) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.

2.04 WATERPROOFING MEMBRANE

A. Schluter-KERDI
    1. Description: 0.008 inch (0.2 mm) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides, which is listed by cUPC to meet or exceed requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10 and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467).
    2. Corners and seals:
        a. Provide matching preformed inside corners.
        b. Provide matching preformed outside corners.
        c. Provide matching preformed pipe seals.
        d. Provide matching preformed mixing valve seals.

B. Schluter-KERDI-BAND
    1. Description: Seams and Corners material 0.004 inch (0.1 mm) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.
    2. Width:
        a. Width as required.

2.05 PREFABRICATED SHOWER COMPONENTS

A. Schluter-KERDI-SHOWER-L/-LS
    1. Description: trapezoid-imprinted, prefabricated, sloped tiled shower tray base, made of 2.75 lb/ft3 (44 kg/m3) density, self-extinguishing (HF-1 rating per UL-94) expanded polystyrene, with removable recessed section and bonded Schluter KERDI Membrane 0.008 inch (0.2 mm) thick, which meet or exceed the requirements of the American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10, and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467). Meeting ANSI A118.10 as detail as referenced in method B422 of the Tile Council of North America Handbook for Ceramic Tile Installation.
    2. Tray for Wall or Entrance Placement:
        a. KSL1000S - 39 inch by 39 inch by 1-21/32 inch (100 cm by 100 cm by 42 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustical ceiling panels.

B. Wire hangers, fasteners, main runners, cross tees, wall angle moldings, perimeter trim and accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16 - Gypsum Board Assemblies

B. Division 23 - HVAC

C. Division 26 - Electrical

1.03 REFERENCE STANDARDS

A. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

B. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

C. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

D. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

E. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

G. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.

H. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

I. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

J. ASTM E 119 Standard Test Method for Fire Tests of Building Construction and Material.

K. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

L. International Code Council-Evaluation Services - Evaluation Report, ESR-1308, Fire- and Nonfire-Resistance-Rated Suspended Ceiling Framing Systems

M. ASCE 7 Standard - American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

N. CISCA Seismic Zones 3 & 4 - Ceilings and Interior Systems Construction Association Guidelines for Seismic Restraint for Direct Hung Suspended Ceiling Assemblies

O. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint

P. International Building Code

Q. ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"

R. NFPA 70 National Electrical Code

S. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

T. International Code Council-Evaluation Services Report - Seismic Engineer Report
   1. ESR 1308 - Armstrong Suspension Systems

U. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report
   1. 0244 - Armstrong Single Span Suspension System

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning. Show locations of items which are to be coordinated with, or supported by the ceilings.

C. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

D. Samples: Submit two samples 6" x 6" in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each of suspension system main runner and trim

F. Certifications: Manufacturer's certifications that system complies with specified requirements:
   1. For seismic performance: International Code Council Evaluation Report, ESR-1308.
   2. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

G. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

D. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
   1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
   2. Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory

E. Acoustical panels, as with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

F. Seismic Performance: Provide acoustical ceiling system that is compliant with the International Building Code, Seismic Category D.

G. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.06 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, weatherproof, sufficient heating or cooling is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved. Ambient conditions of

temperature and humidity are continuously maintained at values near those intended for final occupancy.

B. Install acoustical units after interior wet work is completed and dry.

C. Space Enclosure:
   1. Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot dipped galvanized steel, aluminum or stainless steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not operating. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the ceiling.
   2. Building areas to receive ceilings shall be free of construction dust and debris. Ceilings with HumiGuard Max performance can be installed in conditions up to 120°F (49°C) and maximum humidity exposure including outdoor applications, and other standing water applications, so long as they are installed with either SS Prelude Plus, AL Prelude Plus, or Prelude Plus Fire Guard XL suspension systems. Products with Humiguard Max performance can be installed in exterior applications, where standing water is present, or where moisture will come in direct contact with the ceiling. Only Ceramaguard with AL Prelude Plus suspension system can be installed over swimming pools.

1.07 EXTRA MATERIALS

A. Provide 10% of each type of acoustical unit for Owner's use in maintenance of project. Each carton/box shall be labeled identifying the type of ceiling tile.

B. Provide quantity of each exposed suspension component equal to 2.0 percent of amount installed.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.09 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:
   1. Acoustical Panels: Sagging and warping
   2. Grid System: Rusting and manufacturer's defects

B. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. Substitutions: Refer to Section 01 25 13 & 01 25 33.
      a. Substitutions shall meet all requirements of this section including but not limited to UL acoustical performance, panel edge, durability, recycled content, color, texture, size and sheen.

B. Acoustical Units - General: ASTM E1264, Class A.

C. Acoustical Panels

1. Refer to Drawings except as stated below for fire rated lay-in ceiling systems.

2.02 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Acoustical grid system manufacturer same as for acoustical units.
   2. Refer to drawings for products except as stated below for fire rated lay-in ceiling systems.
      a. Armstrong World Industries, Inc: www.armstrong.com.
      b. Substitutions: Refer to Section 01 25 13 & 01 25 33.
         1) Substitutions shall meet all requirements of this section including but not limited to UL acoustical performance, panel edge, durability, recycled content, color, texture, size and sheen.

B. Components: Main beams and cross tees In accordance with the International Building Code, and ASCE 7 for Category D as described in ESR-1308.
   1. Structural Classification: ASTM C 635, Heavy Duty.

C. Attachment Devices: In accordance with the International Building Code and ASCE 7 for Category D.

D. Wire for Hangers and Ties: In accordance with the International Building Code and ASCE 7.

E. Wall Moldings: In accordance with the International Building Code and ASCE 7 Category D.
   1. Nominal 7/8 inch x 7/8 inch hemmed, pre-finished angle molding

F. Accessories:
   1. BERC2 - 2 inch Beam End Retaining Clip, 0.034 inch thick, hot-dipped galvanized cold-rolled steel per ASTM A568 - used to join main beam or cross tee to wall molding.
   2. SJCG - Seismic Joint Clip, 5 inches x 1-1/2 inch, hot-dipped galvanized cold-rolled steel per ASTM A568. The two piece unit is designed to accommodate a seismic separation joint. The clip is compatible with 15/16 inch and 9/16 inch grid systems including Prelude, Suprafine, and Silhouette. The SJCG is not suitable for use with Vector panel installations.
   3. Touch up Paint: Type and color to match acoustical and grid units.

G. Fire rated lay-in ceiling systems
   1. Panels: Armstrong 2' x 4' Fire Guard, 5/8" thick panels.
   2. 1 = AFG and FST 6000 - Prelude Fire Guard and Prelude XL Fire Guard with steel cap.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than 4" width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

B. All ceiling tiles must be 4" or larger in both dimensions including perimeter ceiling tiles.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system and panels in accordance with the International Building Code and ASCE 7 except as noted in the International Code Council independent engineering evaluation ESR-1308, and with the authorities having jurisdiction.

B. ESR-1308, Alternate Seismic Design Category D,E and F Installation:
   Under this installation, the runners must be rated heavy-duty and have a minimum simple span uniform load of 16.35 pounds per lineal foot (238 N/m); maximum ceiling weight permitted is 1.80 pounds per square foot (8.78 kg/m2).
   1. The BERC-2 clip is used to secure the main runners and cross runners on two adjacent walls to the structure and the two opposite walls to the perimeter trim, as detailed

below. A nominal 7/8-inch (22 mm) wall molding is used in lieu of the 2- inch (51 mm) perimeter supporting closure angle required in ASCE-7 for Seismic Design Categories D, E and F. Except for the use of the BERC-2 clip and the 7/8-inch (22 mm) wall molding and elimination of spreader bars, installation of the ceiling system must be as prescribed by the applicable code.

2. The BERC-2 clip is attached to the wall molding by sliding the locking lances over the hem of the vertical leg of the wall molding. On the walls where the runners are fixed, the runners are attached by pop-riveting the runner to the wall molding.

C. The SJCG Seismic Separation Joint Clip is to be installed per the manufacturer's instructions CS-3815.

D. The presence of a hanger wire within 3 inches of an expansion relief joint as called for in ASTM C636 shall be required in addition to the requirements of the International Building Code, ASCE and with the authorities having jurisdiction.

1. Only applies when using
   a. Prelude XL Fire Guard 15/16"
   b. Prelude Plus XL Fire Guard 15/16"
   c. Suprafine XL Fire Guard 9/16" Exposed Tee Systems

E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

F. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.
2. Double cut and field paint exposed reveal edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Install hold-down clips on panels within 20 ft of an exterior door.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.07 SEISMIC REQUIREMENTS

A. Installation must conform to CISCA for Seismic Zone D

END OF SECTION

SECTION 09 67 23
EPOXY FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Epoxy Flooring

1.02 RELATED SECTIONS

A. Section 09 06 00 - Finish Schedule

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of color samples for Designer's initial selection.

D. Verification Samples: Submit two 2" x 2" samples in size of actual material illustrating color and pattern for each flooring product specified.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

A. Single-source Responsibility: All flooring material by a single manufacturer.

B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
   1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
   2. Contractor shall have completed at least 10 projects of similar size and complexity.

C. Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.
   1. Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

D. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Apply full-thickness mockups on 48-inch- (1200-mm-) square floor area selected by Designer.
      a. Include 48-inch (1200-mm) length of integral cove base.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Pre-installation Conference:
   1. General contractor shall arrange a meeting not less than thirty days prior to starting work.

F. Flooring, wall finish and accessories must be from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

C. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
   1. Maintain material and substrate temperature between 65 and 85 deg F (18 and 30 deg C) during resinous flooring application and for not less than 24 hours after application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring

E. If not cured properly, excessive moisture and high pH in concrete floor slabs may cause failure in adhesion of floor finish materials and environmental concerns. Due to incompatibility of concrete sealers with finish adhesives and moisture sensitivity of flooring adhesives and materials, Contractor shall follow the finish material manufacturer's written installation recommendations regarding concrete moisture, concrete pH, building humidity, and building temperature levels at the time of installation including but not limited to use of compatible concrete curing compounds and sealers and shall provide and install upgraded adhesives and sealers as recommended by the manufacturer at no additional cost to the Owner. Contractor shall follow applicable ACI (American Concrete Institute) procedures without exception for type, strength, and moisture content of concrete specified.

F. Using the manufacturer's approved test method the Contractor shall verify moisture content, emission rate, and alkalinity of concrete slab is within approved adhesive and flooring finish manufacturer's recommended range prior to finish installation and shall make such adjustments in adhesives and procedures as recommended by the finish manufacturer at no additional cost to the Owner.

1.07 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full years from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year from date of installation. A sample warranty letter must be included with bid package.

PART 2 PRODUCTS

2.01 RESINOUS FLOORING

A. Manufacturer:
   1. Torginol, Inc.
      a. Resin Quartz
   2. Substitutions: Refer to Section 01 25 13 Product Substitution Procedures and Section 01 25 33 Product Substitution Request Form.
   3. Finish must be anti-slip in all areas
   4. System Characteristics:
      a. Color and Pattern: Refer to Section 09 06 00 Finish Schedule.
      b. Wearing Surface: Slip resistant, textured. Verify with samples.

5. System Components: Manufacturer's standard components that are compatible with each other and as follows:
    a. Primer:
        1) Moisture Tolerant Primer
    b. Pigmented Basecoat
        1) Aggregates: Pigmented Blended aggregate.
    c. Quartz Broadcast
    d. Top coat: Fully encapsulate Quartz layer
        1) Finish: Anti-slip

2.02 ACCESSORY MATERIALS

A. Primer: Type recommended by manufacturer for substrate and body coats indicated.

B. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

C. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated. Allowances should be included for joint fill material and concrete crack treatment.

PART 3 EXECUTION

3.01 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
    1. Mechanically prepare substrates as follows:
        a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
        b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
    2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
    3. Verify that concrete substrates are dry.
        a. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 85 percent.
        b. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 6 lb of water/1000 sq. ft. of slab in 24 hours.
        c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
    4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for joint fill material, and concrete crack treatment.

3.02 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
      a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.

C. Apply metal trowel single mortar coat in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.

D. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.03 FIELD QUALITY CONTROL

A. Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.
   1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
   3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.04 CLEANING, PROTECTING, AND CURING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer

END OF SECTION

SECTION 09 84 00
TECTUM DIRECT-ATTACHED ACOUSTICAL INTERIOR PANELS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.02 SUMMARY

A. Section Includes:
   1. Cementitious wood fiber plank acoustical wall system

B. Related Sections:
   1. Section 09 20 00 – Plaster and Gypsum Board
   2. Section 01 81 13 – Sustainable Design Requirements
   3. Section 01 81 19 – Indoor Air Quality Requirements
   4. Divisions 23 – HVAC Air Distribution
   5. Division 26 – Electrical

C. Alternates
   1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and compliance with the basis of design.
   2. Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

B. ASTM C423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

C. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials

D. ASTM E2768-11(2018) Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials

E. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint

F. ASTM C636/C636M - 19 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

G. ASTM C754 Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board

H. ASTM E1264 Classification for Acoustical Ceiling Products

I. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

J. International Building Code

K. ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"

L. NFPA 70 National Electrical Code

M. California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.1 2010

N. L.E.E.D. - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings

O. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

P. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

Q. International Well Building Standard

R. Mindful Materials

S. Living Building Challenge

T. U.S. Department of Agriculture BioPreferred program (USDA BioPreffered).

1.04 SYSTEM DESCRIPTION

A. Direct attached acoustical wall systems manufactured from domestic cementitious wood fiber.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of Tectum® Direct-Attach™ ceilings or walls required.

B. Samples: Minimum 6 inch x 6 inch samples of specified Tectum® Direct-Attached interior panels.

C. Shop Drawings: Layout and details of Tectum® Direct-Attached interior panels show locations of items that are to be coordinated with the installation as required.

D. Certifications: UL certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. Acoustical performance, products must be tested to the A, D-20, C-20, or C-40 method.

E. Country of Origin: Submittals must be accompanied by letter, label or certification indicating the manufacturing country of origin. Comply with Made in USA requirements as applicable for the project.

F. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance as specified in Section 2.2, subcontractor shall be required to send material from every production run appearing on the job, finished as intended to be installed, to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.06 SUSTAINABLE MATERIALS

A. Transparency: Manufacturers will be given preference when they provide third party verified documentation to support sustainable requirements for the following: Material ingredient transparency, Removal of Red List Ingredients per LBCV3, Life Cycle impact information, Low-Emitting Materials, and Clean Air performance.

B. Health Product Declaration. The end use product has a published, complete third party verified Health Product Declaration with disclosure at a minimum of 1000ppm of known hazards in compliance with the Health Product Declaration open Standard.

C. Declare Label. The end use product has a published third party verified Declare label by the International Living Future Institute with disclosure of 100 ppm with a designation of Red List Free or Compliant (less than 1% proprietary ingredients).

D. Low Emitting products with VOC emissions data. Preference will also be given to manufacturers that can provide third party verified emissions data showing their products meet CDHP Standard Method v1.1 (Section 01350).

E. Life cycle analysis. Products that have communicated lifecycle data through Environmental Product Declarations (EPDs) will be preferred.

F. End of Life Programs/Recycling: Where applicable, manufacturers that provide the option for recycling of their products into new products at end-of-life through take-back programs will be preferred.

G. Products meeting LEED V4 requirements including:
   1. Storage & Collection of Recyclables
   2. Construction and Demolition Waste Management Planning
   3. Building Life-Cycle Impact Reduction
   4. Building Product Disclosure and Optimization Environmental Product Declarations
   5. Building Product Disclosure and Optimization Sourcing of Raw Materials
   6. Building Product Disclosure and Optimization Material Ingredients
   7. Construction and Demolition Waste Management

1.07 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate UL markings.
   1. Surface Burning Characteristics: Tested per ASTM E84 and complying with ASTM E1264 Classification.

C. Tectum® Direct-Attached, as with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

D. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.08 DELIVERY, STORAGE & HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Provide labels indicating brand name, style, size and thickness.

C. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

D. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.09 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

B. Do not install panels until building is closed in and HVAC system is operational.

C. Locate materials onsite at least 72 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.

D. Maintain the following conditions in areas where acoustical materials are to be installed 72 hours before, during and after installation:
   1. Relative Humidity: 25 - 85%.
   2. Uniform Temperature: 32 - 120 degrees Fahrenheit.

1.10 WARRANTY

A. Tectum® Direct-Attached Wall Panels: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

1. Defects in materials or factory workmanship.

B. Tectum® Direct-Attach Wall Panels warranty - Thirty (30) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.11 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
   1. Tectum® Direct-Attached Wall Panels: Furnish quality of full-size units equal to 5.0 percent of amount installed.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Tectum® Direct-Attached Wall Panels:
   1. Tectum® by Armstrong World Industries, Inc.

B. Suspension System and Accessories:
   1. Armstrong World Industries, Inc.

2.02 TECTUM® DIRECT-ATTACH CEILING AND/OR WALL PANELS

A. Acoustical Panels Type A, B, and C:
   1. Surface Texture: Coarse
   2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
   3. Finish: Surface appearance shall be consistent from panel to panel
   4. Color: Refer to Schedule Schedule Section 09 06 00
   5. Size: Type A Standard 23 ¾” x 48”, Type B Standard 12” x 48”, Type C – Refer to Drawings
   6. Thickness: Standard 2”
   7. Edge Profile: Standard Square
   8. UL Classified Noise Reduction Coefficient (NRC): ASTM C423; 2”-thick panels mounting method: C-20(0.95), Classified with UL label.
   9. UL Classified Flame Spread: ASTM E1264; Class A. Product must be able to meet this criteria after being painted six times.
   10. Light Reflectance (LR) White Panel: ASTM E1477; (Light Reflectance)
   11. Dimensional Stability/Mold Resistance: HumiGuard Plus and no significant mold growth when tested by ASTM D3273.
   12. Sustainable: Third party verified EPD (Environmental Product Declaration) and HPD (Health Product Declaration) and Living Product Imperative Certification.
   13. USDA Certified Biobased Product, 98%
   14. Mounting Method – D-20 for Swimming Pool Applications

2.03 METAL SUSPENSION SYSTEMS

A. Accessories:
   1. #6 x 1-5/8” Painted Head Sharp Point Screws, item 8187L16TWH
   2. #6 x 1-5/8” Painted Head Drill Point Screws, item 8188L16TWH
   3. 2-1/4” Painted Head CMU Screws, item 8189L22TWH
   4. #6 x 2-1/4" Painted Head - Sharp point Screws, item 8187L22TWH
   5. #6 x 2-3/8" Painted Head - Drill point Screws, item 8188L23TWH
   6. 1/4" x 2-3/4" Painted Head - CMU Screws, item 8189L27TWH
   7. #8 x 3" Painted Head - Sharp point Screws, item 8187L30TWH
   8. #8 x 3" Painted Head - Drill point Screws, item 8188L30TWH

9. 1/4" x 3-1/4" Painted Head - CMU Screws, item 8189L32TWH

B. Attachment Component for Direct Attached to Heavy gauge metal steel
   1. 1-5/8" drill point screws item 8188L16

PART 3 - EXECUTION

3.01 3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

A. Measure each wall area and establish layout of wall units. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
   1. 1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.03 INSTALLATION

A. Install Tectum® Direct-Attached Panels in accordance manufacturer's installation instructions.

3.04 ADJUSTING AND CLEANING

A. Replace damaged and broken Tectum® Direct-Attached Panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any Tectum® Direct-Attached Panels that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION

SECTION 09 84 36.12
SOUND-ABSORBING BAFFLE PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing baffle panels, custom-fabricated and vinyl-finished.

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2016.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements
   1. Surface Burning Characteristics (ASTM E84):
      a. Flamespread: 25, maximum.
      b. Smoke Developed: 450, maximum.

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit product data sheet, for specified products.

C. Shop Drawings: Submit shop drawings showing layout, edge profiles and baffle / cloud components, including suspension method, accessories, finish colors and textures.

D. Samples: Submit selection and verification samples of finishes, colors and textures.

E. Test Reports: Certified test reports showing compliance with specified performance requirements.
   1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1 Product Requirements Section.

B. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions. Environmental conditions required for storage are the same as for installation, see 1.06 A. Project Conditions.

1.06 PROJECT CONDITIONS

A. Environmental Requirements: Do not install baffles until wet work, such as concrete and plastering, is complete; the building is enclosed; and the temperature and relative humidity are stabilized at 60 - 80 degrees Fahrenheit and 40% to 50%, respectively.

PART 2 PRODUCTS

2.01 SOUND-ABSORBING BAFFLE PANELS

A. Manufacturer: Kinetics Noise Control, Inc.
   1. Contact: PO Box 655, 6300 Irelan Place, Dublin, OH 43017; Telephone: (614) 889-0480; Fax: (614) 889-0540; E-mail: intsales@kineticsnoise.com; Web site: www.kineticsnoise.com.

B. Substitutions: No substitutions permitted.

2.02 MANUFACTURED UNITS

A. Wave Baffle Type HB

1. Baffles shall be a nominal 2 inch thick, 1 pcf fiberglass insulation blanket fully encapsulated in a solid vinyl covering which is heat sealed on the edges. Vinyl shall be no less than 0.1 inch thick.
2. Size: As shown on drawings up to a maximum 4 feet wide and 30 feet long.
3. Color: As selected from the manufacturer's standard range of fire rated materials.
4. Suspension on the ends of each baffle 4 feet maximum width) shall be through a full-width solid wood spreader mounting bracket covered in vinyl.
5. Sound Absorption (ASTM C423, J Mounting), Sabins per square foot of baffle to meet the following minimum in each frequency band:

   125Hz 250Hz 500Hz 1000Hz 2000Hz

   .51 .56 .93 1.12 1.08 (Perforated vinyl one side)

   .41 .64 1.00 1.33 . 64 (Solid vinyl)

   Testing of baffles must be in a typical horizontally suspended catenary position replicating a ceiling/roof installation. Type E400 mounting is not acceptable.
6. Mounting: Wire, cable, or other approved hanging mechanism attached through the mounting bracket.
7. Vertically hung baffles, as shown on the drawings, will be suspended through attachment at a top mounting bracket on one end of the baffle or through grommets designed to carry the baffle weight without tearing or pulling out.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that the supporting structure for suspension of acoustical baffles previously installed under other sections, is acceptable for product installation in accordance with manufacturer's instructions.

1. Do not install baffles until unsatisfactory conditions are corrected.

3.03 CLEANING

A. Follow manufacturer's instructions for cleaning baffles soiled during installation. Replace baffles that cannot be cleaned to as new condition.

B. Keep site free from accumulation of waste and debris.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, and other coatings.

C. See Schedule - Surfaces to be Finished, at end of Section.

1.02 RELATED REQUIREMENTS

A. Section 09 06 00 - Finish Schedule

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products, including VOC content.

C. Samples: Submit two paper chip samples, 6 x 6 in size illustrating range of colors and textures available for each surface finishing product scheduled.

D. Documentation from the manufacturer identifying VOC and chemical component limits.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

C. Primer and top coat to be from the same manufacturer.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for products and finishes.

1.06 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 4 feel long by 4 feet wide, illustrating coating color, texture, and finish.

C. Provide door and frame assembly illustrating paint coating color, texture, and finish.

D. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 EXTRA MATERIALS

A. Provide at least 1 gallon of each color and type in labeled containers.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sherwin Williams

B. Substitutions: Refer to Section 01 25 13 Product Substitution Procedures and Section 01 25 33 Product Substitution Request Form
   1. Substitutions shall meet the original specification material characteristics including but not limited to durability, recycled content, color, texture, pattern and sheen.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, except field-catalyzed coatings. Prepare pigments:
   1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
   2. For good flow and brushing properties.
   3. Capable of drying or curing free of streaks or sags.

B. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Chemical Content: The following compounds are prohibited:
   1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
   2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint - Wood, Opaque, Latex, 3 Coat:
   1. One coat:
      a. Sherwin Williams Exterior Latex Wood Primer B42 32% Vol. Solids. (87 g/L VOC)
   2. Two coats:
      a. Sherwin Williams A-100 Exterior Latex Gloss A8W16.36% Vol. Solids (<50 g/L VOC)

B. Paint - Masonry/Concrete, Latex, 3 Coat:
   1. One coat:
      a. Sherwin Williams Heavy Duty Block Filler B42W46.50% Vol Solids
   2. Two coats:
      a. Sherwin Williams A-100 Exterior Latex Gloss A8W16. 36% Vol. Solids (<50 g/L VOC)

C. Paint - Ferrous Metals, Unprimed, Alkyd and Acrylic, 3 Coat:
   1. One coat:
      a. Sherwin Williams Kem Kromik Primer B50 Phenolic Alkyd 55% Vol. Solids (389 g/L
      b. VOC)
   2. Two coats:
      a. Sherwin Williams Pro Industrial DTM Semi Gloss B66-650 Series 100% Arcylic 35% Vol. Solids (<50 g/L)

D. Paint - Ferrous Metals, Primed, Alkyd and Acrylic, 2 Coat:

1. Touch-up with one coat:
    a. Sherwin Williams Kem Kromik Primer B50 Phenolic Alkyd 55% Vol. Solids (389 g/L VOC)
2. Two Coats:
    a. Sherwin Williams Pro Industrial DTM Semi Gloss B66-650 Series 100% Arcylic 35% Vol. Solids (<50 g/L)

E. Paint - Galvanized Metals, Acrylic, 3 Coat:
1. One coat:
    a. Sherwin Williams Galvite HS B50 or Pro Industrial Acrylic DTM Primer
2. Two coats:
    a. Sherwin Williams Pro Industrial DTM Semi Gloss B66-650 Series 100% Arcylic 35% Vol. Solids (<50 g/L)

F. Paint - Pavement Marking Paint:
1. Two coats:
    a. Sherwin Williams Setfast Alkyd A300.

2.04 PAINT SYSTEMS - INTERIOR

A. Paint - Wood, Opaque, 3 Coat:
1. One coat:
    a. Sherwin Williams Prep-Rite Wall/Wood Primer B49 55% Vol. Solids (338 g/L VOC)
2. Two coats:
    a. Sherwin Williams ProClassic Interior Alkyd Satin B33 35% Vol. Solids (<50 g/L VOC)

B. Paint - Wood, Transparent, Varnish, No Stain:
1. Self Priming. Do not use sanding sealer.
2. Two coats:
    a. Sherwin Williams Wood Classics Polyurethane Varnish A67 Series (43 g/L VOC)

C. Paint - Wood, Transparent, Varnish, Waterborne Stain:
1. Filler coat (for open grained wood only).
2. Two coats:
    a. Sherwin Williams Wood Classics Interior Oil Stain A48-200 Series (525 g/LVOC)
3. Two coats:
    a. PittTech Plus 4020 (Primer)/PittTech Plus 4216 (Semigloss)

D. Paint - Ferrous Metals, Unprimed, 3 Coat:
1. One coat:
    a. Sherwin Williams DTM Primer B66W00011 Acrylic 39% Vol. Solids (<50 g/L VOC).
2. Two coats:
    a. Sherwin Williams Pro Industrial DTM Acrylic Gloss B66W01051 40% Vol. Solids (<50 g/L VOC)

E. Paint - Ferrous Metals, Primed, Acrylic, 2 Coat:
1. One coat:
    a. Sherwin Williams DTM Primer B66W00011 Acrylic 39% Vol. Solids (<50 g/L VOC).
2. Two coats:
    a. Sherwin Williams ProIndustrial DTM Acrylic Gloss B66W01051 40% Vol. Solids (<50 g/L VOC)

F. Paint - Galvanized Metals, Arcylic, 3 Coat (All Areas except Natatorium and Natatorium support spaces)
1. One coat:
    a. Sherwin Williams Pro Industrial DTM Acrylic Gloss B66W01051 40% Vol. Solids (<50 g/L VOC)
2. Two coats:
    a. Sherwin Williams Pro Industrial DTM Acrylic Gloss B66W01051 40% Vol. Solids (<50

g/L VOC)

G. Paint - Galvanized Metals (Natorium and Natorium support spaces)
   1. One Coat:
      a. PPG Paints - PittTech Plus 4020
   2. Two Coats:
      a. PPG Paints - PittTech Plus 4216 Semigloss

H. Paint - Concrete/Masonry 3 Coat (All areas except Natatorium and Natatorium support spaces)
   1. Two Coats:
      a. Sherwin Williams Pro Industrial Heavy Duty Block Filler B42W00150 50% vol. solids (<50 g/L VOC)
   2. Two Coats:
      a. Sherwin Williams Pro Industrial Pre Catalyzed Water Based Semigloss Epoxy K46W00151

I. Paint - Concrete/Masonry 3 Coat (Natatorium and Natatorium support spaces)
   1. One Coat:
      a. PPG Paints - 4-100XI Perma Crete
   2. Two Coats:
      a. PPG Paints - Aquapon WB EP

J. Paint - Gypsum Board/Plaster, Latex, Semi-Gloss 3 Coat (locker and toilet rooms):
   1. One coat:
      a. Sherwin Williams Pro Block Multi-Purpose Primer B51-450 Series 36% Vol. Solids(<50 g/L VOC)
   2. Two coats:
      a. Sherwin Williams Pro Industrial Pre-Cat Acrylic Epoxy K46-150 Series 36% Vol. Solids (135 g/L VOC)

K. Paint - Gypsum Board/Plaster Latex Coat (Wet Area Ceilings)
   1. One coat:
      a. Sherwin Williams Pro Block Multi-Purpose Prime B51-450 Series 36% Vol. Solids (<50 g/L VOC)
   2. Two coats:
      a. Sherwin Williams Pro Industrial Pre-Cat Acrylic Epoxy K46-150 Series 36% Vol. Solids (135 g/L VOC)

L. Sealer for Non-Slip non high abuse areas such as mechanical rooms, data rooms or janitorial closets.
   1. W.R. Meadows Seal tight Liquid-hard Ultra (0 g/L VOC)

M. Paint - Ferrous Metals Ceiling, Dry Fog: Refer to drawings for color.
   1. One coat primer for metal not factory
   2. DFT 3.4/One Coat
      a. Sherwin Williams ProIndustrial Waterborne Acrylic Dryfall White Flat B42W00181

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Interior Wood: 15 percent, measured in accordance with ASTM D 4442.
   4. Exterior Wood: 15 percent, measured in accordance with ASTM D 4442.

3.02 PREPARATION

A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

C. Marks: Seal with shellac those which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

F. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

G. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

H. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

I. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

J. Interior Wood Items to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

K. Interior Wood Items to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Divisions 21, 22, 23 and 26 for schedule of color coding of equipment, duct work, piping, and conduit.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 CLEANING

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 SCHEDULE - SURFACES TO BE FINISHED

A. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted.
   2. Fire rating labels, equipment serial number and capacity labels.

B. Paint the surfaces described below under Schedule - Paint Systems.

C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
   1. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
   2. Paint shop-primed items occurring in finished areas.
   3. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
   4. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

3.07 SCHEDULE - PAINT SYSTEMS

A. Concrete, Concrete Block, Brick Masonry: Finish all surfaces exposed to view.

B. Gypsum Board: Finish all surfaces exposed to view.

C. Wood: Finish all surfaces exposed to view.

D. Wood Cabinets: Finish all exposed and semi-exposed surfaces.

E. Steel Doors and Frames: Finish all surfaces exposed to view.

F. Steel Fabrications: Finish all surfaces exposed to view.

G. Galvanized Steel: Finish all surfaces exposed to view.

H. Shop-Primed Metal Items: Finish all surfaces exposed to view.

I. Pipe and Duct Insulation Jackets: Finish all surfaces exposed to view.

J. Exterior Pavement Markings: Traffic paint.

SECTION 10 21 13.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

B. Section 09 06 00 - Finish Schedule

C. Section 10 28 00 - Toilet & Utility Accessories.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit two samples of partition panels, 2x2 inches in size illustrating panel finish, color, and sheen. Submit two sets of color chips of actual material panel material representing manufacturers full range of available colors.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

1.06 COORDINATION

A. Coordinate the work with placement of support framing and anchors in wall.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. Scranton Products: www.scrantonproducts.com. Refer to finish schedule for color and finish
   2. Bradley: www.bradley.com
   3. Global Partitions: www.globalpartitions.com
   4. Substitutions: Refer to Section 01 25 13 Product Substitution Procedures and Section 01 25 33 Product Substitution Request Form
      a. Substitutions shall meet the original specification material characteristics including but not limited to durability, recycled content, color, texture, pattern and sheen.

2.02 COMPONENTS

A. Toilet Compartments: Solid molded plastic panels, doors, and pilasters, floor mounted and overhead braced.

B. Door and Panel:
   1. High-Density Polyethylene (HDPE) 1 inch thick - which is waterproof, nonabsorbant and has self lubricating surface that resists marks from graffiti.
   2. Door Height: 55 inch
   3. Color: Refer to Section 09 06 00 Finish Schedule.
   4. Texture: Refer to Section 09 06 00 Finish Schedule.
   5. Door hinge must be continuous.

C. Urinal Screens: Wall mounted with two panel brackets

D. Toilet Partition Type A – Design Based Hiny Hiders Traditional 2600 Door Design.

E. Toilet Partition Type B – Design Based Hiny Hiders Standard.

2.03 ACCESSORIES

A. Pilaster Shoes: Plastic , 3 in high, concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Etched and anodized aluminum handrail with antigrip profile and stainless steel brackets.

C. Brackets: Continuous type, polished stainless steel.

D. Wall Brackets: Continuous type, aluminum.

E. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.

F. Hardware: Polished stainless steel:
   1. Continuous stainless steel - adjust as required.
   2. Door Latch: Slide type with exterior emergency access feature. Stainless steel.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door.
      a. ADA coat hook to be at 44" max.
   5. Provide door pull for outswinging doors. Stainless steel.
   6. Provide door pull on both sides of ADA doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

F. Remove all protective films.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 21 19
SOLID PLASTIC SHOWER AND DRESSING COMPARTMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Solid plastic shower compartments.

B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.

1.02 REFERENCES

A. ASTM International (ASTM) (www.astm.org):
   1. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association (NFPA) (www.nfpa.org) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.03 SUBMITTALS

A. Submittals for Review:
   1. Shop Drawings: Include dimensioned layout, elevations, trim, closures, and accessories.
   2. Product Data: Manufacturer's descriptive data for panels, hardware, and accessories.
   3. Samples: 2 x 3 inch samples showing available colors.

B. Sustainable Design Submittals:
   1. Recycled Content: Certify percentages of post-consumer and pre-consumer recycled content.
   2. Regional Materials: Certify distance between manufacturer and Project and between manufacturer and extraction or harvest point in miles.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years experience in manufacture of solid plastic shower and dressing compartments with products in satisfactory use under similar service conditions.

B. Installer Qualifications: Minimum 5 years experience in work of this Section.

1.05 WARRANTIES

A. Provide manufacturer’s 25 year warranty against breakage, corrosion, and delamination under normal conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Contract Documents are based on products by Scranton Products. (www.scrantonproducts.com)

B. Substitutions: Under provisions of Division 01.

2.02 MATERIALS

A. Doors, Panels and Pilasters:
   1. High density polyethylene (HDPE), fabricated from polymer resins compounded under high pressure, forming single thickness panel.
   2. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.
   3. 1 inch thick with radiused edges.
   4. Fire hazard classification: Not required.

5. Fire hazard classification: Class A flame spread/smoke developed rating, tested to ASTM E84.
6. Fire hazard classification: Pass NFPA 286.
7. Recycled content: Minimum 25 percent.
8. Color: Refer to Finish Schedule Section 09 06 00.

B. Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.

C. Shower Curtains: Vinyl, 42 inches wide x 72 inches high, hung with aluminum curtain hooks with self-lubricating Delrin slides.

2.03 COMPONENTS

A. Panels: 76 inches high, mounted to pilasters with continuous brackets and to panels with continuous extruded aluminum brackets or continuous extruded aluminum shower corner brackets.

B. Pilasters: 82 inches high, fastened to panels with continuous brackets.

C. Headrail: Heavy-duty extruded aluminum, anti-grip design, clear anodized finish, fastened to headrail brackets and top of pilaster using stainless steel tamper-resistant Torx head screws.

D. Headrail Brackets: 20 gage stainless steel, secured using stainless steel tamper-resistant Torx head screws.

E. Brackets: 76 inches long, extruded aluminum, clear anodized finish, attached using stainless steel tamper-resistant Torx head screws.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install compartments in accordance with manufacturer’s instructions and approved Shop Drawings.

B. Install rigid, straight, plumb, and level.

C. Not Acceptable: Evidence of cutting, drilling, or patching.

END OF SECTION

SECTION 10 28 00
TOILET & UTILITY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Accessories for toilet rooms and utility rooms.

C. Utility room accessories.

D. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry

B. Section 09 3000 - Tiling

C. Section 10 21 13.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.

E. ASTM C1036 - Standard Specification for Flat Glass; 2011.

F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Verification Samples: Submit two samples of each accessory, if requested by Designer, illustrating color and finish.

D. Selection Samples: Submit two samples of manufacturers full range of colors.

E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.05 COORDINATION

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Bobrick

B. Commercial Toilet, Shower, and Bath Accessories:
   1. Bobrick: www.bobrick.com
   2. Substitutions: Refer to Section 01 25 13 Product Substitution Procedures and Section 01 25 33 Product Substitution Request Form

C. Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide 5 keys for each accessory to Owner; master key all lockable accessories.

C. Stainless Steel Sheet: ASTM A666/A666M, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Mirror Glass: ASTM C 1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C 1503.

F. Adhesive: Two component epoxy type, waterproof.

G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Refer to Drawings

B. Grab Bars: Stainless steel, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.

2.05 UTILITY ROOM ACCESSORIES

A. Mop and Broom Holder: Refer to Drawings

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 06 10 00 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

END OF SECTION

SECTION 10 50 00
WOODEN LOCKERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provide wooden lockers, end and filler panels and related items.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry

B. Section 06 10 00 - Rough Carpentry

C. Section 06 20 00 - Finish Carpentry

D. Section 07 90 05 - Joint Sealers

E. Section 09 06 00 - Finish Schedule

F. Section 09 21 16 - Gypsum Board Assemblies

1.03 REFERENCES

A. Minimum standard for wood lockers shall conform to AWI (Architectural Woodwork Institute) Architectural Woodwork Quality Standards Illustrated.

1.04 QUALITY ASSURANCE

A. All parts and hardware shall be AWI compliant, structurally sound and free from defects, in material and workmanship under normal use and service for the full warranty period.

1.05 SUBMITTALS

A. Product Data:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Product date specific to materials used in construction of locker.

B. Shop drawings showing individual locker construction, materials, dimensions, room layout and dimensions for installation, installation details including finished end panels, filler panels, crown molding, trim and accessories provided upon request.

C. Submit 2 color chip samples of the actual materials of manufacturer's full line.

1.06 PRODUCT HANDLING

A. Do not deliver lockers until building is enclosed and ready for locker installation. Store lockers and related products in a dry, climate controlled area in order to protect finished from damage during storage and handling.

1.07 PRODUCT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. During and after installation, maintain same temperature and humidity conditions in building spaces as will occur after occupancy.

C. Protect locker finish and adjacent surfaces from damage.

1.08 QUALITY ASSURANCE

A. All lockers and accessories to come from a single manufacturer.

PART 2 - PRODUCTS

2.01 MANFACTURERS

A. Hollman Lockers: www.hollman.com

B. Substitutions: Approved by Owner
   1. Substitutions shall meet the original specification material including but not limited to durability, recycled content, color, texture, pattern and sheen.

2.02 MATERIALS

A. Locker Frame: Tops, sides, and back shall be constructed of 5/8" high density thermo-fused melamine.
   1. Expansion/contraction within +/- 1/16" per locker.

B. Available Locker Models:
   1. Type A: Single tier, Model A: 1-Top Shelf, 1-Coat Rod, 1-Coat Hook with Built In Solid Surface Bench Seat
   2. Type B: Double tier, Model B: 1-Coat Rod, 1-Coat Hook with Built In Solid Surface bench seat
   3. Type C- Double Tier – Model B, 1-Coat Rod, 1-Coat Hook
   4. Type D- Double Tier – Model B, 1-Coat Rod, 1-Coat Hook
   5. ADA Locker Configuration:
      a. Provide ADA lockers with components that comply with ADA.
      b. Same type of components as other lockers.
      c. One component of each type must be ADA compliant.

C. Wood Door Style Flat Panel and Louver to match existing.

D. Wood Door: Wood species and stain to match existing. Cherry Amber #10109

E. Fillers: Filler and back panels matching locker interior to cover semi exposed sides, backs and intersections.

F. Visible Edges: Sealed with a 1.5 millimeter PVC edge banding to closely match locker doors.

G. Locker Doors:
   1. Veneer:
      a. Door edges sealed with 1.5 mm wood edge banding to closely match wood veneer.
      b. Component (5-piece) doors include stiles, rails, and center panel. Stiles and rails are A-1 plain sliced veneer on 3/4 inch MDF core. All stile and rail joints are doweled and glued.
         1) Center Panels:
            (a) Louvered and Flat: A-1 plain sliced veneer on profile panels on MDF core with 3/8 inch solid wood fixed louvers.

H. Veneer finish:
   1. Wood stains use solvent or water-borne stain. 100% solid UV cure sealer with less than 1% VOC is applied over stain.

I. Standard Hardware:
   1. Number disk: 1-1/2" Dia. flush mounted disc with 3/8" high contrast digits. US Block 1L font. Chrome Finish
   2. Coat Rod, 1" Dia. recessed rod.
   3. Coat Hook(s), 2-prong metal hooks
   4. Hinges are nickel finished, concealed, heavy duty European steel allowing 110 degree door opening with lifetime warranty.
      a. 4 hinges per door 60"H and over.
      b. 3 hinges per door 36" - 50" H.
      c. 2 hinges per door 35"H and under.

J. Locks: Centered vertically in door and spaced horizontally per lock type. High security padlock

K. Venting: 12 millimeter openings between door and top and bottom of locker and dividers on multiple opening frames provide continuous natural air flow.

2.03 FABRICATION

A. Locker shall be fabricated using doweled and glued and nailed assembly process.

B. Fabricate lockers square, rigid and without warp, with the finished faces flat and free of scratches and chips.

C. Machine all parts and attachment holes accurately and without chips.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until adjacent substrates and finishes have been properly prepared.

B. Verify prepared bases are in correct position and configuration.

C. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install lockers and accessories in accordance with manufacturer's approved layout, drawings and instructions for a plumb, rigid and flush installation. Finished end panels, back panel, filler panel, flat tops shall be installed using concealed fasteners.

B. Lockers to be installed on a 4" high base per design drawing, supplied either by manufacturer or by owner according to contract. Base extending from the wall 2" less than the locker depth. All hardware and installation instructions are to be provided by manufacturer.

C. Anchor lockers to wall studs or furring strips attached to wall through locker back and to the base through the locker floor. Attach lockers together through predrilled holes with manufacturer supplied connectors.

D. Adjust doors and hinges to accommodate uniform spacing after installation of lockers. Verify all working parts of locker including hinge and lock function. Attach number disks in specified sequence. Clean lockers and deliver keys and pertinent information to appropriate individual.

3.03 WARRANTY

A. All wood parts and hardware shall be structurally sound and free from defects in material and workmanship under normal use and service for a period of three (3) years from date of delivery. All locking mechanisms are warranted for one (1) year.

B. Lockers must be secured to the wall.

END OF SECTION

SECTION 10 51 00
LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lockers.

1.02 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

1.03 REFERENCES

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Drawings shall be submitted showing individual locker size and overall dimensions.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 3 inches square, representing actual product, color, and patterns.

F. Sustainable Design Submittals:
   1. Recycled Content: Certify percentages of post-consumer and pre-consumer recycled content.
   2. Regional Materials: Certify distance between manufacturer and Project and between manufacturer and extraction or harvest point in miles.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company regularly engaged in manufacture of products specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.

B. Installer Qualifications: A company regularly engaged in installation of products specified in this Section, with a minimum of 5 years' experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Locker components shall be stored flat until assembly. All finishes shall be protected from soiling and damage during handling.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.08 WARRANTY

A. Tufftec Warranty: Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge. (Labor not included in warranty.)

B. Duralife Warranty: Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 15 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge. (Labor not included in warranty.)

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Scranton Products, Web: https://www.scrantonproducts.com

B. Substitutions: Refer to Section 01 25 13 Product Substitution Procedures and Section 01 25 33 Product Substitution Request Form

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.02 LOCKERS

A. Design: Storage locker.
   1. Product: Tufftec Lockers.
   2. Vertical Stack: Two tier.

B. Size: Individual and stack height as indicated on drawings.
   1. Locker Depth: 15 inches.
   2. Locker Width: 12 inches.

C. Hardware:
   1. Plastic Coat Hook: Top-mounted, two-pronged plastic coat hook.
   2. Padlock hasp.
   3. Horizontal venting.
   4. Continuous hinge.
   5. Multi point security latch.
   6. End panel.

2.03 CONSTRUCTION

A. Locker Doors and Frames: Made from high impact, high density polyethylene (HDPE) formed under high pressure into solid plastic components 1/2 inch thick with homogeneous color throughout.

B. Sides, Tops, Bottoms, Backs, and Shelves: Made from high impact, high density, polyethylene (HDPE) formed under pressure into solid plastic components 3/8 inch thick with homogenous natural color throughout. Vertical back, outside, inside panels, horizontal top, bottom, divider, and shelves will be grey in color.

C. End Panels: Filler panels of plastic material in color of locker unless noted otherwise as an accent color.

D. Continuous Latch: Made from high impact HDPE plastic and capable of accepting various locking mechanisms. The spring-loaded latch shall be securely fastened to the entire length of the door providing a quiet positive latching function.

E. Tufftec Door Hinge: Heavy duty extruded aluminum with powder coating in black or silver. Full length, assembled onto the door and front.

F. Duralife Door Hinge: Heavy duty zinc-plated steel. Full length, assembled onto door and locker front.

G. Assembly Profile: To be full height of lockers. Made from PVC plastic and snapfit assembled onto locker sides.

H. Assembly Profile: To be full height of lockers. Profile to be tongue-and-groove joint construction using 3/8 inch thick HDPE.

I. Coat Hooks: Two-prong, high impact plastic. Mounted to bottom of shelf or divider. One each per door opening.

2.04 MATERIALS

A. Lockers to be constructed from High Density Polyethylene (HDPE) resins.
   1. Resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers, and other writing instruments.

B. HDPE Components: To have a smooth "orange peel" finish. Locker doors and door frames to be the same color.
   1. Tufftec Color: Refer to Finish Schedule.

2.05 FABRICATION

A. Locker Components: Fabricated square and rigid with a finish free of scratches and chips.

B. Solid Plastic Locker Components: Snap together at profile connections or slide together at dovetail connections for easy assembly and provide a solid and secure anti-racking bookcase component construction for clean lines and precise reveals. Adjacent lockers share a common side panel. Locker units are manufactured for assembly in a group of no more than three adjacent lockers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Report discrepancies to the architect.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lockers at the location shown in accordance with the manufacturers' instructions for plumb, level, rigid and flush installations.

C. Anchor the units to the wall studs through the locker back and to the floor using 1-1/2 inches tapcon screws.

D. Lockers shall be floor-mounted as scheduled or indicated. Floor shall be level for proper installation.

E. Lockers shall be installed on a 4 inch high base as scheduled or indicated. Base shall be level for proper installation.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops

B. Window Sills

1.02 DEFINITION

A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry

B. Section 06 20 00 - Finish Carpentry

C. Section 06 41 00 - Architectural Casework.

D. Section 07 90 05 - Joint Sealers

E. Section 09 3000 - Tiling

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

B. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

1.05 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

B. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: 3 samples for each finish product specified, minimum size 2 inches square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Installation Instructions: Manufacturer's installation instructions and recommendations.

G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

B. Qualifications:
   1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

C. Fabricator/installer qualifications:
   1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

D. Applicable standards:
   1. Standards of the following, as referenced herein:

a. American National Standards Institute (ANSI)
b. American Society for Testing and Materials (ASTM)
c. National Electrical Manufacturers Association (NEMA)
d. NSF International

2. Fire test response characteristics:
   a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
      1) Flame Spread Index: 25 or less.
      2) Smoke Developed Index: 450 or less.

E. Coordination drawings:
   1. Shall be prepared indicating:
      a. Plumbing work.
      b. Electrical work.
      c. Miscellaneous steel for the general work.
      d. Indicate location of all walls (rated and non-rated), blocking locations and recessed wall items, etc.
   2. Content:
      a. Project-specific information, drawn accurately to scale.
      b. Do not base coordination drawings on reproductions of the contract documents or standard printed data.
   3. Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.
      a. Provide alternate sketches to designer for resolution of such conflicts.
         1) Minor dimension changes and difficult installations will not be considered changes to the contract.
      b. Drawings shall:
         1) Be produced in 1/2-inch scale for all fabricated items.
      c. Drawings must be complete and submitted to the architect within 60 days after award of contract for record only.
         1) No review or approval will be forthcoming.
         2) Coordination drawings are required for the benefit of contractor's fabricators/installers as an aid to coordination of their work so as to eliminate or reduce conflicts that may arise during the installation of their work.

F. Job mock-up:
   1. Prior to fabrication of architectural millwork, erect sample unit to further verify selections made under sample submittals and to demonstrate the quality of materials and execution if requested by architect.

G. Pre-installation conference:
   1. Conduct conference at project site one month prior to installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 WARRANTY

A. Provide manufacturer's warranty against defects in materials.
   1. Warranty shall provide material and labor to repair or replace defective materials.
   2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
      a. Warranty shall be transferable to subsequent owner for remainder of warranty period.

3. Manufacturer's warranty period:
    a. Ten years from date of substantial completion.

1.09 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Countertop Fabrications
    1. Subject to compliance with requirements, provide products from manufacturer selected by Architect.
        a. Solid Surface Countertops, Sills
            1) Colors as selected by architect. Refer to Section 09 06 00 Finish Schedule.
                (a) Substitutions: Approved by Owner
                    (1) Substitutions shall meet the original specification material characteristics including but not limited to durability, recycled content, color, texture, pattern and sheen
        b. Quartz Countertops
            1) Colors as selected by architect. Refer to Section 09 06 00 Finish Schedule.
                (a) Substitutions: Approved by Owner
                    (1) Substitutions shall meet the original specification material characteristics including but not limited to durability, recycled content, color, texture, pattern and sheen

2.02 COUNTERTOPS

A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
    1. Flat Sheet Thickness: 1/2 inch, minimum.
    2. Edge Treatment as indicated on Architectural Drawings.
    3. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
        a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
        b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    4. Other Components Thickness: 1/2 inch, minimum.
    5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

B. Quartz Countertop: Homogeneous quartz surfaces materials
    1. Sheet Thickness: 3 cm
    2. Edge Treatments as indicated on drawings
    3. Other Components: Thickness 3 cm
    4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

2.03 MATERIALS

A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

B. Solid Surface Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined with joints inconspicuous in finished work. Exposed joints/seams shall not be allowed. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.

C. Quartz Adhesives: Manufacturer approved adhesive to create color-matched seam.

D. Joint Sealant: Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone - any type), UL-listed silicone sealant in colors matching components. Sealant to be made by same manufacturer as the solid surface. Install applied sidesplashes using manufacturer's standard color-matched silicone sealant.

E. Joint Sealant: Mildew-resistant silicone sealant, color to match components.

2.04 WINDOW SILLS

A. Edge Treatment as indicated on Architectural Drawings.

B. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISSFA-2 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   1. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E 84.
   2. Color and Pattern: to be selected by Architect. Refer to Section 09 06 00 Finish Schedule.

2.05 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

C. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Seal joint between back/end splashes and vertical surfaces.

3.04 CLEANING AND PROTECTION

A. Clean countertops surfaces thoroughly.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Date of Substantial Completion.

SECTION 13 11 00
SWIMMING POOLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT and applicable parts of DIVISION 1 - GENERAL REQUIREMENTS, as listed in the Table of Contents, be included in, and made a part of this Section.

1.02 SUMMARY OF WORK

A. Introduction

1. Provide labor, materials, equipment, and services necessary to renovate the existing pool and spa. This work must include the structure(s) and installation of pool finishes as well as products listed in Part 2 of Section 131100.

B. Work included in this section:

1. It is the intent of this section to place the entire responsibility for the renovation of the pool(s) (including the construction of the pool shell(s)) under one vested Contractor. Under this section the Contractor will provide but is not necessarily limited to the following:

a. Dewater as necessary to keep existing pool free from water during construction.

b. Provide electrical conduit, wiring, junction boxes etc. to low voltage pool equipment within pool filter/chemical rooms per Division 26 - Electrical. (Low voltage is considered less than 110 V.)

c. Coordinate for required bonding and grounding of the pool shell, fittings, and equipment.

d. Provide necessary piping and valving as shown on the drawings and specified herein.

e. Provide individually sized housekeeping pads for each pool pump. Provide housekeeping pads for pool equipment as required in the drawings.

f. Provide the main drain covers

g. Construct the cast in place pool features as described in these specifications and detailed on the drawings, including reinforcement steel, inserts, fittings, fiberglass/stainless-steel main drain sumps and embedded items (piping, anchors, etc.). Reference Division 3 - Concrete and Structural. Before commencing the placement of concrete, verify electrical bonding of the pool and spa embedded items and reinforcing steel. Also, coordinate and arrange required electrical, plumbing and or building inspections.

h. Provide an aggregate cementitious finish in the pool with a slip resistant surface. Provide specialty tile for the wall targets, floor lane markings, depth markings and warning sign, and other trim tile as required. Reference Section 131103 - Swimming Pool Tile - including the tolerance requirements for the concrete substrate.

i. Provide a ceramic tile finish for the spa. Reference Section 131103 – Swimming Pool Tile.

j. Provide for the storage of pool related equipment, materials, and systems. Items are the responsibility of the Contractor until accepted by the owner.

k. Start, test, calibrate and adjust mechanical equipment, electrical equipment, recirculation, chemical, and other supplied systems including deck, loose,

maintenance, and safety equipment. Instruct the Owner's representative in the systems operation and maintenance as described herein.

l. Provide the heating system for the pool. Include piping, heaters, heat exchangers, booster pumps, controls, gauges, thermostats, control valves and wiring required to draw water from the recirculation line, heat the water and return it back to the recirculation line and interlock with pool recirculation pumps.

C. Related work specified in other sections:

1. Section 131104 – Swimming Pool Cementitious Finish

2. Section 131103 – Swimming Pool Tile

3. The following work related to the swimming pools must be completed by other trades.

a. Provide, erect, and maintain necessary barricades, signs, lights, and flares for pool construction to protect workers and the public.

b. Prior to concrete pours, verify electrical bonding of the pool embedded items. Coordinate and arrange required electrical, plumbing and or building inspections that must be performed on embedded items. Reference Division 26 - Electrical.

D. Related work specified in Plumbing section. Reference Division 22 - Plumbing. Work that must be completed by others.

1. Provide water service for pool fill/auto fill. Install slow closing solenoid valve(s) in the bypass auto-fill piping.

E. Related work specified in Mechanical section. Reference Division 23 – HVAC. Work that must be completed by others.

1. Provide combustion air, venting, and gas to each of the pool heaters.

2. Provide air recirculation systems for pool related spaces.

F. Related work specified in Electrical sections. Reference Division 26 – Electrical. Work that must be completed by others.

1. Provide motor starters, auxiliary contacts, magnetic relays, emergency stops and other electrical control devices necessary for the complete operation of the pool systems. Provide power distribution to all pool equipment including power from VFD to the pool pump motor.

2. Ground and bond pool structures, fittings, and equipment in accordance with Article 680 of the N.E.C. Test and verify that the system electrical ground is true and solid. Provide certification to this effort. Confirm electrical conduits that penetrate the pool shell are watertight and installed per N.E.C. Article 680.

3. Obtain permits, inspections, and approvals of wiring including grounding and bonding of metal components associated with the pool in accordance with Local, State and National Electrical Codes.

1.03 QUALITY ASSURANCE

A. The specifications and drawings illustrate certain technical aspects of the design are common only to pool systems planned for public use. Understanding these aspects, their functions and interaction through experience is vital to completing a successful operating system. It is mandatory that the Contractor have achieved such experience as a prerequisite for bidding on this project.

1. The Swimming Pool Contractor must include a bid bond from an approved surety company registered in the State of Tennessee certifying that the Swimming Pool Contractor has adequate bonding capacity to provide a bid for this project. The Swimming Pool Contractor

must submit a copy of the bid bond for review prior to the Swimming Pool Contractor's selection.

2. If the Contractor has not received prior written approval for this project or has not been included in the pre-approved list of Contractors, they must submit a list of projects meeting the aforementioned qualifications, including contact information of the General Contractor must be submitted for review and approval at least 10 days prior to bidding of the project. The Contractor must have completed at least five (5) public-use pools with individual water surface areas in excess of 5,000 square feet and a depth of 7'-0" or more within the past 10 years.

3. The Contractor must submit prior to the start of construction the name of the on-site Project Superintendent including their relevant experience. The Contractor's on-site Project Superintendent must have completed at least five (5) public-use pools with individual water surface areas in excess of 5,000 square feet and a depth of 7'-0" or more within the past 10 years. A list of projects meeting the aforementioned qualifications, including contact information of the General Contractor as well as Owner must be included with the experience submittal. Project Superintendent on the project cannot change unless written authorization has been provided by the Architect and Owner.

4. The Owner reserves the right to reject a bid if the evidence submitted by, or investigation of, the Contractor fails to satisfy the Owner that the Contractor is properly qualified to carry out the obligation of the contract and to complete the work described or if the Contractor does not have the qualifications stated herein. Subject to compliance with item 2 above on this specification.

5. The following Contractors have been pre-approved. The Contractor must meet the requirements listed above.

Burleson Pools
2725 Cullom Blvd SE
Owens Cross Roads, AL 35763
Ph: 256.829.2771

Memphis Pool
2762 Gettwell Road
Memphis, TN 38118
Ph:901.763.8732

Capri Pools
22 Gateway Commerce Center Dr, W Ste 110
Edwardsville, IL 62025
Ph: 314.351.6020

Landmark Aquatic
156 Weldon Parkway
Maryland Heights, MO 63043
Ph: 314.432.1801

Rotolo Consultants Inc.
38001 Brownsvillage Road
Slidell, LA 70460
Ph: 800.641.2427

AquaConstruction International
P.O. Box 17039
Memhpis, TN 38187
Ph: 901.766.0946

The Pool Company Inc.
2332 Jefferson Ave
Tacoma, WA 98402
Ph: 253.926.6875

1.04 REGULATORY AGENCY REQUIREMENTS AND ENGINEERING SERVICES

A. The system must comply with necessary pre-construction approvals.

B. Give necessary notices, obtain permits, and pay government fees, and other costs in connection with his work, including the filing of necessary as-built drawings, prepare documents (including any amendments to the approved construction documents) and obtain necessary approvals of governmental departments having jurisdiction over their work. Obtain required certificates of inspection for his work and deliver copies to the Owner and Architect before requesting acceptance and final payment for the work.

C. Include in the work, without extra cost to the Owner, labor, materials, services, apparatus, or drawings in order to comply with applicable laws, ordinances, rules, and regulations, whether or not shown on drawings and/or specified.

1.05 COORDINATION AND CLARIFICATION

A. Coordinate with other trades' work relating to this section.

B. Must establish with other trades, having related work in this section, that work necessary to complete the pool(s) as shown on the drawings and in the specifications is included in the base bid and alternates to the Owner.

C. If in doubt regarding the responsibility for work covered in this section and/or discovery of errors or omissions in the bidding documents, notify the Architect through channels established by the specifications and request a clarification ten (10) days prior to the bid date.

1.06 CONTRACTOR'S ALTERNATE PROPOSAL

A. Submit bid to the owner based on materials, equipment and methods as specified in this Section. No substitution of material will be allowed.

B. It is the intent of the contract documents to encourage competition. The base proposal must include the construction methods and equipment as specified and detailed. Proposed system substitutions must have prior written approval by the Architect.

C. If there is a deviation from the basis of design equipment, confirm that engineering criteria are appropriate for the substituted equipment.

D. Substitutions of specified construction methods and equipment must include a complete submittal as required by these specifications and drawings of appropriate scale incorporating required changes. Provide a list of at least ten (10) satisfactory installations comparable to this project that have been manufactured and installed under the manufacturer's current legal name. Submit a list of such projects with the name, address and current telephone number of the Owner's Operator and Architect of Record to the Architect on the bid date.

E. Changes or modifications to the Contract Documents that are not authorized by the architect are the sole responsibility of the Contractor.

1.07 SUBMITTALS

A. Submittals must be made in accordance with the requirements of Division 1 - General Requirements and in strict compliance with the following procedures and guidelines.

B. One (1) set of shop drawings and engineering data must be tabbed, indexed, and referenced to the specifications, compiled into an electronic submittal, and submitted in two stages. The first stage must include items for the pool shell(s), reference swimming pool structural specifications. The second stage must be for remaining items. Each section of items must be prefaced by a cover sheet listing the items submitted within the section. Electronic submittals must be organized, numbered, and submitted in the same format and order as the project specifications. Only complete sets will be reviewed.

1. Engineering data covering systems, equipment, structures, and fabricated materials, which will become a permanent part of the work under this contract, must be submitted for review. This data must include drawings and descriptive information in sufficient detail and scale to

show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorage and supports required; performance characteristics; fabrication and dimensions needed for installation and correlation with other materials and equipment. A certification, in writing, must be provided indicating that equipment will fit in the space allotted and as shown on the drawings.

2. Submittals regardless of origin must be stamped with the approval of the Contractor and identified with the name and number of this contract, Contractor's name, and references to applicable specification paragraphs and contract drawings. Each submittal must indicate the intended use of the item in the work. When catalog pages are submitted, applicable items must be clearly identified. The current revision, issue number, and date must be indicated on drawings and other descriptive data.

3. The submittals will not be accepted from anyone but the Contractor. Submittals must be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

4. The Contractor's stamp of approval is a representation that the Contractor accepts full responsibility for determining and verifying quantities, dimensions, field construction criteria, materials, catalog numbers and similar data, and that he has reviewed or coordinated each submittal with the requirements of the work and the contract documents.

5. Each submittal must include a statement prepared by the originator of the drawings and data, certifying compliance with the contract documents except for deviations, which are specifically identified.

6. Deviations from the contract documents must be identified on each submittal and must be tabulated in the Contractor's letter of transmittal. Such submittals must, as pertinent to the deviation, indicate essential details of changes by the Contractor (including modifications to other facilities that may be a result of the deviation) and required piping and wiring diagrams.

7. The Contractor must accept full responsibility for the completeness of each submission, and, in the case of a resubmission, must verify that exceptions previously noted have been considered.

8. The need for more than one resubmission, or a delay in obtaining review of submittals, will not entitle the Contractor to an extension of the contract time unless the delay of the work is directly caused by a change in the work authorized by a change order.

9. Review of drawings and data submitted by Contractor will cover only general conformity to the drawings and specifications, external connections and dimensions that affect the layout. Review does not indicate a thorough review of dimensions, quantities, and details of the material, equipment, device, or item shown. Review of submittals does not relieve Contractor from responsibility for errors, omissions, or deviations, or responsibility for compliance with the contract documents.

10. When the drawings and data are returned marked REJECTED, REVISE AND RESUBMIT or SUBMIT SPECIFIED ITEM, the corrections must be made as noted thereon and as instructed and six corrected copies (or one copy and one corrected reproducible copy) resubmitted.

11. Resubmittals must bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal. Resubmittals must be indexed, tabbed, referenced to the specifications, and bound in a three-ring binder and submitted at one time.

12. When corrected copies are resubmitted, the Contractor must, in writing, direct specific attention to revisions and must list separately revisions made other than those called for on previous submissions.

13. When the drawings and data are returned marked NO EXCEPTIONS TAKEN or MAKE CORRECTIONS NOTED, no additional copies are to be provided unless specifically requested to do so for record.

C. Permits, Receipts and Test Reports

1. Provide the Architect with copies of permits and receipts for fee payments.

2. Submit a sample format for each test report intended for use. Submit test reports required herein only on approved forms.

D. Include complete product data indexed, tabbed, and referenced to specifications with 8 ½" x 11" cover sheet covering:

1. Paragraph 2.01 - Overflow System

2. Paragraph 2.02 - Pumping Equipment

3. Paragraph 2.03 - Filtration Equipment

4. Paragraph 2.04 - Recirculation Fittings

5. Paragraph 2.05 - Piping Systems

6. Paragraph 2.06 - Chemical Treatment Systems

7. Paragraph 2.07 - Chemistry Monitoring and Control Systems

8. Paragraph 2.08 - Flow Meters

9. Paragraph 2.09 - Water Level Controllers

10. Paragraph 2.10 - Deck Equipment

11. Paragraph 2.11 - Loose Equipment

12. Paragraph 2.12 - Maintenance Equipment

13. Paragraph 2.13 - Thermometers

14. Paragraph 2.14 - Swimming Pool Finishes

15. Paragraph 2.15 - Sealants

16. Paragraph 2.16 - Pool Heaters

E. Include engineering/construction drawings for the pool structure.

1. Reference Division 3 - Concrete.

2. Reference Section 131101 - Swimming Pool Cast-in-Place Concrete

1.08 TESTING REPORTS

A. Provide all testing reports as described in the specifications. Testing report(s) and any additional documentation of the test(s) must be submitted to the Architect within seven (7) days of the commencement of the test(s) unless otherwise noted. The following testing report(s) must be submitted for review/record:

1. The pool main drain piping must be capped and hydrostatically pressure tested after the removal of pool finishes and prior to the installation of new pool finishes. Hydrostatic pressure tests must be performed by the Contractor and witnessed by the Owner, or a representative designated by the Owner.

2. The pool must be tested for water tightness after the pool finishes have been removed and prior to the application of any new pool finishes. The water tightness test must be performed by the Contractor and witnessed by the Owner, or a representative designated by the Owner.

3. The domestic water must be analyzed prior to filling the pool after the application of the plaster finish. The Contractor must provide a domestic water analysis by a water testing

agency to determine types and quantities of chemicals required to ensure calcium-balanced water immediately upon the completion of filling the pool(s). Refer to specification 131104.

4. The slump of the plaster finish must be tested should a plastering machine be used. The Contractor to perform slump test to ensure slump does not exceed 2.5” when tested using a 2" by 4" by 6" high slump cone. Refer to specification 131104.

5. Concrete test panels/cylinders must be tested for compressive strength. The Contractor to produce test panels/cylinders to be tested by a third-party testing agency provided by the Owner. Refer to specifications 131101.

1.09 OPERATION AND MAINTENANCE MANUALS AND CLOSE-OUT SUBMITTALS

A. Detailed operation and maintenance information must be supplied for equipment requiring maintenance or other attention. The equipment supplier and/or the Contractor must prepare an operation and maintenance manual for equipment. Parts lists and operating, and maintenance instructions must be provided.

B. Each operation and maintenance manual must include the following:

1. Equipment function and calibration, normal operating characteristics, and limiting conditions.

2. Assembly, installation, alignment, adjustment and checking instructions.

3. Operating instructions for startup, routine and normal operation, regulation, and control, shut down and emergency conditions.

4. One (1) copy of instructional videos.

5. One (1) copy of Safety Data Sheet forms for all pool chemicals provided.

6. Operating cycles must be specifically described in outline format and in referenced detail. A wall-mounted color-coded piping flow diagram must be provided in the pool equipment room. The diagram must be engraved on laminated plastic with color-coded piping to match the color of coding on piping, and including valves identified with number on tags. The minimum size is 11-inch x 17 inch.

7. Include manufacturer recommended maintenance schedule, parts lists, piping diagram (to agree with wall mounted diagram) and trouble-shooting information for pool mechanical equipment.

8. Using reference to keyed valves and wall diagram, include specific written instructions for procedures that must be followed for the following:

   a. Emptying and refilling the pool(s) including de-watering during the period that the pool(s) will be empty.

   b. Water level control adjustment and chemical control operation.

   c. Normal surge tank operation and balancing.

   d. Filter operation and backwashing; and

   e. Super chlorination.

9. Lubrication and maintenance instructions.

10. Guide to “troubleshooting.”

11. Parts list and predicted life of parts subject to wear.

12. Outline, cross section, and assembly drawings; engineering data and wiring diagrams.

13. Test data and performance curves, where applicable.

14. Specific written instructions for procedure for emptying and refilling the pool(s) including de-watering during the period that the pool will be empty. Provide a yellow warning sign 8-1/2 in. x 11 in., that must be mounted in the pool mechanical room, that reads:

WARNING
Prior to emptying Pool
Consult O & M Manuals for Procedures

Add another sign that reads:

Keep Caps, Plugs and Tops Tight Fitting to Prevent Escape of Fumes.

15. Additionally, provide the following signs mounted on the chemical room doors:
    a. NFPA Hazard Diamond for each chemical stored in room.
    b. Warning: Authorized Personnel Only Beyond This Point
    c. Signage indicating location of associated Safety Data Sheet forms for all chemicals stored in room.
16. One set of applicable submittals must be included in each manual.

C. The operation and maintenance manuals must be in addition to instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by the Contractor.

D. Provide electronic copies of Operation and Maintenance Manual. Material must be assembled and bound in the same order as specified.

E. Material must be marked with project identification. Non-applicable information must be marked out or deleted.

F. Shipment of equipment will not be considered complete until the required manuals and data have been received.

G. The Contractor must provide, assemble, and inventory all deck, loose, safety, and maintenance equipment including any loose mechanical equipment prior to the Owner taking possession of the pool(s). The Contractor must provide a checklist that has been signed by the Owner verifying receipt of all items listed in Part 2 - Products.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original, unopened containers and crates with labels intact and legible.

B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.

C. Handle materials in a manner to prevent damage.

D. Store materials on clean raised platforms with weather protective coverings. Provide continuous protection of materials against damage or deterioration.

E. Remove damaged materials from site.

1.11 WARRANTIES

A. The Contractor warrants to the Owner and Architect that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements, including substitutions not properly approved and authorized will be

considered defective. The Contractor’s warranty will exclude remedies for damage or defect caused by abuse, improper or insufficient maintenance, improper operations, modifications not executed by the Contractor or improper wear and tear under normal use. If required by the Architect, provide satisfactory evidence as to the kind and quality of materials and equipment.

B. The Contractor must agree to repair or replace defective or non-complying work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.

C. Warranties must be for a period of one year from the date of substantial completion or the owner begins using the pool unless otherwise specified. Submit warranties covering, but not limited to the following:

1. Defects in material, manufacture and installation of the filtration, backwash, chlorination, pH adjustments and cleaning systems, including controls for a period of one (1) year.
2. Defects in the refurbishment of the recirculating overflow system for a period of two (2) years.
3. Defects in material, workmanship, and installation of the pool pumps for a period of one (1) year.
4. Manufacturer's minimum eighteen (18) month warranty against defective materials, components, and workmanship in the variable frequency drive system.
5. Manufacturer's minimum fifteen (15) year warranty on the filter tank against defective materials or workmanship of the tank and components. Prorated warranties are not acceptable.
6. Defects in material, workmanship, and installation of the pool piping system and recirculation fittings for a period of three (3) years.
7. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the sanitizing feed system.
8. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the pH buffer feed system.
9. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the ultraviolet sanitizing system (excluding the UV lamps, quartz, and seals). Medium pressure ultraviolet bulbs must be warranted for a period of 8,000 hours. Intermittently operated lamps (≥ 1 on/off cycle per day) will be replaced free of charge should failure occur prior to 4,000 hours and replacement will be prorated between 4,000 and 8,000 hours.
10. Manufacturer's minimum five (5) year warranty against defective materials, components, and workmanship in the pool chemical controller. ORP, pH, flow and temperature sensors must be covered by a standard two (2) year warranty. Other sensors and flow cell components must be covered by a standard one (1) year warranty.
11. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the pool water level control system.
12. Defects in material, workmanship, and installation of deck equipment including deck anchors for a minimum period of one (1) year.
13. Defects in material, workmanship, and installation of the pool cementitious finish against cracking and delamination for a period of three (3) years.
14. Defects in material, workmanship, and installation of the tile finish against cracking and delamination for a period of five (5) years.
15. Manufacturer's minimum fifteen (15) year systems warranty against defective materials, components and workmanship in the pool tile setting materials.

16. Manufacturer's minimum five (5) year warranty on the complete heat exchanger assembly. Parts must be covered by a standard one (1) year warranty.

1.12 SYSTEM TRAINING

A. A qualified representative of the Contractor performing work under this section must put the equipment into operation and instruct the Owner's representatives in the operation of this equipment to the Owner's satisfaction immediately after project's substantial completion.

B. The Contractor's training representative must have completed the equipment/system's manufacturer's training requirements and be certified, by the manufacturer, to provide and teach system training.

C. The representative from the Contractor must be either a CPO (Certified Pool Operator) or have an AFO (Aquatic Facility Operator) certification.

D. Training period to consist of 8 hours of on-site training and scheduled as follows:

1. 8 hours of training on the complete swimming pool system. The training must be comprised of at least 4 hours of training on water chemistry analysis and adjustment. The water chemistry training will include in-depth review of the use of the Langlier index and its computation.

2. The training must include information on the care, operation, adjustment, and maintenance of items provided by the Contractor under the "Part 2 – Products" section of this specification.

3. Provide a project specific video recording instruction manual in addition to the training sessions. The video instructions must be project specific and must include information on the care, operation, adjustment, and maintenance of items provided by the Contractor under the "Part 2 – Products" section of this specification. This video recording must be done separate from the Owner training.

4. The Contractor must include one (1) copy of video recording instructions in each Operations and Maintenance Manual.

1.13 POOL FILL WATER QUALITY

A. The Owner is to bear the cost of the water required for filling the pool for water tightness testing and the final filling. Removal of iron or copper (if in excess of .3 ppm) will be required for the final fill to avoid staining of the pool finish.

B. Provide the necessary plant equipment so that the temperature of fill water will be within plus or minus 10 degrees of the ambient air and/or the pool structure at the time of filling. Extreme caution is urged if the temperature variance is greater than 10-degree F.

C. Provide the necessary chemicals and to adjust and balance the water chemistry in the pools to the following levels:

pH	7.4 - 7.6
Calcium Hardness	200 - 400 PPM
Total Alkalinity (Sodium Hypochlorite)	80 - 120 PPM
Langelier saturation index	-0.3 - +0.3
Total Dissolved Solids (TDS)	not to exceed 1,500 PPM

1.14 START-UP CHEMICALS

A. The Contractor must maintain the chemical balance of the pool water (including the cost of chemicals required) until the pool and mechanical system(s) are fully operational and accepted by the Architect and the Owner.

B. Provide the Owner with sufficient quantities of the necessary chemicals to maintain the pool operation after the owner begins using the pool.

1. The Contractor is required to provide chemical quantities as shown on the drawings for the following chemicals:

    a. Sodium Hypochlorite

    b. Muriatic Acid

1.15 RECORD DRAWINGS

A. Provide a complete set of record drawings of the entire pool system(s) including sub-systems. Record drawings must be prepared in accordance with the requirements of Section 01 and must be a complete, stand-alone set. The Contractor is permitted to obtain original documents and copy them for this purpose only. Provide a digital record set (latest version of AutoCAD or compatible software).

PART 2 - PRODUCTS

2.01 OVERFLOW SYSTEM

A. Stainless-Steel Gutter

1. Manufacturers

    a. The existing Paddock Pool Equipment Company perimeter overflow system for the pool must be refurbished in place. Refurbishment of the stainless steel gutter to be in accordance with manufacturer recommendations but must include the following steps for refurbishment.

        1) Remove all existing stains and corrosion from stainless steel gutter

        2) Clean all surfaces of the stainless steel gutter

        3) Passivate all surfaces of the stainless steel gutter

2. Grating

    a. Grating systems must be oriented to provide openings that are perpendicular to the edge of the gutter in the configuration as shown on the drawings. Perimeter systems to be covered by a protective grating machined from UV resistant high-density Polyethylene (HDPE) top grating for maximum efficiency in quelling waves. Top grating must meet and/or exceed ASTM D2047 Slip Resistance (Wet) with a nominal value of 0.62 to create a non-skid surface. Open area of grating must not be less than 32%. Color to be white.

3. Accessories

    a. The perimeter system must be retrofitted with ten (10) lane line anchors. Quantities, locations, and descriptions must be as shown on drawings.

    b. Targets and markings: The perimeter gutter system must have swimming lane racing targets located as required and must conform to the applicable rules as designated by United States Swimming. The targets must consist of a permanent black slip-resistant PVC material that must be incorporated into the surface at the specified locations. Paints or coating systems must not be used for target markings.

4. Sealant

    a. Sealant must be used as a sealing application between the bottom of the gutter system and grout under gutter and at the joint between the deck and the gutter as shown on the drawings. The Contractor must tool a joint in the grout under gutter to provide a groove to apply caulk. The Contractor must clean and abrade surfaces with a fine grade abrasive prior to caulk application to enhance bond strength.

2.02 PUMPING EQUIPMENT

A. Proposed substitutions must include a mechanical drawing incorporating required changes in layout, piping, and valves. The cost of such changes must be included in the price of the substitute. Confirm correct pump motor voltage prior to ordering pump. Motors must be capable of continuously running without overloading at points on the characteristic curve of the pump without overload or damage. Confirm by 1/4-inch scale shop drawing that the pumps provided will fit within the available space and can be reasonably removed for servicing.

1. Pumps must be certified by the National Sanitation Foundation (NSF) and bear the certification mark.

2. The pump motor must be totally enclosed, fan cooled (TEFC) and premium efficiency of the horsepower and speed specified. A pump requiring larger horsepower is not acceptable unless submitted as a substitute and approved by the engineer, in which case necessary electrical revisions must be coordinated and provided.

3. The entire pumping unit must be mounted on a base using cap screws to preserve the back-pull-out feature of the pump. Pumps must not be secured with floor studs or “all-thread.” The pump base must be coated with the same epoxy coating as the pump.

4. Recirculation Pump for Pool – Metallic Components

   a. Provide horizontally mounted centrifugal pumps as shown on the drawings and described in these specifications. Each pump must be of a straight centrifugal, end suction, bronze fitted, close coupled type.

   b. Pumps manufactured by Paco, Griswold, Aurora, or Herborner are considered equal, provided they meet the requirements.

   c. Pump casing must be cast iron fitted with a replaceable bronze case wear ring. Mechanical seals must be provided specific for a chlorinated water application. Pump impeller must be enclosed type of cast bronze or 316L stainless-steel, statically, and dynamically balanced, and trimmed for the specified design conditions. If a VFD is used in conjunction with a pump, the impeller must be trimmed to the maximum diameter based on the rated motor horsepower. Bronze materials must be suitable for use in a chlorinated environment. Suction and discharge flanges must be provided and tapped for gauge connections. Provide steel or cast-iron bases with equivalent epoxy coating for corrosion protection.

   d. Provide a fusion-bonded epoxy coating on wetted parts to protect pump internals from corrosion, including pump volute interior and complete pump impeller (bronze impellers only). Sandblast to bare, white metal. The thickness must be 8 to 12 mils (heavy film). Verify thickness by non-destructive testing. Coat parts as recommended by the manufacturer, including preheating parts to 400 degrees and electrostatic deposition or fluidized bed technique. Provide primers if required to resist chlorinated water <10 ppm. The coating must be Scotchkote 134 manufactured by Fusecote or approved equal.

   e. Provide a hair and lint strainer, for each pump, of fiberglass or epoxy coated stainless-steel construction with a clear observation top in the sizes (or pipe sizes) indicated on the drawings. Verify and coordinate pipe and pump suction sizes in the field. Provide a stainless-steel basket with at least four (4) times the free open area as the inlet pipe, and one spare basket with each strainer.

      1) Basis of Design: As manufactured by MerMade Filter Inc., or Neptune/Benson Inc., or Fluidtrol Process Technologies, Inc.

   f. Recirculation pumps must be provided by the same manufacturer. Confirm voltages prior to ordering pumps.

B. Recirculation and Feature Pumps for Spa – Composite Components

a. Provide horizontally mounted, self-priming, centrifugal pumps as shown on the drawings and described in these specifications. The pumps must be of a straight centrifugal, end suction, non-corrosive PPO Resin material construction, closed coupled type, with integral hair and lint strainer.

b. The pump body, seal plate, and attached hair and lint strainer must be constructed of non-corrosive PPO Resin materials, and close-coupled to an electric motor by means of an adaptor of the same material.

c. The pump must have a PPO Resin diffuser to aid in priming and it must contain a replaceable bronze wear ring for the impeller. The impeller must be of the closed type and PPO Resin, non-overloading at points on the performance curve. The mechanical shaft seal must be constructed of ceramic and carbon seal faces, with stainless-steel, brass, and Buna N materials in the spring bellows portion. The impeller must be secured to the motor shaft by means of a stainless-steel key and locking screw into the end of the motor shaft. The pump must be capable of operating at up to 50 psi, 104° F continuous water temperature.

d. The electric motor coupled to the pump must be of the NEMA Rated series JM construction with stainless-steel shaft inside a removable shaft sleeve of 300 series stainless-steel. Motors must be continuous duty rated at 40° C (or realign better) ambient.

e. Pump to include integral variable frequency drive with the pump.

f. Pumps must meet Department of Energy (DOE) minimum efficiency standards for dedicated-purpose pool pump (DPPP) motors.

g. The pump strainer must consist of a PPO Resin body, Polycarbonate Resin Thermoplastic cover with O-ring seal, and Cam and Ramp Lid, and a strainer basket of mineral reinforced polypropylene material.

h. The strainer basket must be securely positioned below the suction inlet of the trap, with access for inspection and cleaning through a removable trap body lid. The trap body lid must be secured by means of a locking ring. Provide one spare basket for each strainer.

C. Variable Frequency Drive Starter – Pool Recirculation Pump

1. Provide variable frequency drive starters (VFD) for the pool pumps as indicated on the drawings. VFDs must be Eco-Flow-C by H2Flow Controls, AcuDrive by Pentair, GreenDrive by Neptune Benson, or approved equal.

   a. Basis of Design: Eco-Flow-C by H2Flow Controls

2. Ensure that equipment is provided with the correct operating voltage and that interconnected electrical and electronic equipment must adequately communicate and operate the specified pumping equipment. Equipment installations must meet or exceed the requirements of the National Electric Code and other local and state regulations.

3. Variable Frequency Drive Base Requirements

   a. Provide complete VFD as specified herein or in the equipment schedule for loads designated that must be variable speed or variable flow.

   b. The VFD must convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD must be a six or twelve pulse input design, and the input voltage rectifier must employ a full wave diode bridge. The output waveform must closely

approximate a sine wave. The VFD must be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform.

c. Indoor Applications: VFD must be fully enclosed in a corrosion resistant NEMA 12/IP54 UL listed enclosure.

d. VFD and required options will be incorporated by the VFD manufacturer into an integrated package, with a single input feed and main disconnect.

e. VFD must have a fused disconnect and battery back-up, for the purpose of maintaining programming in the event of a power outage, or properly rated circuit breaker.

f. The VFD must produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating.

g. The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis and be capable of running the motor at its nameplate RPM, voltage, current, and slip.

h. The VFD will be capable of running variable torque loads. The VFD must be able to provide its full-rate output current continuously and 110% of rated current for 60 seconds.

i. VFD must offer a motor spinning test that will allow the user to determine if the motor is running in the correct direction.

j. Switching of the input power to the VFD must be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.

k. Switching of power on the output side between the VFD and the motor must be possible with no limitation or damage to the VFD and must require no additional interlocks.

l. Cooling must be via an aluminum heat sink and must prevent the introduction of ambient air to the electronics for cooling. With the exception of the water-resistant heat sink fan, electronics must be fully sealed within the enclosure.

m. The VFD must have temperature-controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.

n. VFD must provide full torque to the motor, given input voltage fluctuations of up to +10% to -10% of the rated input voltage.

4. Harmonics:

a. The VFD must provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor.

b. The VFD must be provided with line-side harmonic reduction, as required, to ensure that the current distortion limits, as defined in table 10.3 of IEEE 519-1992, are met.

c. Harmonic solutions must be capable of withstanding up to 2% ambient voltage distortion with the maximum Current Distortion not to exceed 12% at 100% load.

5. Protective Features:

a. VFD must have input surge protection.

b. VFD must include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

c. Printed Circuit boards must be conformal coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC 61721-3-3, Class 3C2 as standard.

d. Dry-pump detection must be available to detect if the pump has run dry. If this condition occurs, the drive will be safely stopped. A timer must be included to prevent nuisance tripping.

e. VFD must include two current sensors on output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

6. Interface Features:

a. VFD must provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.

b. VFD Display must have the ability to display parameters pertaining to the VFD or the load including the following: current, speed, DC bus voltage, output voltage, input signal in mA, or other values from a list of user-selectable parameters.

c. LED lights must be provided. These indications must be visible both on the keypad and on the VFD when the keypad is removed.

d. Two-level password protection must be provided to prevent unauthorized changes to the programming of the VFD.

e. VFD must offer as standard an internal clock. The internal clock can be used for: Timed Actions, Energy Meter, Trend Analysis, date/time stamps on alarms, Logged data, Preventive maintenance, or other uses.

f. A battery back-up must be provided to maintain internal clock operation during power interruptions.

g. Inputs and outputs must be optically isolated.

h. The VFD must have at least two analog signal inputs. Inputs must be programmable for either 0 -10V or 0/4-20 mA.

i. At least one programmable analog output must be provided for indication of the drive status. This output must be programmable for output speed, voltage, frequency, motor current and output power. The analog output signal must be 0/4-20 mA.

j. The VFD must be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.

k. The VFD must be equipped with a standard RS-485 serial communications network connection.

7. Adjustments:

a. The VFD must have selectable output switching frequencies to mitigate motor noise.

b. Multiple complete programming parameter setups must be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to program for up to four alternate control scenarios without requiring parameter changes.

c. In each programming setup, independent acceleration and deceleration ramps must be provided. Acceleration and deceleration time must be adjustable over the range from 0 to 3,600 seconds to base speed.

d. The VFD must have four programmable “Bypass frequencies” with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature must offer a Semi-Automatic program to simplify the set-up.

e. VFD must include an automatic acceleration and deceleration ramp-time function to prevent nuisance tripping and simplify start-up.

f. The VFD will include a user-selectable Reset function, which enables the selection of between zero and multiple restart attempts after a self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload, and motor overload). The time between restart attempts must be adjustable from 0 through 600 seconds.

g. The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD.

h. Provide a manual bypass in conjunction with the VFD for the recirculation pump(s) consisting of a door interlocked main pad lockable disconnect in the off position, a built-in motor starter and a facility for allowing DRIVE/OFF/BYPASS/TEST switching by three contactor control.

8. Individual VFD options such as bypass, motor selection contactors, etc. must be incorporated by the manufacturer onto a single panel with a single input feed and main disconnect function. Enclosures must be UL listed and fully assembled by the VFD manufacturer.

9. Service Conditions:

a. The ambient operating temperature of the VFD must be -10ºC to 40ºC (14 to 104°F).

b. Elevation to 3,300 feet (1000 meters) without derating.

c. VFD’s must be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -10% variations. Line frequency variation of ± 2% is acceptable.

D. Other System Pumps and Motors

1. Air Blower

Provide an air blower for the spa hydrotherapy jets as shown on the drawings.

E. Pump Gauges

1. Pressure gauges must be provided on the discharge of the pumps.

2. Compound gauges must be provided at the intake port of the pumps, after the hair and lint strainer.

3. Gauges must be liquid filled, 316L stainless-steel bourdon tube type with a minimum 2-1/2-inch diameter dial, high impact polypropylene or stainless-steel case, corrosion resistant white scale with black divisions and numerals, 300 Series stainless-steel heavy duty rotary bushed movement, black enameled balanced Micrometer pointer.

a. Basis of Design: Gauges must be manufactured by Weksler Instrument Corporation or approved equal.

4. Scale ranges must be selected to indicate the normal system operating pressure of each system or location within the system. Pressure ranges must be calibrated in psig (0-60 psi) and compound gauge must be calibrated in inches of mercury (0-30 in Hg / 0-60 psi).

5. A stainless-steel filter type pressure snubber must be provided for each pressure gauge consisting of a 3/8-inch diameter by 1/8-inch-thick micro metallic stainless-steel filter and

placed in the line just before the pressure gauge. Provide isolation brass valves or brass gauge cocks at each gauge for easy replacement and maintenance.

2.03 FILTRATION EQUIPMENT

A. The filter system must consist of high-rate pressure sand filter tanks as shown on the drawings. Every aspect and component of the filter system must be certified by the National Sanitation Foundation (NSF) and bear the certification mark. The filter must have an engraved metal data plate permanently affixed on the face of the system that describes operational data and instructions and indicates startup date.

B. It is the intent of these specifications to describe a filtration system complete in every respect with accessory items and supplied and warranted by one manufacturer.

C. Horizontally Oriented Fiberglass Tanks - Pool

1. The filter tanks must be horizontally oriented single cell fiberglass tanks, minimum 42 inches in diameter. The filter system must be listed as approved by the National Sanitation Foundation prior to bid date.

    a. Basis of Design: Fiberglass filters must be the product of Stark/Pentair, Paddock, or Neptune Benson provided they meet the specifications and layout. System design is based upon Neptune-Benson. Valves must be provided to backwash one filter at a time.

2. Filter tanks must incorporate components and features as described in this section.

3. Two (2) saddle style bases must be provided for tank support. Systems that incorporate stacked tanks must include similar bases and mounting saddles for the upper vessel. Tank supports and connections must be seismic rated to support the filter tank(s) for the appropriate seismic zone where the project is located. Access to the tank must be provided by a 14" x 18" manhole with two (2) curved yokes. Manhole seal must be complete with a one-piece 1/4" neoprene gasket and positioned so that internal pressure from the filter will augment the seal. No additional hardware or through bolts will be allowed.

4. Each filter tank must be equipped with the necessary flanges and connections for the internal and external piping. Connections must be comprised of fiberglass flanges and schedule 80 PVC flanges.

5. Tank connections 2 inches and smaller must be 150 lb. Type 316L stainless-steel threaded full couplings. Tank connections 3 inches and larger must be heavy steel bosses drilled and tapped on both sides to receive standard flanged fittings or Sch. 40 Type 316L stainless-steel nipples.

6. The discharge from the automatic air release valve must be hard piped to waste. Each filter tank must have a means of releasing air. Each coupling or orifice must be provided with a slotted PVC sand retainer or stainless-steel strainer. An automatic air release system must be provided for each tank.

7. The drain system must consist of a 3/4-inch 316L stainless-steel coupling mounted at the lowest point in the bottom head. This drain must be valved and piped to the nearest floor drain or backwash pit.

8. Filter Piping - Internal

    a. The lower internal distribution system must be a horizontal header/lateral arrangement. The header must be Schedule 80 PVC construction, capped on one end and flanged or threaded at the other end for field connection. Lateral connections must be spaced no more than 6 inches on centers and must be 1-1/2-inch FPT connections. Attachments to header must be solvent welded and thermo-welded to ensure integrity of connection.

b. Under drain system must be factory installed and constructed of extra heavy Schedule 80 high impact PVC. Multiple PVC main headers must be tapped and threaded to receive laterals.

c. Laterals must consist of 1-1/2-inch Schedule 80 PVC pipe with openings as required. Each lateral must be fabricated complete with socket cap on one end and male adapter on the other end. Both fittings must be solvent welded to the slotted pipe. Laterals must be designed and sized at the factory, so they are installed in the field and over the entire cross sections area of the filter.

d. The upper distributor must consist of PVC piping Schedule 80 and/or deflector plate per manufacturer standard design.

e. Each filter must be supplied with a pressure equalizing upper internal distribution system consisting of a horizontal header/lateral arrangement. The header piping must be constructed of Schedule 80 PVC. The header/lateral piping and connections must be designed and sized to provide uniform distribution and unrestricted flow during the filtration and backwash cycles.

f. Upper laterals must be constructed of Schedule 80 PVC pipe with machine slotted openings or orifices. Machined slots or orifices must be clean, de-burred and free of obstructions that would not permit the free flow of water through the opening. Details of the lateral attachment to the header must be submitted for review and approval.

g. The lower and upper distribution systems must be properly supported and anchored. Hardware in wetted areas must be Type 316L stainless-steel or non-metallic. Tank interiors must be inspected prior to the media being placed in the filters.

9. Filter Piping - External (Face)

a. External face piping must be Schedule 80 PVC pipe and fittings. Flanges must be located so as to allow for easy dismantling of face piping. Fittings must be solvent cemented.

b. Piping must be drilled and tapped where necessary to accommodate gauge tubing connectors.

c. Valves 3" and larger must be constructed with cast aluminum S12A alloy (as defined by ASTM B275) housing and fully coated with Rilsan on interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and 316L stainless-steel shaft. Valves must be rated for 150 psi bubble tight shutoff. Unless otherwise specified, nuts and bolts must be stainless-steel with stainless-steel washers and used when secured to PVC flanges. Systems incorporating solenoid, pneumatic, pressure amplified, hydraulic or multi-directional valves are not acceptable.

d. Standard accessory items must include sight glass rated for 50 psi with polycarbonate glass, remote mounted gauge panel with two 4½" diameter pressure gauges, ¼" petcocks, ¼" poly vent tubing with PVC compression adapters.

10. Backwash Control

a. The filter manifold face piping must be designed to allow for one (1) filter tank to backwash at a time while the recirculation system is operating. A manual backwashing system must be provided with the filter system.

b. Manual Backwash System

1) The manual backwash system must be equipped with a face piping configuration such that the operator must manually control and operate both the time and sequencing of the backwash cycle. Valving on the filter face piping must be a mechanical linkage device allowing the operator to simultaneously move two (2)

valves at once. Mechanical linkage components must be PVC or Type 316L Stainless-steel.

11. Automatic Air Relief Valve

    a. A 1” valve must be provided to automatically and continuously release air in the filter. The valve must be fabricated of plastic with Buna-N seals. A plumbing kit must be provided with two (2) PVC ball valves to allow manual air relief and isolation of the automatic valve. Valves fabricated of cast iron, bronze or stainless-steel valves will not be accepted.

12. Filter Media

    a. Filter media must be a carefully selected grade of hard uniformly graded silica material. Media must be milled angular shaped particles of silica quartz. The filter sand must have a particle size between 0.45 mm and 0.55 mm and have a uniformity coefficient not to exceed 1.53. Specific gravity must not be less than 2.5 with a pH of 7.0.

    b. Media (sand) must be cleaned and free from clay or limestone deposits. The bottom layer of support media must be placed by hand to avoid damage to the under-drain system and leveled before the addition of the upper layer of filter media.

    c. Media must be delivered after approval by the manufacturer of the filter and stored in 100-pound bags for ease of handling and elimination of possible contamination.

    d. Media must be supplied by the filter manufacturer and approved by the filter manufacturer prior to shipping.

13. Support Media

    a. A Gravel support media of a hard-coarse aggregate with a sub-angular grain shape with a particle size of 1/8" x 1/4" must be used on the inside of the bottom head to the elevation where the filter media commences. The specific gravity must not be less than 2.5. Support media must be placed by hand to avoid damage to the underdrain system and leveled before the addition of the upper layer of filter media. Concrete under fill is not recommended. Support gravel must be delivered and stored in 100-pound bags (approximately one cubic foot) for ease of handling and elimination of possible contamination. Media must be free from minerals which can precipitate onto pool surfaces.

    b. Sand must be a carefully selected grade of hard, uniformly graded silica material. Media must be naturally rounded particles of silica or milled angularly shaped particles of silica quartz. Sand must have a particle size between 0.45mm and 0.55 mm (#20). No more than 1.5% is allowed to pass through a #40 sieve (.0164”). Uniformity coefficient must not exceed 1.53. Specific gravity must be not less than 2.5. The filter must contain a minimum bed depth as recommended by the manufacturer. Systems which do not provide a minimum bed depth will not be accepted. Sand must be delivered and stored in 100-pound bags (approximately one cubic foot) for ease of handling and elimination of possible contamination. Media must be free from minerals which can precipitate onto pool surfaces.

D. Vertical Sand Filter – Spa

1. The filter (Pentair Triton, or equal) shall be constructed of multi-layer fiberglass. Layers shall consist of a combination of chopped glass and woven roving in an isopthalic-polyester matrix. The vessel shall be assembled from one side shell and two domed ends which shall be joined with an adhesive and reinforced with FRP layup. The vessel shall be capable of withstanding 50 psig internal pressure. Alternate construction methods shall not be acceptable.

2. Vessels shall be provided with ABS support bases. The tanks will be secured to these bases with adhesive.
3. The wetted surface shall be a standard gel coat (GC). The gel coat shall be a modified polyester gel coat equivalent to a Cook gel coat 943-AN-023 with a thickness of no less than 10 mils.
4. The external surface shall be smooth in appearance and be free of cracks or other defects. The exterior surface shall be supplied with an all weather coating. Coating shall be urethane based with UV inhibitors. The surface coating shall be almond colored.
5. Each tank shall have one influent header fitted with sufficient distributors to properly distribute incoming flow evenly across the sand bed surface and one hub with sufficient laterals equally distributed not less than 12 inches below the filtering sand bed with a total effective slot area such that the average velocity through the slots will not exceed 6 feet per second at the design flow rate. The hub shall be fabricated of ABS and all distributors and laterals shall be replaceable. The laterals shall have “cam and ramp” ¼ turn connections and be constructed of ABS plastic with molded ‘V’-groove slots. Laterals with machined or cut slots shall not be accepted. Laterals shall be threaded at right angles into the header pipe.
6. Exterior influent and effluent pipe connections shall be 2” PVC. Each tank shall have an 8 inch diameter access manhole with molded cover, o-ring, and pressure guage.

2.04 RECIRCULATION FITTINGS

A. Main drain replacement covers for the pool and spa must comply with the Virginia Graeme Baker Act and ANSI/APSP-16 2017. Covers to be PVC and match up with the existing installed main drains.

B. PVC channel drains and covers (six required) must be provided as sized on the drawings. Channel drains must comply with the Virginia Graeme Baker Act and ANSI/APSP-16 2017 and be Aquastar 32CDFL-32 A 2x2b, or equal.

2.05 PIPING SYSTEMS

A. General

1. Provide recirculating piping between the pool(s) and the pool mechanical room, fill funnel and all interconnecting piping to and from the chemical feed systems and chemical controller.
2. Provide necessary pipe supports and support systems required to support associated piping and valves.
3. Provide other tubing, conduit or piping associated with equipment specified herein. Coordinate with other trades.

B. Pipes

1. Pipe routing as shown and detailed on the contract drawings is diagrammatic only and is not intended to show minor details or exact locations of piping systems. Installation is required and must be adjusted to accommodate interference and adjustments anticipated and encountered. Pipe sizes on plans refer to the nominal inside diameter of the pipe.
2. PVC swimming pool piping must be NSF approved and conform to the requirements of ASTM D-1785.
3. PVC pipes must be the product of one manufacturer. Approved manufacturers of PVC piping are Eslon, Harvel, and Chemtrol or approved equal.
4. The swimming pool piping above and below the floor in the pool mechanical room must be Schedule 80 PVC.

5. The influent and effluent lines to the heat source unit must be CPVC. Connections between metallic piping and/or equipment and PVC must be flanged.

6. PVC and CPVC fittings must be the product of one manufacturer. Molded fittings must be manufactured by Ipex, Chemtrol, Harvel, Spears, and Lasco/Westlake or acceptable substitutes. Fabricated fittings must be manufactured by Harrison Machine, Spears, or an acceptable substitute.

7. Chemical feed lines from chemical feeders to recirculation piping must be Schedule 80 PVC piping. Piping must be hard piped into the recirculation piping via tee or saddle per the drawings. Required valves must be of PVC construction.

8. Flanged plumbing connection hardware must be stainless-steel.

9. Materials must be installed by workmen thoroughly skilled in their trades and work must present a neat and mechanical appearance when complete. At no additional expense to the Owner, replace or correct work not judged acceptable by the Architect, Engineer, or Owner's representation.

10. Support hardware, brackets, fasteners, hangers, etc. furnished and installed in the surge tank must be 316L stainless-steel.

11. No installation allowed that will provide a cross-connection or interconnection between a distributing supply for drinking purposes and the swimming pool, or between the pool and a sanitary or storm water sewer system that will permit a backflow of water into the pool water system.

12. Mechanical equipment must be connected into the recirculation piping system must be connected utilizing flanged or union connections.

13. Provisions must be made to purge pipes in the system.

14. Concentric reducers must be fiberglass by MerMade Filter, Inc., or equivalent reducers of schedule 80 PVC construction.

C. Pipe Hangers and Supports

1. Manufacturer

   a. Subject to compliance with these specifications, pipe hanger and support systems must be manufactured by Cooper B-line (basis of design), Inc, TOLCO, and Anvil International or approved equal.

2. Hangers

   a. Pipes 2 inches and smaller

      1) Adjustable steel clevis hanger, B-Line models B3100 or B3104.

      2) Adjustable steel swivel ring (band type) hanger, B-Line model B3170.

   b. Pipes 2-1/2 inches and larger

      1) Adjustable steel clevis hanger, B-Line model B3100.

      2) Adjustable steel yoke pipe roll, B-Line model B3114.

3. Multiple or Trapeze Hangers

   a. Trapeze hangers must be constructed from 12-gauge roll formed ASTM A1011 SS, Grade 33 structural steel channel, 1-5/8 by 1-5/8-inch minimum, B-Line B22 strut or stronger as required.

   b. Mount pipes to trapeze with 2-piece pipe straps sized for outside diameter of pipe, B-Line B-2000 series.

4. Wall Supports

    a. Pipes 2-1/2 inches and smaller

        1) Steel offset “J” hook hanger, B-Line model B3600.

    b. Pipes 3 inches and larger

        1) Welded strut bracket and pipe straps, B-Line models B3064 and B2000 series.

        2) Welded steel bracket B-Line model B3066 or B3067 with roller chair or adjustable steel yoke pipe roll. B-Line model B3120 or B3110.

5. Floor Supports

    a. Electroplated carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line model B3092 and B3088T or B3090 and B8088. Pipe saddle must be screwed or welded to an appropriate base stand.

6. Vertical Supports

    a. Steel riser clamp sized to outside diameter of pipe, B-Line model B3373.

7. Plastic Pipe Supports

    a. V-Bottom clevis hangers with galvanized 18-gauge continuous support channel, B-Line models B3106 and B3106V, to form a continuous support system for plastic pipes smaller than 1 inch or flexible tubing.

    b. A vented and sloped continuous PVC Schedule 40 pipe no smaller than 1-1/2 inch outside diameter will be used to route flexible tubing with the appropriate pipe supports.

8. Supplementary Structural Supports - Design and fabricate supports using structural quality steel bolted framing materials. Channels must be roll formed, 12-gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch or greater as required by loading conditions. Submit design for pipe tunnels, pipe galleries etc. for approval. Use clamps and fittings designed for use with the strut system.

D. Hanger Attachments

1. Upper Attachments

    a. Beam Clamps

        1) Beam clamps must be used where piping must be suspended from building steel. Clamp type must be selected on the basis of load supported and load configuration.

        2) C-Clamps must be locknuts and cup point set screws similar to B-Line model B351L or B3036L. Top flange c-clamps must be used when attaching a hanger rod to the flange of structural steel, B-Line model B3034 or B3033 or approved equal. Refer to manufacturer’s recommendations for set screw torque. Retaining straps must be used to maintain the clamp position on the beam where required.

        3) Center load beam clamps must be used where specified. The steel clamps must be B-Line models B3050 or B3055. Forged steel beam clamps with cross bolt must be B-Line B3291-B3297 series or approved equal as required to fit beams.

    b. Concrete Inserts

        1) Cast in place spot concrete inserts must be used applicable, either steel or malleable iron body, B-line B2500 or B3014 or approved equal. Spot inserts

must allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rods sizes, B-line models N2500 or B3014N series.

2) Continuous concrete inserts must be used where applicable. Channels must be 12 gauge, ASTM A1011 Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert must have a load rating of 2,000 lbs/ft. in concrete, B-Line models B22I, 32I, or 52I or approved equal. Select channel nuts suitable for strut and rod sizes.

E. Hanger Accessories

1. Hanger rods must be threaded on both ends or continuously threaded rods of circular cross section. Use adjustable lock nuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

F. Hanger Finish

1. Indoor Finishes

a. Hangers must be zinc plated in accordance with ASTM B633 or must have an electro-deposited green epoxy finish.

b. Strut channels must be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 or must have an electro-deposited green epoxy finish.

c. Zinc Plated hardware is not acceptable for use in chemical rooms.

G. Valves

1. Valves 3 inches and larger must be butterfly type valves, with PVC body, 150# SWP with stainless-steel shaft, PVC or polypropylene disc and replaceable resilient seat bonded to a rigid shaft and guaranteed for bubble tight shutoff from 27-inch vacuum to 150 PSI. Extended neck 2 inches beyond flanges for insulated piping must be provided with handle for manual operation. Valve components must be suitable for swimming pool chlorinated water service. Butterfly valves must be Georg Fischer Type 567, Asahi/America Type SP Pool-Pro, Chemtrol Model-B, Simtech VP series, Colonial Valve 411 Series, or approved equal.

2. Valves smaller than 3 inches must be PVC true union ball valves, full port, three-piece construction, blowout-proof stem, Viton seal with socket end connectors.

3. Check valves must be a quick closing non-slam type, either self-aligning wafer or flanged type, of corrosion resistant materials suitable for use in a swimming pool environment. Provide check valves in accordance with the manufacturer's recommendations. Locate check valves at least 5 pipe diameters from pumps and fittings. Check valves must be Technocheck Corp., model 5050, with epoxy coated cast iron body and bronze swing plates on a stainless-steel spring, Colonial Valve model 601N or 601NP PVC valve with EPDM O-ring and stainless-steel spring or approved equal, for installation between 150 lb. flanges.

4. Butterfly type valves 8 inches and larger must be fitted with a watertight gear operator.

5. Valves located 7 feet or greater off the floor must be fitted with a chain operator.

6. Submerged valves, valves buried below grade, or valves not readily accessible, must be provided with a stainless-steel reach rod and handle.

7. Valve hardware must be 316L stainless-steel and meet ANSI hardware installation guidelines.

H. Pipe and Valve Identification

1. Exposed pool piping must be equipped with color coded flow directional arrows at sixty (60) inch intervals per local and state swimming pool health code. Verify that pool piping identification is in accordance with local and state health regulations.

2. Valves must be identified with minimum 1-1/2-inch diameter plastic laminate engraved tags with minimum 1/2-inch-high numbers. Tags must be fastened to valves with a nylon attachment (zip tie). Valves must be described as to their function and referenced in the operating instruction manual and wall mounted piping diagram that must be prepared.

2.06 CHEMICAL TREATMENT SYSTEMS

A. Sodium Hypochlorite (Liquid Chlorine)

1. Chemical feeders for chlorine must be peristaltic type pumps. Chemical feed pump(s) must be provided and connected to the filtered water return lines to the pool(s) as shown on the pool plans. The pump(s) must be capable of feeding a solution to the pool(s) to maintain chlorine (12% sodium hypochlorite) level against the back pressure involved and must be fully adjustable while in operation.

2. Chemical feeders must be manufactured by LMI, ProMinent, G. H. Stenner & Co., or approved equal.

3. The pump(s) must be provided complete with fractional horsepower motor for 120V, 60 Hz current, plastic feed lines, and fitting necessary for connections to the pool system piping.

4. Chemical pumps must be electrically connected to and operated by the water chemistry controllers.

5. The chemical pump(s) must be affixed with a metallic stamped label indicating the chemical being pumped and the pool to which it is connected.

6. Wall mount or provide non-metallic shelf support for the chemical feed pump(s).

7. Feeder systems must be provided with a check valve at the point of injection into the pool recirculation system.

8. Provide “Vapor Shield” vent check valve for the bulk tank which seals container while allowing the liquid to remove via pump. The Vapor-Shield must prevent an internal vacuum and collapse of a sealed container and must prevent the pump from developing a vacuum-lock while attempting to remove the liquid from the sealed container. The Vapor-Shield must prevent the release of chlorine vapors. The Vapor-Shield body must be constructed entirely from schedule 80 PVC with 3/8” polypropylene tube fittings and factory-installed chlorine resistant viton sealant on threaded connections. The diaphragm and O-rings must be constructed of chlorine resistant viton. Nonmetallic or materials not rated appropriate for use with chlorine must not be used. The Vapor-Shield must be fitted with a ¾” male NPT threaded fitting to allow for the installation onto a threaded bulkhead fitting located at the top of the bulk chlorine tank. The unit must be supplied with no less than fifteen (15) feet of 3/8” polyethylene tubing. Vapor shield chlorine vent must be Recreonics #52-095 or approved equal.

9. Bulk Chlorine Tank

   a. Provide one (1) 200-gallon bulk chlorine solution tank in the chlorine room as shown on the drawings. The tank must be a double wall bulk tank constructed of polyethylene rigid support with top manway and vent. Tank must be 41” outside diameter by 52” high. The manufacturer must be Chemtainer, Industries, TC4152DC, or approved equal.

   b. The bulk chlorine tank must be provided with fittings for remote fill piping and venting as shown on the drawings. Coordinate fitting locations at the top of the tank with

manufacturer prior to ordering. Field cutting tank for additional piping penetrations will not be accepted.

B. pH Buffering System (Muriatic Acid)

1. Chemical feeders for muriatic acid must be peristaltic type pumps. Chemical feed pump(s) must be provided and connected to the filtered water return lines to the pool(s) as shown on the pool plans. The pump(s) must be capable of feeding a solution to the pool(s) to maintain pH level against the back pressure involved and must be fully adjustable while in operation.

2. Chemical feeders must be manufactured by LMI, ProMinent, G. H. Stenner & Co., or approved equal.

3. The pump(s) must be provided complete with fractional horsepower motor for 120V 60 Hz current, plastic feed lines, and fitting necessary for connections to pool system piping.

4. The chemical pump(s) must be electrically connected to and operated by the water chemistry controllers.

5. The acid pump(s) must be affixed with a metallic stamped label indicating the chemical being pumped and the pool to which it is connected.

6. Provide non-metallic wall mounted shelf support for the chemical feeder(s).

7. Bulk Acid Storage:

a. Provide one (1) 100-gallon bulk acid storage tank in the pH buffer room as shown on the drawings. The tank must be a double wall bulk tank constructed of polyethylene rigid support with top manway and vent. Tank must be 35” outside diameter by 39” high. The manufacturer must be Chemtainer, Industries, TC3539DC, or approved equal.

b. The bulk acid tank must be provided with fittings for remote fill piping and venting as shown on the drawings. Coordinate fitting locations at the top of the tank with manufacturer prior to ordering. Field cutting tank for additional piping penetrations will not be accepted

8. Provide “Vapor Shield” vent check valve for the acid drum/tank which seals container while allowing the liquid to remove via pump. The Vapor-Shield must prevent an internal vacuum and collapse of a sealed container and must also prevent the pump from developing a vacuum-lock while attempting to remove the liquid from the sealed container. The Vapor-Shield must prevent the release of acid vapors. The Vapor-Shield body must be constructed entirely from schedule 80 PVC with 3/8” polypropylene tube fittings and factory-installed acid resistant viton sealant on threaded connections. The diaphragm and O-rings must be constructed of acid resistant viton. Metallic or materials not rated appropriate for use with acid should not be used. The Vapor-Shield must be fitted with a ¾” male NPT threaded fitting to allow for the installation onto common five (5) through fifty-two (52) gallon acid shipping container caps and lids. The unit must be supplied with no less than fifteen (15) feet of 3/8” polyethylene tubing. Vapor Shield must be Recreonics #52-095 or approved equal. An Acid Fume Scrubber, part #7747090, with refill reagent kit, #7747091, manufactured by ProMinent is an equal.

C. Ultraviolet Dechloramination and Disinfection System

1. Medium Pressure UV

a. Ultraviolet Disinfection Equipment: Must operate within the UVC electromagnetic spectrum emitting wavelengths in the range of 200nm to 400nm. This required wavelength will provide constant disinfection/inactivation of bacteria, algae, molds, viruses, and destruction of Monochloramines, Trichloramines, and Dichloramines. Ultraviolet Lamp/Chamber and Spectra Touch Control Panel by Evoqua Technologies

Ltd. or approved equal. Deviations/exceptions must be provided in writing to and approved by the designer prior to the bid date.

1) Ultraviolet disinfection equipment by Aquionics and Prominent are approved equals.

b. The UV System must have a MET or equivalent (ETL, CSA, or UL) listing, be NSF-50 2016 certified including Section 14.18 (crypto inactivation) and 3rd party validated to the USEPA UVDGM 2006 Guidelines.

1) Equipment General Description: The Ultraviolet System must be provided in a complete package to include a stainless-steel chamber, Spectra Control System located in NEMA 12 (IP52) rated panel, Medium Pressure Bulb(s) designed to emit wavelengths within the UVC electromagnetic spectrum, automatic wiper system, and Project Commissioning by a Certified Ultraviolet Technician.

c. Wafer (WF) Units: Ultraviolet manufacturer to offer unit capability of a horizontal OR vertical installation application using state of art design and direct flow through characteristics. Unit must be a medium pressure system with 94% UVT at the indicated design flow rate. Systems validated or designed for flows based on 98% UVT are not acceptable. Chamber and Control Cabinet must be as indicated on the drawings.

d. Ultraviolet Lamp

1) Ultraviolet lamp must be medium pressure high intensity. Lamp must be designed to emit continuous Ultraviolet wavelengths in the range of 200nm to 400nm. This will provide optimal disinfection benefits and destruction of the Monochloramine, Dichloramine, and Trichloramine compounds. The lamp(s) must remain unaffected by temperature variance of 0 degrees F (-17 C) to 200 degrees Fahrenheit (93 degrees Celsius).

2) The lamp system must provide a constant dose of not less than 60 mJ/cm2 until the end of the lamp life for indoor applications and not less than 40 mJ/cm2 for outdoor disinfection and this must be based on constantly monitoring the full recirculating flow rate, not on a side stream treatment. The system must be equipped with infinitely variable power control of the lamp intensity & dose. Power stepping not acceptable. The lamps must be capable of turndown to 30% of the nominal rated power.

3) The lamp must be connected via means of a plug connector and must have a mechanical interlock to prevent lamp removal when lit for safety reasons.

e. Ultraviolet Reactor

1) The unit must be constructed of 316L stainless-steel electropolished and passivated to prevent corrosion within the harsh pool environment.

2) The Ultraviolet chamber must come complete with the following equipment: Ultraviolet intensity monitor factory calibrated to provide intensity in mWcm2, monitors providing percentage of lamp output not acceptable. It must include a built-in alarm system to notify the operator when the output level drops below the required level of 60 mJ/cm2 for indoor pools or 40mJ/cm2 for outdoor pools (or operator set dosing levels).

3) UV Reactor will be a validated system with third party testing to a recognized international standard such as the USEPA DGM.

4) Ultraviolet temperature monitoring system must be provided to maintain system integrity in the event of flow interruptions to the chamber.

5) Ultraviolet chamber must come complete with annealed quartz sleeve with “O” ring seals for water tightness. The system must be complete with advanced seal arrangement to reduce the risk of quartz over-compression on the seal face.

f. Automatic Wiper System

1) An automatic cleaning system must be provided for cleaning of quartz sleeve and Ultraviolet monitor probe. The system must travel the entire length of the quartz sleeve twice per desired cleaning cycle. Precision molded wiper rings must be provided to ensure thorough quartz tube cleaning and quartz tube protection. The wiper cycle must be user selectable and adjustable within a range of 5 minutes to 24 hours depending on anticipated application and deposit build-up.

2) The wiper system must have the following characteristics:

a) The system must utilize direct drive with square faced coupling and acme threaded shaft to prevent slippage and pin shearing. Systems utilizing shear pins or complicated gear boxes will be unacceptable.

b) The wiper power supply must be 24-volt DC for improved safety. Higher voltage not acceptable.

c) System must incorporate Direct Shaft Encoding for positional location. Systems relying on external limit switches or internally located magnets will be unacceptable.

d) The wiper interval must be operator selectable with optional override switch.

e) Wiper faults must be indicated on the control system display.

f) Wiper System to utilize “Intelligent Operation” for automatic start-up commissioning.

3) Records wiper position at chamber ends. Position must be fixed and not dependent on a timed interval or component striking end of chamber.

4) Establish a travel run without using limit switches to ensure system integrity and longevity.

g. UV Strainer

1) The UV system must be provided with a downstream strainer to protect against the possibility of lamp/quartz breakage traveling downstream.

2) Pressure gauges must be provided on each side of the strainer. Gauges must be liquid filled, 316L stainless-steel bourdon tube type with a minimum 2-1/2-inch diameter dial, high impact polypropylene or stainless-steel case, corrosion resistant white scale with black divisions and numerals, 300 Series stainless-steel heavy duty rotary bushed movement, black enameled balanced Micrometer pointer. Pressure ranges must be calibrated in psig (0-60 psi). Basis of Design: Gauges must be manufactured by Weksler Instrument Corporation or approved equal.

3) A stainless-steel filter type pressure snubber must be provided for each pressure gauge consisting of a 3/8-inch diameter by 1/8-inch-thick micro metallic stainless-steel filter and placed in the line just before the pressure gauge. Provide isolation brass valves or brass gauge cocks at each gauge for easy replacement and maintenance.

h. Ultraviolet Control System

1) The control cabinet must be a SPECTRA control unit and or pre-approved equal.

2) The power must be controllable to provide full power, half power and infinite variable power based on real time interface with changes in UVT, Flow Rate or Combined Chloramines. The power panel must house the electronic ballasts required to ignite and power the lamps.

3) Three levels of operation must be provided to meet the needs of the operator and pool environment: Simple Control (start, stop and reset), Full Parameter Display, and Customized Operator Configuration.

4) Modes of operation must be password protected to secure system critical setup functions. Touch Control system must have clearly identifiable start, stop, and reset icons (suitable for gloved operation) with Running and Fault LCD indicators.

5) The display must include the following:

a) Ultraviolet calculated dose

b) Ultraviolet intensity (as a percentage and mW/cm^2)

c) Lamp Current

d) Flow rate (as gallons per minute or m^3/hour)

e) Chamber Temperature

f) Operation hour meter

g) Fault indicators to include Lamp fault, low UV & temperature alarm, ground fault trip, wiper fault.

h) Alarm functions must have a simple text message display to assist in fault finding.

i. Ultraviolet Control System Interface

1) The Control system must have a minimum of the following system interface control:

a) Remote operation

b) Process interrupt features (from valves & flow meters)

c) Low UV dose

d) Flow meter input.

e) Auto-Restrike.

f) Half to full power UV setting with 24 hour/7-day settable timer.

g) Variable power/Dose pacing interface

2) Control system must have built in data-logging capabilities to record the following information:

a) UV intensity required.

b) UV intensity measured.

c) Lamp current

d) Chamber Temperature

e) Flow Rate

f) Time and date stamp, every alarm generated.

j. Manufacturers must maintain spare or replacement parts in the USA for the same day or not longer than next day delivery in North America.

2.07 WATER CHEMISTRY MONITORING AND CONTROL SYSTEMS

A. A programmable pool chemical automation system must be provided for continuous monitoring and control of the pool(s) water chemistry and related disinfection equipment. The installation of the system must be per the manufacturer's specification. A factory trained/authorized representative must provide training to the Owner and the training must be video recorded. Water chemistry controllers must be provided by ProMinent Fluid Controls, BECS Technology, SB Control Systems, or a technically equal system capable of providing equal performance for operating functions.

1. The water chemistry control systems for the pool must feature and be capable of the following. Water chemistry controllers without these capabilities and features are not considered equal. Water chemistry control system requirements are based upon the following products: ProMinent DCM511/512, BECSys7, Chemtrol 3000.

a. Continuous, real-time monitoring and control of pH and ORP.

b. Free chlorine, system flow rate, water chemistry balance calculations, water temperature, and other readings and control as deemed necessary for the project per this section.

c. The controller must have the ability to monitor and control the UV treatment system.

d. The controller must manage the recirculation pump with a programmable Fireman Cycle feature, which automatically turns off the Heater, UV, and Auxiliary systems prior to shutting off the recirculation pump.

e. Management of the heater on/off status based on real-time water temperature reading.

f. The utilization of simultaneous ORP and PPM (bracketing) control for managing both the quantity and quality of the sanitizer/oxidizer. Controllers that do not have the ability to control simultaneously to ORP and PPM control points or that utilize an alternate chlorine set point or boost function will not be considered equal.

g. Actuating outputs in the following operator selectable modes: off, manual, automatic, proportional and must have a manual on fail-safe timer to ensure that if the controller is left in manual mode, the controller will revert back to automatic mode to prevent an over-feed event.

h. Programmable events can be time set to occur daily, weekly, or monthly.

i. Remote monitoring of the recirculation flow rate of the system when installed with compatible magmeters.

j. Provide use of flow signal as a supplemental chemical feed interlock to prevent the dosing of chemicals during a system low flow/no flow condition.

k. The controller must continuously monitor data-log while being monitored and control via two-way remote communication.

l. The controller must continuously calculate and display the Langelier Saturation Index and Ryznar Index using either sensor data and/or manual input for pH, temperature, total alkalinity, and calcium hardness.

m. Programmable high and low alarm levels for control functions with operator-selectable feed lockout and alarm buzzer options.

n. Performance and Certifications

1) The controller system must be NSF/ANSI 50 listed for automatic controller equipment for swimming pools, spas, and other recreational water facilities.

2) The controller system must be certified to UL61010/IEC61010, standards.

3) The controller must automatically activate the appropriate chemical feeders in order to maintain the sanitizer/oxidizer level:

a) Within +/- 0.1 parts per million (PPM) or +/- 10 mV (millivolts) of oxidation reduction potential (ORP)

b) The pH within +/- 0.1 pH unit of the set points selected by the operator.

c) Set point and calibration levels must be adjustable with a keypad mounted on the front panel of the unit as well as the remote interface.

d) The controller must use pH sensor with +/- 0.04 accuracy in the operational range of 6.8 – 8.2 as certified by NSF.

e) An ORP sensor with an accuracy of +/- 3% mV as certified by NSF.

f) A free chlorine sensor that operates in a range of 0.1 parts per million (PPM) up to 10.0 parts per million (PPM) within a 9% accuracy as tested by NSF or another third-party certifying agency.

o. System Supply

1) The controller must be factory supplied with:

a) ORP, pH, temperature, and free chlorine sensors.

b) A flowrate sensor to measure system flowrate.

p. Hardware

1) The controller must have:

a) A minimum of seven (7) fully configurable digital inputs.

b) A minimum of four (4) fully assignable digital outputs.

c) A minimum of nine (9) configurable analog inputs.

d) A minimum of five (5), 115 VAC fully assignable relays.

e) The controller must be capable of expanded capabilities with an optional input/output expansion card kit.

f) High voltage field wiring must be through a separate NEMA 4X factory engineered and supplied enclosure that precludes direct access to controller electronics. High voltage connections must be clearly identified, and a field wiring diagram must be provided with the controller for the Contractor’s reference. Controller high-voltage relay assignment parameters must be programmed at the factory prior to delivery to installation location.

g) The controller must include a sensing flow cell that is hydraulically designed to allow verified correct flow and consistent pressure across sensors. Flow cell will be clear PVC that is modular in concept and have the flexibility to add supplementary water chemistry sensors as desired. The sensing flow cell must include a safety flow switch sensor, water spigot, and isolation valves.

q. Communications

1) The controller must have as a standard feature:

a) The controller must include the capability of ethernet connection and secondary wireless communication.

b) The controller must allow full two-way remote communication and full control of parameters.

c) Accessibility with a standard internet browser using a fully interactive Ethernet TCP/IP graphical interface that includes security access codes.

d) Real-time monitor/control with real-time auto polling, data logging, email and text alarms and providing both graphical and report formats via a personal computer, smartphone, or tablet device.

e) The controller must have the ability to facilitate email or text alarm notifications, historical graphing, and real-time control via a personal computer, smartphone, or tablet device.

f) The controller must have the ability to export a .csv file once per day with reading type, time, and reading. The export must be done via email and must include the controller serial number. Export data must include ORP, Free Available Chlorine, pH, and Temperature.

g) The controller must have the ability to allow software upgrades and programming as needed in the field.

r. Commissioning and Manuals

1) The control system must be provided with on-site start-up operator training performed by a representative trained and authorized by the controller manufacturer.

2) The manufacturer must supply an operation and maintenance manual describing features, operating instructions, maintenance procedures and replacement parts.

3) Installation of the system must be per the manufacturer's specification and no exceptions must be allowed. A factory trained/authorized representative must provide training to the owner and the training must be video recorded.

2. The water chemistry control systems for the spa must feature and be capable of the following. Water chemistry controllers without these capabilities and features are not considered equal. Water chemistry control system requirements are based upon the following products: ProMinent DCM513, BECSys5, Chemtrol 3000.

a. Continuous, real-time monitoring and control of pH and ORP.

b. System flow rate, water chemistry balance calculations, water temperature, and other readings and control as deemed necessary for the project per this section.

c. The controller must manage the recirculation pump with a programmable Fireman Cycle feature, which automatically turns off the Heater, UV, and Auxiliary systems prior to shutting off the recirculation pump.

d. Management of the heater on/off status based on real-time water temperature reading.

e. The utilization of simultaneous ORP and PPM (bracketing) control for managing both the quantity and quality of the sanitizer/oxidizer. Controllers that do not have the ability to control simultaneously to ORP and PPM control points or that utilize an alternate chlorine set point or boost function will not be considered equal.

f. Actuating outputs in the following operator selectable modes: off, manual, automatic, proportional and must have a manual on fail-safe timer to ensure that if the controller is left in manual mode, the controller will revert back to automatic mode to prevent an over-feed event.

g. Programmable events can be time set to occur daily, weekly, or monthly.

h. Remote monitoring of the recirculation flow rate of the system when installed with compatible magmeters.

i. Provide use of flow signal as a supplemental chemical feed interlock to prevent the dosing of chemicals during a system low flow/no flow condition.

j. The controller must continuously monitor data-log while being monitored and control via two-way remote communication.

k. The controller must continuously calculate and display the Langelier Saturation Index and Ryznar Index using either sensor data and/or manual input for pH, temperature, total alkalinity, and calcium hardness.

l. Programmable high and low alarm levels for control functions with operator-selectable feed lockout and alarm buzzer options.

m. Performance and Certifications

1) The controller system must be NSF/ANSI 50 listed for automatic controller equipment for swimming pools, spas, and other recreational water facilities.

2) The controller system must be certified to UL61010/IEC61010, standards.

n. The controller must automatically activate the appropriate chemical feeders in order to maintain the sanitizer/oxidizer level:

1) Within +/- 0.1 parts per million (PPM) or +/- 10 mV (millivolts) of oxidation reduction potential (ORP)

2) The pH within +/- 0.1 pH unit of the set points selected by the operator.

3) Set point and calibration levels must be adjustable with a keypad mounted on the front panel of the unit as well as the remote interface.

4) The controller must use pH sensor with +/- 0.04 accuracy in the operational range of 6.8 – 8.2 as certified by NSF.

5) An ORP sensor with an accuracy of +/- 3% mV as certified by NSF.

o. System Supply

1) The controller must be factory supplied with:

a) ORP, pH, and temperature sensors.

b) A flowrate sensor to measure system flowrate.

p. Hardware

1) The controller must have:

a) A minimum of seven (7) fully configurable digital inputs.

b) A minimum of four (4) fully assignable digital outputs.

c) A minimum of nine (9) configurable analog inputs.

d) A minimum of five (5), 115 VAC fully assignable relays.

e) The controller must be capable of expanded capabilities with an optional input/output expansion card kit.

f) High voltage field wiring must be through a separate NEMA 4X factory engineered and supplied enclosure that precludes direct access to controller electronics. High voltage connections must be clearly identified, and a field wiring diagram must be provided with the controller for the Contractor's reference. Controller high-voltage relay assignment parameters must be programmed at the factory prior to delivery to installation location.

g) The controller must include a sensing flow cell that is hydraulically designed to allow verified correct flow and consistent pressure across sensors. Flow cell will be clear PVC that is modular in concept and have the flexibility to add supplementary water chemistry sensors as desired. The sensing flow cell must include a safety flow switch sensor, water spigot, and isolation valves.

q. Communications

1) The controller must have as a standard feature:

a) The controller must include the capability of ethernet connection and secondary wireless communication.

b) The controller must allow full two-way remote communication and full control of parameters.

c) Accessibility with a standard internet browser using a fully interactive Ethernet TCP/IP graphical interface that includes security access codes.

d) Real-time monitor/control with real-time auto polling, data logging, email and text alarms and providing both graphical and report formats via a personal computer, smartphone, or tablet device.

e) The controller must have the ability to facilitate email or text alarm notifications, historical graphing, and real-time control via a personal computer, smartphone, or tablet device.

f) The controller must have the ability to export a .csv file once per day with reading type, time, and reading. The export must be done via email and must include the controller serial number. Export data must include ORP, pH, and Temperature.

g) The controller must have the ability to allow software upgrades and programming as needed in the field.

r. Commissioning and Manuals

1) The control system must be provided with on-site start-up operator training performed by a representative trained and authorized by the controller manufacturer.

2) The manufacturer must supply an operation and maintenance manual describing features, operating instructions, maintenance procedures and replacement parts.

3) Installation of the system must be per the manufacturer's specification and no exceptions must be allowed. A factory trained/authorized representative must provide training to the owner and the training must be video recorded.

2.08 FLOW METERS

A. Recirculation flow meter must be provided according to the manufacturer in the filtered water return lines for the pool as indicated on the drawings. The flow sensor must be the GF Signet 2551 insertion magmeter. Provide the coaxial cable from the sensor to the display/transmitter. Flow meter accuracy must be +/- 2% of reading.

B. Impact flow meter must be provided as indicated on the drawings for pool filter backwash. Impact flow meter must be a pilot, impact ball, variable area type with one piece, impact resistant machined acrylic plastic body. GPM scale must be permanently etched or imprinted on the meter. Flow rate indicator must be of stainless-steel material. The scale range must be appropriate for a specific flow rate. Pipe size to accommodate backwash rate. The backwash piping flow meter must be BLUE-WHITE series F-300 or approved equal.

C. FlowVis flow meters must be provided as indicated on the drawings for the spa recirculation and spa hydrotherapy jet pump return piping. Flow meters to be sized to the existing piping.

2.09 WATER LEVEL CONTROLLERS

A. In Surge Tank Water Level Controller

1. Provide a water level sensing and control system for the pool(s) that will monitor the water level in the surge tank and automatically activate the auto water make-up control valve. For sensing water level and activating make-up water control valve for the pool(s), use Series ELC-810 controller housed in a watertight NEMA 4X UL94 5V UL flammability rated polycarbonate enclosure to meet IP66 and NEMA 4, 4X, 12 and 13 ratings. The controller must utilize two sensor(s) to control water level. ELC-810 series must have a menu-driven LCD display screen and utilize a five-switch user interface for navigation through the menu. The menu must allow changing the following settings: delay to shutoff, alternate sensor option, maximum time on, manual override, delay to normal, type of sensor, high level option, flow sensor active, and sounder with alarm. Menu settings must be capable of password protection. The controller must be capable of displaying the following data: last fill time, last drain time, last alarm. The controller must be capable of determining the following: maximum time on exceeded, over current to solenoid valve, no valve/valve wiring problem, and sensor not working properly. The controller must have a low voltage interlock with auto water make-up solenoid valve and the high-level shutoff solenoid valve and must provide adjustable time delay for increasing level and manual override. The controller must require 115 VAC, 1 phase, 60 Hz power. The water level control package must be manufactured by AquatiControl Technology, model ELC-810-DS-ST-XXX (Coordinate the specific length(s) of cable required for each controller prior to ordering). Refer to drawings for additional information.

2. Provide two proximity switch sensor(s) that must be sensitive to within +/- 1/8” (4mm) of nominal water level. Supply voltage to sensor must be 12V to 24V DC from controller. Current consumption must be < or = 15mA. Response frequency must be 100Hz. Maximum control output must be 200mA. The sensor operating temperature must be -25 Deg. C to 70 Deg. C. Operating humidity must range from 0% RH to 95% RH. The sensor(s) must be mounted in a 1” Schedule 80 PVC pipe (length must be determined by depth of surge tank). Sensing pipe must be mounted to surge tank wall with composite/non-metallic hangers and stainless-steel hardware. Sensing pipe(s) must be capable of being submerged under water safely. Refer to drawings for additional information.

3. Wiring from the sensor to the controller must be provided and must be connected to the terminal points mounted within a corrosion resistant, nonmetallic NEMA 4X enclosure. Wiring connections must be made through the bottom of the enclosure. The enclosure size must be no less than 8” wide x 5” high x 4” deep. The access door must be the entire front face panel of the enclosure. Confirm location in field.

4. Major components must be plugged-in using WAGO terminal blocks for ease of installation and replacement. Unit must be designed to activate a 24-volt AC solenoid valve.

B. Solenoid Valves

1. Provide a make-up water solenoid valve, normally closed, stainless-steel fitted, bronze body, 24 VAC slow-closing type. Interlock with automatic water level control system. Refer to the drawings for additional information including size of pipe. Solenoid must be by ASCO 8221 or approved equal.

2. Provide a solenoid valve for the high-level sensor, normally opened, stainless-steel fitted, bronze body, 24 VAC slow closing type. Refer to Plumbing drawings for pipe size. Interlock with automatic water level control system. Refer to the drawings for additional information. Solenoid must be the 8221 Series by ASCO or approved equal. Maximum size of 2 1/2".

2.10 DECK EQUIPMENT, INSERTS & ANCHOR SOCKETS

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. Grab rails (five sets) must be provided as required in the quantities and to the dimensions as shown on the drawings. Grab rails must be fabricated of one continuous length of polished and buffed tubing. The tubing must be ASTM-A-554 grade 316L stainless-steel, 1.50-inch OD x 0.120-inch minimum wall thickness, polished and buffed to 320 grit finish and must be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance. Bends must be smooth and free of wrinkles. Grab rails must be pretzel bend style with dimensions as indicated in the plans and as manufactured by Spectrum Products, SR Smith, Paragon, Paddock or approved equal. New escutcheons to be provided and must be of the keyhole or oblong shape, similar to the casted, electro-polished stainless-steel escutcheon with set screw by Paragon #28303SS, SR Smith #IEP-200, Spectrum #35222 or approved equal.

2. Entry rails must be provided as shown on the drawings, fabricated from one continuous piece of polished and buffed ASTM-A-554 grade 316L stainless-steel, 1.50-inch OD x 0.120-inch wall thickness, polished and buffed to 320 grit finish and must be passivated for maximum corrosion resistance. Bends must be smooth and wrinkle free. Custom rails as manufactured by Spectrum Products, Paragon, SR Smith, Paddock or approved equal. Custom rail submittal drawings must be complete with details of custom fabrication and installation information. Anchor sockets for railings must be of the wedge type, cast bronze or stainless-steel, 4 inches in depth and made to receive 1.50-inch OD tubing as manufactured by Paragon #28105, SR Smith #AS-200B, Spectrum #54052 or approved equal. The wedge must be cast bronze, incorporate a stainless-steel tightening bolt, and flat washer, and be designed as the sacrificial element to the anchor system. Metallic components must be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance. Anchors must be provided with flush closure caps and escutcheons with set screws where indicated. Escutcheons must be of the keyhole or oblong shape, similar to the casted, electro-polished stainless-steel escutcheon with set screw by Paragon #28303SS, SR Smith #IEP-200, Spectrum #35222 or approved equal.

3. Stanchion posts must be provided as required and in the quantities shown (eight locations) on the drawings. The posts must be a straight length of type 316L stainless-steel tubing, 1.90-inch OD x 0.145-inch wall thickness x 8-foot overall length, polished and buffed to 320 grit finish. Stanchions must be capped at one end with a closure plug containing a U-shaped hook and fitted with a stainless-steel eyebolt attached to an adjustable nickel-plated bronze sliding collar. Stanchion with sliding collar and eyebolt as manufactured by Paragon #38106 with #38301, SR Smith #10168-MG with #35-102, Spectrum Products #23614 with #23625 or approved equal. Anchor sockets for stanchions (four existing anchors to remain/four new anchor locations on the shallow end of the pool) must be of cast bronze or stainless-steel, sized to receive a full 6 inches penetration of 1.90-inch OD tubing as manufactured by Paragon #38201TC, Spectrum Products #23626, Kiefer #700103, SR Smith #AS-100D or approved equal. Each anchor socket must be provided with a flush threaded, vandal proof

closure cap Paragon #38201TC, Spectrum Products #23628, or Kiefer #700103C and a grounding lug with screw. Provide Paragon #38303, Spectrum Products #23630, Kiefer #700103K or approved equal spanner wrenches for removing the closure cap. Anchors or sockets must be provided with flush closure caps and escutcheons with set screws where indicated.

4. Starting Blocks

   a. The Owner will furnish eight SR Smith Velocity starting blocks to the Contractor for installation. Contractor to provide the anchors from the manufacturer and complete the installation of the starting blocks.

   b. Anchors sockets for single post starting blocks must be provided with depths that allow for installation of starting blocks at all course layouts indicated on the drawings. A stainless-steel cap must be provided to flush mount on the deck when starting block is removed. The anchor socket must be made of machined bronze or cast T304 stainless-steel. An assembly of tightening hardware must be provided with either the starting block frame or the starting block anchor to prevent rocking. Anchors for starting block must be by the starting block manufacturer - Paragon Quickset Dual-wedge anchor, SR Smith Rock Solid anchor.

5. Surge tank access hatch must be provided in quantities as shown on the drawings. The access hatch must be a single door 3'-2" x 2'-6" with 1" fillable pan to receive ceramic tile and grout or concrete fill to match the surrounding deck. The frame must be ¼ inch extruded aluminum with built in neoprene cushion and continuous anchor flange. Door must be ¼" aluminum plate reinforced with aluminum stiffeners as required. The door must be equipped with heavy continuous stainless-steel hinges and must have compression spring operators for easy operation. The door must open to 90 degrees and lock automatically in that position. The door must be built to withstand a live load of 150 lbs. per square foot and equipped with a continuous Type 316L stainless-steel hinge, tubular type, and an automatic hold open arm with release handle. Hardware must be type 316L, 18-8, stainless-steel. A flush lift handle and a snap lock with removable key wrench must be provided. Factory finish must be mill finish with bituminous coating applied to the exterior of the frame. The access door must be Type TER single leaf pan type door ordered as a custom size as manufactured by the Bilco Company.

6. Surge tank ladder must be provided for the depth of the surge tank as indicated on the drawings and include a pull-up handrail. The ladder and handrail must be constructed of polypropylene that conforms to ASTM-D4101. Ladders must meet all ASTM0C-497 load requirements and OSHA 1910.26 and 1910.27 specifications. The ladder must be fastened to the floor and wall with 1/2" x 3-3/4" 316 stainless-steel anchors and installed per manufacturer's instructions. Adjustable mounting bracket must be 8". Aluminum reinforced copolymer polypropylene rail must be 1-3/4" x 1-3/4" diameter. Steel reinforced copolymer polypropylene ladder rungs must be 1-5/8" x 1-1/4" diameter with molded finger grips, 12" O.C. The ladder must be manufactured by Lane International Corporation or approved equal.

7. Pool Lift

   a. The pool lift must be a battery powered handicap lift with footrest assembly. Lift to be the Scout XL from Aqua Creek Products to be compatible with the existing ADA lift anchor.

2.11 LOOSE EQUIPMENT

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

   1. Competition floating lane ropes must be as shown on the drawings and described in these specifications. Floating lane ropes must be a non-turbulent type with wave quelling floats and

3/16” stainless-steel coated cable. Floats must be injection-molded polyethylene. Colors to alternate the length of the pool with a contrasting solid color for the final 15 feet. Owner/Architect to select colors from standard color chart. Floating lane ropes must be provided as completely assembled and installed with take up reel, type 304 stainless-steel spring and cable lock, hooks, and wrench. 5/8” wrench must be made of a forged steel shaft with a polished chrome finish. The take up reel must be constructed of type 304 stainless-steel. The spool must be a bronze nickel-plated casting with a nylon sleeve. Floating lane ropes must be similar to Competitor Swim Products, Competitor Gold Medal 6” Racing Lanes, Kiefer Wave Eater II 6” Racing Lanes, or Anti-Wave Maximum 6” Racing Lanes, Malmsten Gold Pro 6” Racing Lanes pre-assembled and sized to fit the length of the pool. Provide contrasting disks located 15 meters from each end to meet resurfacing requirement.

Quantities:

Competition Pool:	Provide 7 at 25 yards
	Provide 5 at 60 feet

2. Cup anchors for floating lane ropes anchored in concrete must be 316L stainless-steel with stainless-steel threaded eyebolts. The heavy-duty cup anchors must be 3-3/8-inch diameter. Cup anchors must be Spectrum Products #58280, SR Smith #WA-100, Paragon #14-503 or approved equal.

3. Backstroke flags:

   a. Backstroke flags must be provided for all course layouts shown on the drawings. Backstroke flags must be made of Vinyl material, triangular in shape (12” wide x 17” long), and alternating in color, butted end to end on vinyl covered stainless-steel cable. Submit standard color samples for review and approval by the Owner/Architect. The cable must be attached to a stainless-steel take up reel at one end and a stainless-steel tension spring end-fitting at the other. Equipment must be similar to the following items by Kiefer: backstroke flag (#600808), racing lane cable (#210210), take-up reel (#210218S), and spring end fitting (#210219) or approved equal from Competitor Swim Products.

4. Lane Rope Storage Reel

   a. Lane rope storage reel must be fabricated from two powder-coated enclosed aluminum wheels joined together by a 1-1/4-inch aluminum axle. This unit must ride easily on four 6” stainless-steel casters with individual brakes. The reel must have a collapsible tow handle for safe movability. The storage reel should be able to hold 902’ of 4” lane ropes or 492’ of 6” lane ropes. The storage reel must come assembled. The correct number of storage reels must be provided to store the lane lines. Lane line storage reel must be Competitor Swim Products Elite Stor Lane Reel #200 850 with Competitor storage reel cover #200 861, SR Smith XL Capacity Lane Line Reel #38000 with SR Smith lane line reel cover #36100 or approved equal.

5. The lifeline must be 3/4-inch blue and white polyethylene rope with floats that are 5-inch diameter by 9-inch-long. Floats must be spaced on five-foot centers. Metallic rope hooks must be stainless-steel. Provide lifeline at five-foot break between shallow and deep water as shown on the drawings. Lifeline must be equal to Recreonics #14-438.BW or Lincoln Aquatics #44-115 safety line rope, Recreonics #14-381, Lincoln Aquatics #44-190 or Competitor Swim #350EZBW locking 5” x 9” floats, and Recreonics #14-456 or Lincoln Aquatics #44-125 rope end hooks.

2.12 MAINTENANCE EQUIPMENT

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

   1. Test Kits

a. Provide two (2) test kits:

1) The first test kit must feature liquid reagents, a color comparator, waterproof instructions and treatment charts, chemistry guide and water gram. Test kit to have the ability to test for free and total chlorine (0.5 – 5.0 ppm), bromine (1-10 ppm), pH (7.0 – 8.0), acid and base demand, total alkalinity, calcium hardness and cyanuric acid. The test kit must be Taylor Complete K-2005C test kit or approved equal.

2) The second test kit must be photometric and utilize either liquid and powder reagents or tablet reagents for stability that will allow accurate measurement of free and total chlorine (0-10 ppm), bromine, pH, alkalinity, calcium hardness, and cyanuric acid. The test kit must have solid-state digital electronics and built-in filters. The test kit must be direct reading with automatic blank settings, automatic power cut-off, and store a minimum of the last 10 results in nonvolatile memory. Provide LMP106C Pooltest 6 with Hard Carry Case Kit and LMC001 Check Standard by Lumiso, AquaPRO 6 Test Kit manufactured by Orbeco-Hellige Inc and Reference Standard Kit (LP275680) or M-2005 Commercial Calorimeter Kit, in hard carry case, by Taylor Technologies or approved equal.

2. Stainless-steel Protective - Provide protective coating on swimming pool rail goods. The coating must provide envelope protection. Surfaces coated must be clean and dry and free of oil, films, grease, silicones polishes and waxes, anything that leaves a film on the surface. Care must be taken not to clean the surface with a type of cleaner or solvent that may leave behind a thin film. The coating must be applied at approximately ½ mil WFT yielding a dry film thickness of 3-5 microns. Three coats are required. Allow to dry to touch between coats. The coating must be ProtectaClear-AF as manufactured by Everbrite and distributed by TMI Salt Pure Corporation or Spectra Shield as manufactured by Spectrum Products.

2.13 THERMOMETERS

A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.

1. The inline thermometers must be near the heating loop and must have a 9-inch adjustable angle with a minimum 6-inch stem. There must be a minimum of two (2) thermometers per loop and must have ability to read temperature in both degrees Fahrenheit and Celsius. Thermometers must be Recreonics #32-702, Lincoln Aquatics #21-125, or approved equal.

2.14 SWIMMING POOL FINISHES

A. Swimming Pool Cementitious Finish - Reference specification section 131104, Swimming Pool Cementitious Finish.

B. Swimming Pool Tile - Reference specification section 131103, Swimming Pool Tile.

2.15 SEALANTS

A. Provide sealed expansion joints as shown on the pool and pool structural drawings or noted on the construction/expansion joint layout, and as required. Expansion joints must be constructed and sealed as indicated and in accordance with the manufacturer’s recommendation. Sealant must be manufactured by LATICRETE International, Inc., Mapei, or Deck-O-Seal. If submerged joints are provided within a pool structure that utilizes a cementitious finish, a 2”x2” tile trim must be installed adjacent to the sealant on each side of the joint. Reference specification section 13154/131103, Swimming Pool Tile.

1. For submerged joints:

a. Latasil, one component, neutral cure, high performance, 100% silicone sealant in the color(s) as selected by the Owner/Architect. Must be used in conjunction with Latasil 9118 Primer per manufacturer's recommendations.

b. Mapesil T, 100% silicone sealant in the color(s) as selected by the Owner/Architect.

2.16 POOL HEATERS

A. Provide the pool water heating system. Heating system to include piping, heaters, booster pumps, controls, gauges, thermostats, control valves and wiring required to draw water from the recirculation piping, heat the water and return it back to the recirculation piping. Interlock pool heating system with pool recirculation pumps.

1. Pool heater manufacturer representative must be on site to start and adjust pool heater(s). Copies of the startup report must be sent to the Architect/Engineer.

2. The heater(s) system must consist of a direct gas fired boiler boiler with an internal pumped bypass as shown on the drawings. Proposed substitutions must include a mechanical drawing incorporating required changes in layout, piping valves, gas, venting and electrical connections. The cost of such changes must be included in the price of the substitute. Confirm by 1/4-inch scale shop drawing that the alternate heater(s) must be provided will fit within the available space.

3. The pool heater(s) must have an input rating as shown on the drawings and must be orificed for operation on Natural Gas.

B. Direct Gas Fired Boiler (with Internal Pumped Bypass)

1. Basis of Design: Lochinvar Copper-Fin 2, Raypak HiDelta, or approved equal.

a. The water containing section must be of a "fin tube" design, with cupro-nickel tubes having extruded integral fins. The tubes must terminate into a one piece, lined, bronze header. There must be access to the front header of the heat exchanger for the purposes of inspection, cleaning, or repair. The heat exchanger must be mounted in a stress-free jacket assembly in order to provide a "free floating design" able to withstand the effects of thermal shock. The heater(s) must bear the ASME "H" stamp for 160 psi working pressure and must be National Board listed.

b. The combustion chamber must be sealed and completely enclosed with a ceramic fiberboard insulation. A burner/flame observation port must be provided on each end of the unit. The burners must be constructed of a high temperature stainless steel and fire on a horizontal plane. The heater(s) must have a multi-speed combustion air blower to precisely control the fuel/air mixture for maximum efficiency.

c. The heater(s) must be constructed with a heavy gauge galvanized steel jacket assembly, primed and pre-painted on both sides with a minimum dry film thickness of 0.70 mils. The jacket design must allow single unit venting connection without the use of external draft hood devices.

d. The heater(s) must be certified and listed by CSA International under the latest edition of the appropriate ANSI test standard. The heater(s) must comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The heater(s) must operate at thermal efficiency up to 85% (HiDelta 83%). The heater(s) must be ASME inspected, and HLW-stamped and National Board registered for 160 PSIG working pressure, complete with a Manufacturer's Data Report.

e. Heat Exchanger

1) The heat exchanger must be of a single-bank, horizontal-grid design with integral cupro-nickel finned tubes, each end of which is rolled into an ASME

boiler-quality steel tube sheet. The heater(s) must be capable of operating at inlet water temperatures as low as 105°F without condensation.

f. The heater(s) must be furnished with a factory supplied pumped bypass assembly to ensure proper operation without condensation. The bypass assembly must include a sealed bronze pump. The bypass assembly must be constructed of schedule 80 CPVC piping with brass inserts and an automatic three-way valve to protect the unit against inlet water temperatures that would cause the heat exchanger to condense.

g. The heater(s) must have an independent laboratory rating for Oxides of Nitrogen (NOx) of less than 30 ppm corrected to 3% O2.

h. The heater(s) must be equipped with a controller incorporating software customized for operation of the heater(s). Internal safety, operating and ignition controls must be included in the controller. The controller must provide on/off control of the gas supply to the burner, operation of the combustion air blower, ignition of the gas-air mixture, flame proving, control of water temperature set points, and monitoring of safety functions.

i. The heater(s) must feature an LED/LCD display that provides external heater(s) status/faults. Local communication, programming, and a display of operating and alarm status conditions must be accessible through the control panel. The control panel must contain an on/off main power switch, a digital display of temperature functions, the operational status of the heater(s), or an active alarm fault.

j. The heater(s) must allow 0-10 VDC input connection for BMS control. Supply voltage must be 120 volt / 60 hertz / single phase.

k. The control system must include redundant proven pilot hot surface ignition with full flame monitoring capability. Multiple main gas valves with redundant valve seats and built-in low gas pressure regulators must be supplied as standard. Gas valves will be referenced to the combustion chamber to ensure proper air/gas mixture for efficient combustion.

l. The heater(s) must be approved for indoor installation. The heater(s) must be supplied with venting and air intake in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 latest edition (Category I). Refer to Mechanical drawings for required air intake and venting configuration to include with the heater(s).

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS, INSPECTION AND PREPARATION

A. Carefully examine the contract documents for requirements that affect the work of this section. Prior to starting work, notify the Architect of defects requiring correction. Do not start work until conditions are satisfactory.

B. Verify that work by others, related to this section, has been completed. This includes earthwork, concrete work, and mechanical, electrical, and plumbing connections.

C. Protect materials and work completed by others from damage while completing the work in this section.

3.02 FIELD MEASUREMENTS

A. Verify benchmark and pool location prior to layout.

B. If field measurements differ from the construction drawing dimensions, notification must be given to the Architect prior to proceeding with work.

3.03 EXCAVATION, REINFORCING STEEL AND SWIMMING POOL SHOTCRETE OR CAST-IN-PLACE CONCRETE

A. Reference Section 131101 - Swimming Pool Cast-In-Place Concrete

3.04 TOLERANCES FOR CONSTRUCTION OF THE POOL SHELL

A. The completed structures must be constructed level and to the dimensions, elevation, depths, and thickness as shown on the plans.

B. The vertical wall surface tolerance of the pool shell, for the first 36 inches from the water surface must be plus or minus 1/4 inch from plumb measured with a 6-foot straight edge.

C. For competitive racecourses, the following pool shell tolerances must apply:

Course	Tolerance	Minimum	Maximum
25 Yard	+ 1 3/16" /- 0"	75' – 3/4"	75' – 1 15/16"

1. The above dimensions include allowances for a touchpad at each end of the course. The maximum dimension includes the construction tolerance. These above tolerances also apply to courses utilizing moveable bulkhead(s).

2. The above dimensions apply to a vertical plane extending 1'-0" above and 3'-0" below the surface of the water at points of both end walls.

D. Provide the services of a registered engineer or land surveyor who must measure and certify the length of each lane for each possible racing course. Courses designed with touchpads for competition must be measured and certified with touchpads in place. Course length survey must be made with the pool filled with water between 78- and 82-degrees Fahrenheit. The Contractor to submit compliant survey measurements to the Architect for review and record.

3.05 WATER TIGHTNESS TEST

A. The water tightness test described within the following section is in accordance with the Hydrostatic Tightness Testing of an Open Concrete Containment Structure as required by American Concrete Institute (ACI) 350.1-10 Section 2. Test reports must be provided and must include test locations within the structure, dates of testing, water level measurements, amounts of evaporation, measured volume corrections, retest results (if applicable), actions taken, and final results.

B. This test applies to the pool after the existing finishes have been removed.

C. The water tightness test must be completed prior to the application of the finishes.

D. Water Tightness Test Procedure

1. Preparation

2. Fill: Fill and then isolate the pool. The water tightness test must begin after the vessel has been filled for a minimum of three (3) days. During the filling, outlets must be monitored for water tightness and concrete joints, if applicable, must be monitored for visible leakage. If visible leakage from the vessel is observed, the condition must be corrected prior to the start of the test.

3. 24-hour Allowable Loss

   a. Calculate the allowable water loss from the unlined vessel(s). This is .3% of the total vessel volume. For example, if the vessel has a volume of 200,000 gallons, the 24-hour allowable loss will be 400 gallons.

Vessel	Total Volume (Gallons)	24-hour Allowable loss (.3% or .003 of Total Volume)
EXAMPLE	200,000 gal	600 gal

Pool		

4. Measurement

   a. Measurements must be taken at the pool(s) and surge tank(s). Document the separate findings on the chart below. Repeat the measurements and document every 12 hours for a total of three (3) days. The Contractor must check the pool(s) and surge tank(s) for water loss with the Owner or a representative designated by the Owner every 12 hours. Submit photo documentation (with time stamps) of each measurement with the completed water tightness report. Example measurements are shown in the table below.

5. Evaporation Measurement Procedure

   a. Fill a floating, restrained, partially filled, calibrated, open pan with water and allow the container to float within the pool during the testing period. This will be used to measure evaporation.

Vessel	12 hrs. passed	24 hrs. passed	Day 1 TOTAL	36 hrs. passed	48 hrs. passed	Day 2 TOTAL	60 hrs. passed	72 hrs. passed	Day 3 TOTAL
Pool									
Evaporation/ Precipitation Pan									

6. Calculate Daily Loss

   a. Calculate the total daily water loss for the vessel(s) and record in the table below. If a vessel has a daily water loss that is greater than the calculated 24-hour allowable loss, the vessel cannot be considered watertight.

      1) Daily Loss = 7.481 x Structure Surface Area (SF) x [Total Water Loss per Day (FT) – Evaporation per Day (FT)]

   b. For example, we have a body of water that is 200,000-gallon volume and 3,500 square feet of surface area. Measurements for this example body of water are recorded in the table above.

      1) Day 1 Loss = (7.481 gallons per cubic foot) x (3,500 SF) X [(.031 ft water loss) – (.014 ft evaporation)] = 445 gallons Day 1 loss

      2) Day 2 Loss = (7.481 gallons per cubic foot) x (3,500 SF) X [(.035 ft water loss) – (.015 ft evaporation)] = 524 gallons Day 2 loss

      3) Day 3 Loss = (7.481 gallons per cubic foot) x (3,500 SF) X [(.039 ft water loss) – (.016 ft evaporation)] = 602 gallons Day 3 loss

Vessel	Daily Water Loss Day 1 (Gal)	Daily Water Loss Day 2 (Gal)	Daily Water Loss Day 3 (Gal)	Allowable Loss (calculated above, Gal)	Are daily values higher than the Allowable Loss? (Y/N)
EXAMPLE	445 gal	524 gal	602 gal	200 gal	Y, not watertight
Pool					

7. Absorption

a. Waiting 3 days after the initial water fill will allow the concrete to absorb water and must be sufficient to minimize the effect of absorption on the test results.

8. Evaporation

a. Evaporation must not have a significant effect on natatoria that are completely enclosed with no air circulation during the water tightness test. However, evaporation will have a significant effect on the water level in natatoria that has air movement across the water surface or are still partially uncovered.

9. If leaks are detected and/or the test is failed, Contractor must submit a water tightness remediation plan for review by the Architect/Engineer. This plan must include comprehensive details pertaining to leak detection, as well as materials that are proposed for repair and patching work. Following review by the Architect/Engineer, Contractor must detect the leaks and repair the vessel per the reviewed and approved plan. A subsequent water tightness test must be performed to ensure that all leak detection and leak repair efforts are effective, and vessel meets water tightness test criteria.

3.06 PIPING INSTALLATION

A. General

1. Provide and erect, according to the best practices of the trade, piping shown on the drawings and required for the complete installation of these systems. The piping shown on the drawings must be considered as diagrammatic in indicating the general run and connections and may or may not in parts be shown in its true position. The piping may have to be offset, lowered, or raised as required or as directed at the site. This does not relieve responsibility for the proper erection of the systems or piping in every respect suitable for the work intended as described in the specifications and approved by the Architect. In the erection of piping, it must be properly supported, and proper provisions must be made for expansion, contraction and anchoring of piping. Piping must be cut accurately for fabrication to measurements established at the construction site. Pipe must be worked into place without springing and/or forcing, properly clearing windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted. Pipes must have burrs and/or cutting slag removed by reaming or other cleaning methods in strict accordance with the manufacturer's instructions. Changes in direction must be made with fittings. Open ends of pipes and equipment must be properly capped or plugged to keep dirt and other foreign materials out of the systems. Plugs of rags, wool, cotton waste or similar materials will not be used in plugging. Piping must be arranged so as not to interfere with removal and maintenance of equipment, filters, or devices, and so as not to block access to manholes, access openings, etc. Flanges or unions applicable for the type of piping specified must be provided in the piping at connections to items of equipment. Piping must be installed to ensure noiseless circulation. Valves and specialties must be so placed to permit easy operation and access.

B. Pipe Hangers and Supports

1. Pipes must be adequately supported by pipe hangers and supports as specified.

2. Horizontal PVC Schedule 80 piping must be supported in accordance with the manufacturer’s recommendations for fluid temperature not exceeding 120-degree F and as listed below:

Nominal Pipe Size	Hanger Support Spacing	Minimum Rod Size for Single Rod Hanger
1-1/4” and less	5’-0”	3/8”
1-1/2” to 3”	6’-0”	1/2”
4” to 6”	8’-0”	5/8”
8” to 12”	10’-0”	7/8”
Greater than 12”	12’-0”	1”

3. Horizontal CPVC Schedule 80 piping must be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 140-degree F and as listed below:

Nominal Pipe Size	Hanger Support Spacing	Minimum Rod Size for Single Rod Hanger
½" and less *	4'-0"	3/8"
¾" to 2"	6'-0"	3/8"
2-1/2" to 3"	7'-0"	1/2"
4" to 8"	8'-0"	7/8"
Greater than 12"	10'-0"	1"

4. Round rods supporting the pipe hangers must be of the following dimensions:

Nominal Pipe Size	Rod Diameter
1/2" to 2" pipe	-3/8" rod
2-1/2" to 3" pipe	-1/2" rod
4" to 5" pipe	-5/8" rod
6" pipe	-3/4" rod

5. Hanger rods must be galvanized steel. Provide for controlling level and slope by turn buckles or other approved means of adjustment and incorporate lock nuts.

6. Provide means of preventing dissimilar metal contact such as plastic-coated hangers, copper colored epoxy paint, or non-adhesive isolation tape.

7. Provide hangers to provide a minimum of 1-inch space between finished covering and adjacent work.

8. Place a hanger within 12 inches of each horizontal elbow.

9. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.

10. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified. Trapeze hangers must be spaced according to the smallest pipe size or provide intermediate supports according to the support spacing schedules. Provide heavier members as required for the load supported for the entire span distance. Hanger rods must be as specified above and properly sized for the load supported, but not less than 5/8 inches diameter.

11. Piping must be rigidly supported from the building structure by means of hanger assemblies properly selected and sized for the application in accordance with the manufacturer's recommendations and specifications. Do not support piping from other pipes, ductwork or other equipment that is not building structure. Do not modify the building structure for hanger installation.

12. Attachment of piping hangers to the building structure must be provided in a manner approved by the Architect. Provide concrete inserts installed by others in the building construction at the time the concrete is poured, and hangers must be attached to these inserts.

13. The use of pipe hooks, chains, or perforated iron for pipe hanger supports will not be permitted.

14. A design for piping in a service tunnel, if required, supported by a structure must be submitted for approval. The structure must be non-corrodible and must be of a size and configuration to rigidly support the piping as shown in the plans at a minimum spacing as shown below.

C. Concrete Inserts

1. Provide inserts for placement in form work before concrete is poured.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Where concrete slabs form finished ceilings, inserts must be flush with the slab surface.

4. Provide hook rods to concrete reinforcement section for inserts carrying pipe over 4 inches.

D. Flushing, Draining and Cleaning Pipe Systems

1. Flush out water systems with water before placing them in operation. Other systems must be cleaned by using compressed air or nitrogen. After systems are in operation and during the test period, strainer screens must be removed and thoroughly cleaned.

E. Expansion and Contraction

1. Make necessary provisions for expansion and contraction of piping with offsets, loops, flexible connections, and anchors as required to prevent undue strain. Provide shop drawings for method and arrangement for control of expansion and contraction of piping.

F. Testing

1. Piping installation and pressure testing must be performed by the Contractor and reviewed by the Owner or a designated representative of the Owner before commencement of backfilling. A minimum one (1) week notice must be provided prior to review. Results must be submitted to the Architect. Pictures with time stamps for each section of piping must be included with testing report(s) and be submitted within one (1) week of the pressure test(s).

2. Existing suction pool piping from the main drains to the pool equipment room must be capped and hydraulically pressure tested with water to a pressure of not less than 50 PSI for a period of no less than two (2) hours. Pressure testing must be conducted in accordance with ASTM D2774. The temperature of the water used for the test must be between 40ºF and 90 ºF.

3.07 EQUIPMENT AND SYSTEMS INSTALLATION

A. Provide and assemble equipment, special parts and accessories as shown on pool drawings, specifications, and shop drawings of the equipment suppliers.

B. Provide anchors and inserts imbedded in the deck including fittings, inserts and structure sleeves and required anchorage as shown on the plans and as indicated in this section of the specifications. Equipment must be set true and plumb, using factory jigs where available. Removable equipment items must be easily removable from anchors and must fit without noticeable wobble.

C. Provide templates for equipment anchors. Provide anchor bolts of the size and spacing as required by the equipment manufacturer. Anchor bolts must be stainless-steel Type 316L and of a length capable of adequate anchorage into rough slab-on-grade allowing for finish deck tile and setting bed. Anchors must be set and cast into place during building concrete work. Inspect anchor settings for horizontal and vertical alignment prior to placing concrete.

D. Provide equipment and systems in accordance with manufacturer's directions. Equipment must be assembled and in place for final observation.

E. Items necessary to complete this section are shown on the plans or described in the specifications including items that may be purchased by the Owner. Items are detailed and specified as a guide for dimensional purposes. Make provisions accordingly and submit shop drawings and submittals based on that data.

3.08 START-UP AND INSTRUCTION

A. Written reports of each of these visits outlining the pool's operation, competence and performance of the pool's operation personnel, and other pertinent comments must be submitted to the Owner and Architect/Engineer within one (1) week after each visit.

B. Provide specific written procedures that must be followed for emptying and refilling the pool as mentioned previously in this section. The procedures must be included in the bound volume of operating instructions and references in the front index with a note headed by the words: "CAUTION -- VERY IMPORTANT".

END OF SECTION

SECTION 13 11 01
SWIMMING POOL CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:
   1. Swimming pools:
      a. Bottom slabs.
      b. Walls.
      c. Miscellaneous features, slabs on grade and all other elements.
   2. Surge tanks:
      a. Bottom slab, walls and top slab.

B. Related Requirements:
   1. Division 03 for all concrete not related to swimming pool construction.
   2. Division 03 or Division 13 for water tightness testing.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete Subcontractor.
      e. Special Pool finish Subcontractor.
   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, anchor rod and anchorage device installation tolerances if required for equipment installation, under slab pipe encasement requirements, and concrete protection.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar

diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Engineer.

E. Samples: For waterstops.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Waterstops.
   6. Curing compounds.
   7. Bonding agents.
   8. Joint-filler strips, if required.
   9. Repair materials.
   10. Dowel bar substitutes.

C. Material Test Reports: For the following, from a qualified testing agency:
   1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.07 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.08 DELIVERY, STORAGE, AND HANDLING

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

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

1.09 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:
   1. Maintain concrete temperature below 95 deg F (35 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 PRODUCTS

2.01 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301 (ACI 301M).
   2. ACI 117 (ACI 117M).

2.02 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

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

C. Void Forms (if indicated on drawings): Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

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

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.03 STEEL REINFORCEMENT

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

2.04 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

B. Dowel Bar Substitutes: Tapered, threaded couplers, pre-assembled to reinforcing with mounting plate for attachment to form work and a pressed in metal disc thread protector which can be easily removed. The mechanical connection shall meet building code requirements of developing in tension or compression. The mechanical connection shall be the positive locking, taper threaded type coupler manufactured from high quality steel. The bar ends must be taper threaded using the manufacturer’s requirements.
   1. Lenton Form Saver; Erico Corp.

2.05 CONCRETE MATERIALS

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

B. Cementitious Materials:
   1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

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

2.06 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   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. Sika Greenstreak.

b. Vinylex Waterstop & Accessories.
2. Profile: Ribbed without center bulb, non-tapered.
3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick); nontapered.

B. Non-Expanding Plastic Adhesive Waterstops: Manufactured rectangular or trapezoidal strip, single-component, self-sealing adhesive compound, for adhesive bonding to concrete, 5/8 by 1-1/2 inch.
1. Products: Subject to compliance with requirements, provide the following:
a. Synko-Flex SF302, Henry Company.
1) Synko-Flex SF311 Solvent Based Primer.

2.07 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
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. BASF Corporation-Construction Systems; Confilm.
b. ChemMasters, Inc; Spray-Film.
c. Dayton Superior; AquaFilm J74RTU.
d. Euclid Chemical Company (The); an RPM company; Eucobar.
e. L&M Construction Chemicals, Inc; E-CON.
f. Metalcrete Industries; Waterhold.
g. Sika Corporation; Caltexol CIMFILM.
h. TK Products; TK-2120 TRI-FILM.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

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

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of pool finish.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
a. BASF Corporation-Construction Systems; MasterKure CC 200 WB (Pre-2014: Kure-N-Seal W).
b. Dayton Superior; Cure & Seal 1315 J22 WB.
c. Euclid Chemical Company (The); an RPM company; Diamond Clear VOX.
d. L&M Construction Chemicals, Inc; Dress & Seal WB.
e. SpecChem, LLC; Cure & Seal WB 25.
f. W.R. Meadows, Inc; Vocomp-20.

2.08 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
1. Provide for cast-in-place concrete coping.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Dayton Superior Corporation; Conspec Strong Bond.
b. Euclid Chemical Company (The), an RPM company; Flex-Con.
c. W. R. Meadows, Inc.; Sealtight Acry-Lok.
d. Kaufman Products, Inc.; Surebond.

2.09 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
   1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.
      a. Xypex Concentrate.
   2. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   3. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
   5. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.
      a. Xypex Concentrate.
   2. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   3. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
   5. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete and concrete with a w/c ratio below 0.50.

2.11 CONCRETE MIXTURES FOR SWIMMING POOL ELEMENTS

A. Slabs, Walls, Coping and Other Elements: Normal-weight concrete.
   1. Minimum Compressive Strength: 4500 psi (31.0 MPa) at 28 days.
   2. Maximum W/C Ratio: 0.42.
   3. Minimum Cement Content: 600 lb/cu. yd.
   4. Slump Limit: 4 inches (100 mm), 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
   5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

2.12 FABRICATING REINFORCEMENT

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

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.14 DRAINAGE FILL

A. Drainage Course under bottom slabs: Narrowly graded mixture of frost-free, washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

PART 3 EXECUTION

3.01 FORMWORK INSTALLATION

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

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

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
   2. Class D, 1 inch (25 mm) for rough-formed finished surfaces.

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

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

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

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

H. Chamfer exterior corners and edges of permanently exposed concrete.
   1. Comply with pool and gutter profile shown if edges not shown to be chamfered.

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

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

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

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

3.02 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. If required for equipment or piping installation, install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.03 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

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

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

3.04 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

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

3.05 STEEL REINFORCEMENT INSTALLATION

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

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

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

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

E. Dowel bar substitutes may be used in lieu of lap splices.

3.06 JOINTS

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

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams and slabs in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of slabs and beams.
5. Vertical joints in walls shall be located at corners, and in concealed locations where possible.
6. Use a bonding agent:
    a. At locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
    b. At cove joint where cove mortar is placed against hardened wall and slab.
    c. At coping where coping is placed against hardened wall.

C. Contraction Joints in Slabs: No contraction joints shall be placed in pool bottom slab.

D. Joints in Coping:
1. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated, or, 2 feet maximum. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
    a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
    b. Isolation Joints: Install vertical joint-filler strips at _ feet.
        1) Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants are indicated.

3.07 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

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

3.08 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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

3.09 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

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

3.10 FINISHING SLABS AND WALLS

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

B. Verify all finish requirements with swimming pool finish subcontractor before finishing concrete.
   1. Provide certification, with swimming pool finish subcontractor, that concrete finish complies with manufacturer’s recommendations for final pool finish.

C. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
   1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

D. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces to receive trowel finish.

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

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

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

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

3.12 CONCRETE PROTECTING AND CURING

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

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

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

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

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

3.13 CONCRETE SURFACE REPAIRS

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

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

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

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

3.14 FIELD QUALITY CONTROL

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

B. Inspections:
   1. Steel reinforcement placement.

2. Headed bolts (if required for equipment and piping installation).
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
      a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete;one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31/C 31M.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
   7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
   8. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
   9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
   10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.
   11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
   12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION

SECTION 13 11 03
SWIMMING POOL TILE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and General Provisions of the contract, including General and Supplementary Conditions apply to the work of this section.

1.02 SUMMARY

A. The cementitious pool finish must have ceramic tile markings and trim at locations including the depth markings, wall targets, floor lane markings, ADA ramp, construction joint installations bands and other tile installations as shown and detailed on the contract drawings and in strict accordance with these specifications.

B. Provide a ceramic tile finish on the entire interior surface of the spa.

C. The Contractor must furnish and install the work of this section.

1.03 RELATED SECTIONS

A. Section 1131100 - Swimming Pool

B. Section 131104 - Swimming Pool Cementitious Finish

1.04 QUALITY ASSURANCE

A. Reference Standards: Conform to the following standards unless otherwise required herein.

1. American National Standards Institute (ANSI)

   a. A108.01 – General Requirements: Subsurfaces and Preparations by Other Trades.

   b. A108.02 – General Requirements: Materials, Environmental, and Workmanship.

   c. A108.1, Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile and Paver Tile installed with Portland Cement Mortar.

   d. A108.1C – Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry Set or Latex-Portland Cement Mortar.

   e. A108.5 – Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.

   f. A108.6 – Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy for the Epoxy Grouting Installation Process.

   g. A108.10 – Installation of Grout in Tile Work.

   h. A108.13 – Installation of Load Bearing, Bonded, Waterproof Membranes for Thin Set Ceramic Tile and Dimension Stone for the Waterproofing Membrane Installation Process

   i. A137.1 Standard Specifications for Ceramic Tile.

2. American Society for Testing and Materials (ASTM)

   a. C144-99, Aggregate for Masonry Mortar

   b. C150-00, Portland Cement

c. C171-97a, Sheet Materials for Curing Concrete

d. C206-97, Finishing Hydrated Lime

e. C207-91 (R1997), Hydrated Lime for Masonry Purposes

f. F-1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

g. F-2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes

3. Tile Council of North America (TCNA); 2021 Edition, Handbook for Ceramic Tile Installation.

4. American Concrete Institute

a. ACI 302 – Guide for Concrete and Floor Slab Construction

5. International Concrete Repair Institute (ICRI)

a. Concrete Surface Profile (CSP)

B. The Contractor must have two years' experience in similar pool projects for which the Owner may require written proof thereof and proper tools to install tile.

1.05 MANUFACTURERS

A. Subject to compliance with requirements provide ceramic tile, mortar, and grout of the following manufacturers: American Olean Tile Co. (tile), Dal-Tile Co. (tile), Buchtal (tile), KlinkerSire (tile), MAPEI, Inc. (thin-set, waterproofing, grout, and admixtures), and LATICRETE International Inc. (thin-set, waterproofing, grout, and admixtures) or approved equal.

1.06 SUBMITTALS

A. Submit shop drawings indicating tile layout, patterns, joint layout, color arrangement, perimeter conditions, junctions with dissimilar materials, thresholds and setting details.

B. Submit product data indicating material specifications, characteristics, and instructions for using adhesives and grouts.

C. Samples:

1. Submit physical samples for all tile color selections by Owner/Architect.

2. Submit physical samples for grout color selections by Owner/Architect.

D. Mockups:

1. Mount tile and apply grout on 24"x24" backerboard to indicate pattern, color variation and grout joint size variations of each pattern. Furnish mounted tile samples as requested by the Architect/Owner for approval.

E. Submit manufacturer's installation instruction.

F. Submit maintenance data.

1. Include recommended cleaning and stain removal methods, cleaning materials.

1.07 PRODUCT DELIVERY AND STORAGE

A. Deliver tile materials to site in unopened factory containers sealed with grade seals bearing printed name or manufacturer and the words "Standard Grade". Keep the grade seals intact and containers dry until tiles are used. Keep cementitious materials dry until used.

1.08 JOB CONDITIONS

A. Inspect and verify job conditions. Report defects in base surfaces for correction before proceeding.

B. Maintain environmental conditions, including temperature humidity and ventilation, within limits recommended by the manufacturer. Do not install products under environmental conditions outside the manufacturer's absolute limits.

C. Do not install mortar, set, or grout tile exterior when inclement weather conditions are expected within 48 hours after work is scheduled to be completed unless proper protection is provided.

D. Maintain a temperature range of 50 degrees Fahrenheit to 90 degrees Fahrenheit during installation of tile and grout materials. Tile installation should cure for a minimum 14 days with average a temperature of 70 degrees, while maintaining the minimum 40 degrees and maximum 90 degrees Fahrenheit, prior to filling pool with water.

E. Vent temporary heaters to outside to avoid carbon dioxide damage to the new tile work.

1.09 COLORS

A. Colors must be selected by the Owner/Architect or Interior Designer. Note that swimming pool regulations may dictate color selections within the pool tank. See tile materials for price group breakdowns.

1.10 WARRANTIES

A. The Contractor warrants to the Owner that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, improper or insufficient maintenance, improper operation, modifications not executed by the Contractor or improper wear and tear under normal usage. If required by the Owner, provide satisfactory evidence as to the kind and quality of materials and equipment. Warranties must be for a period of five years, unless otherwise specified.

B. Setting materials must be provided by the same manufacturer. Mixing materials and application procedures must be done in accordance with manufacturer's recommendations and requirements. Documentation must be provided to this effect by the Contractor with verification from the manufacturer. This documentation must be included in the operations and maintenance manual under warranties as documentation qualifying the project for a 15 Year Systems Warranty by LATICRETE International, Inc., MAPEI, Inc. or approved equal.

C. The Contractor must contact the tile setting material manufacturer's technical representative to review installation details, job site conditions, selected materials, and their conformance to the manufacturer's warranty requirements prior to the commencement of work. Failure to follow these requirements will not relieve the Contractor of the requirement to provide specified warranties.

D. The Contractor must agree to repair or replace work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.

PART 2 - PRODUCTS

2.01 TILE MATERIALS

A. Standard grade conforming to ANSI A137.1. Provide trim units as indicated and specified, including special shapes as detailed or required. Tile patterns and colors must be as indicated and specified, colors of approved shades. Mesh mounted or perforated paper backed tile is not

allowed where the mesh of paper remains as a permanent part of the installation. If dot mounting is used, a minimum of 67% of the depth of the tile must be free from dots to ensure proper grout curing.

B. Porcelain Mosaic Tile

1. Slip-resistant porcelain mosaic tile, cushion, or all-purpose edges, 2” square for floor, walls, and stair treads unless otherwise noted below. The minimum dynamic coefficient of friction must be 0.42 for wet surfaces and 0.65 for ramped surfaces. Where special shapes are required, they must be selected from price group 1-4. Equivalents provided by Knoxtile, Dal-Tile or American Olean. For wet surfaces: Dal-Tile Keystones matte 2”x2” (price group 1-3), Buchtal Chroma Mosaics with front mount film 2”x2” (seven color options) 7161HVF or American Olean Unglazed color-body 2”x2” (price group 1-3). Colors, blends and patterns must be selected by the Owner/Architect.

2. Contrasting nosing at pool stairs must be Universal Trim 2”x2” with color selected by the Owner/Architect from Dal-Tile Keystone Matte (price group 1-2), American Olean Unglazed color-body 2”x2” (price group 1-2).

3. Contrasting tile strip, wall targets and lane markings on the pool floor, ADA ramp, with color selected by Owner/Architect from Dal-Tile Keystone Matte 2”x2” (price group 3-4), American Olean Unglazed color-body 2”x2” (price group 3-4), or from Knoxtile 2”x2” Mosaic 7160HVF 5535 Grey Black. The main racecourse wall targets and lane markings must be black.

4. Tile at top horizontal plane of the spa and spa waterline tile with color, blends and patterns selected by Owner/Architect from American Olean Unglazed color-body 2”x2” (price group 1-4), DalTile Keystone Matte 2”x2” (price group 1-4).

C. Message Tile and Depth Markings

1. Horizontal and vertical depth markings and warning signs must be 6”x6” with 4” high numbers and letters. Horizontal depth markers must be slip resistant. Single tile abbreviations must be used for ‘FT’ and ‘IN.’

2.02 SWIMMING POOL / SPA TILE SETTING MATERIALS AND INSTALLATION

A. Surface Preparation

1. Surface preparation must be in accordance with ACI 302. The surface must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion, free of dirt, oil, grease, curing compounds, or other foreign materials. Sound and remove loose concrete to firm substrate. Surfaces must be roughened to a CSP of 3 to 5 (reference ICRI CSP Standards for acceptable profile height). Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate must be patched per manufacturer’s recommendations.

B. Slurry Bond Coat

1. Horizontal surfaces to receive a thick bed mortar application must be installed over a slurry bond coat of either LATICRETE 254 Platinum one-step, polymer-fortified, thin-set mortar or MAPEI Planislope RS polymer-modified pre-blended, rapid-setting mortar mixed with water only in compliance with ANSI A108.1A (2.2 & 5.2). As manufactured by LATICRETE International, MAPEI, Inc., or approved equal. Note that slurry bond coats are not required under vertical applications of the render and scratch coat.

C. Mortar & Leveling Beds

1. Bonded Thick Bed Method (Floor / Horizontal Surfaces): Provide a dry pack, thick mortar bed on horizontal surfaces consisting of LATICRETE 3701 Fortified Mortar Bed or MAPEI

Planislope RS polymer-modified pre-blended, rapid-setting mortar mixed with water only. Apply over a properly prepared slurry bond coat.

2. Render- Scratch and Float Coats (Wall / Vertical Surfaces): Provide wall render (scratch and float coats) on vertical competition turning surfaces to a depth of 4'-0" below the water surface, consisting of either LATICRETE 3701 Fortified Mortar Bed or LATICRETE 3701 Lite Mortar or MAPEI Planislope RS polymer-modified pre-blended, rapid-setting mortar mixed with water only for lift thicknesses up to ½". Wall render is made to a plastic consistency when used vertically. Fill holes and bring surface up to line and plane as required. As manufactured by LATICRETE International, MAPEI, Inc. or approved equal. Note that slurry bond coats are not required under vertical applications of the render and scratch coat.

D. Tile Thin-Set

1. Use either LATICRETE 254 Platinum one-step, polymer fortified, thin-set mortar or MAPEI Keraflex Super one-step, polymer modified, thin-set mortar, used in accordance with the manufacturer's requirements. As manufactured by LATICRETE International, MAPEI, Inc., or approved equal.

E. Tile Grout

1. Use either LATICRETE SPECTRALOCK PRO Premium Grout or MAPEI Kerapoxy CQ Grout in accordance with the manufacturer's requirements as manufactured by LATICRETE International, MAPEI, Inc. or approved equal. Color selection by Owner/Architect.

F. Elastomeric Sealant

1. Use LATICRETE LATASIL over LATASIL 9118 primer or MAPEI Mapesil "T" 100% silicone sealant for inside/outside corners, expansion/movement joints, and to seal lighting/plumbing fixture penetrations. The primer and sealant installation must be in accordance with the manufacturer's requirements. As manufactured by LATICRETE International, Inc., MAPEI, Inc. or approved equal. Color selection by Owner/Architect.

G. Mixing and application procedures must be in accordance with the manufacturer's recommendations and requirements. The manufacturer's representative must visit the site to verify field conditions, confirm materials and application requirements and ascertain that materials and systems are so installed. Documentation must be provided to this effect.

PART 3 - EXECUTION

3.01 PREPARATION

A. Complete water tightness test prior to tile installation. The concrete tank must be watertight per ASTM D5957, the Tile Council of North America, and specification 131100.

B. Clean substrates of dust, dirt, oil, grease, curing compounds and other foreign substances and mechanically roughen concrete and shotcrete for bond. Conform to applicable reference standards and to recommendations of manufacturers of materials used and meeting ICRI, CSP of 3-5.

C. Substrates to Receive Mortar Setting Beds

1. Dampen concrete substrate to receive tile work according to above referenced standards or tile manufacturer's instructions, as required.

D. Substrates to receive thin set tile applications must meet normal construction tolerances of 1/4" in 10' where competition tolerances do not apply and must meet competition tolerances where required elsewhere in these specifications, and must be free of bumps, dips and surface irregularities that may affect the satisfactory installation of the tile.

E. Tile Wetting

1. Dampen tile according to above reference standards or tile manufacturer's instructions, as required.

F. Screeds

1. Accurately set temporary screeds to control the finish plane of mortar-bed set tile and remove as soon as setting bed is sufficiently hardened. Fill void spaces from screeds with same mortar.

3.02 TILE INSTALLATION

A. Arrange tile according to patterns detailed. Set tile with flush well-fitted joints, finished in true planes, plumb, square, joints of uniform size. Provide approved trimmers as shown or required. Cut tile without marring. Carefully grind and joint tile edges and cuts.

B. Follow Tile Council of North America installation methods P601 and B417 to achieve total tile system thickness for thin or thick set.

1. Thick Set

a. Apply specified setting bed mortar, up to 2” in thickness, on cured and dried concrete pool shell. Tamp and screed to required planes. Spread no more mortar than can be covered with tile before initial set. Do not use re-tempered mortar. Trowel 3/32” to 1/8” thick bond coat over plastic setting bed mortar just before setting tile or apply bond coat to back of each tile placed. Set tile in position and beat firmly into the setting bed mortar. Bring tile faces to a true and correct plane. Complete beating and leveling before mortar sets and in no case later than one hour after first placing. When ready, wet and remove paper and glue avoiding excess water. At this time adjust out-of-line or out-of-level tile.

2. Thin Set

a. Apply specified bond coat on cured and dried concrete pool shell. Trowel 3/32” to 1/8” thick bond coat over concrete pool shell just before setting tile or apply bond coat to back of each tile placed. Set tile in position and beat firmly into the setting bed mortar. Bring tile faces to a true and correct plane. Complete beating and leveling before mortar sets and in no case later than one hour after first placing. When ready, wet and remove paper and glue avoiding excess water. At this time adjust out-of-line or out-of-level tile.

C. Finished tile surface must be level and in plane, with no sharp or protruding edges. Tiles out or plane more than 1/16" must be removed and replaced. Sharp edges must be stoned smooth.

D. Grout Joint Sizes

1. Unless otherwise approved, install tile with uniform 3/32” joint width. A maximum 1/8" joint width may be utilized to meet specific installation requirements, if required.

E. Ceramic Tile Joint Grouting

1. Mix grout to a thick creamy consistency and force into joints for entire thick depth, flush with surface. Clean off excess and fill skips and gaps before grout sets. Color selection by Owner/Architect or Interior Designer. Provide dampness for minimum 3-day curing and polish with clean dry cloths (not required when epoxy grouts are used).

F. Expansion Joints

1. Place expansion joint per applicable TCNA Method P601MB, P601TB, or P602 and conforming to Method EJ171. Provide shop drawings showing backer rod and joint dimensions. Expansion, control, construction, cold, and seismic joints in the pool structure should continue through the tile work, including such joints at vertical surfaces. Movement joints must be placed at changes in direction and elevation. Refer to the structural engineer

for additional required movement joints. Joint size must be a minimum of 1/8". Joints through tile work directly over structural joints must not be narrower than the structural joint. The Contractor must use cement compatible coatings when using chalk lines for joint layout purposes.

G. Fill and Empty Rates

1. Use a fill and drain rate of 2'-0" per 24 hours to minimize thermal shock and structural movement. Maintain a temperature differential of 10 degrees Fahrenheit or less between the pool water and the substrate during fill and drain cycles.

3.03 TESTING AND INSPECTION

A. Before filling of the pool, and its subsequent provisional acceptance at substantial completion, the tile installation must be visually inspected and sounded in the presence of the Architects and/or the Owner's representative to verify mortar coverage below the tile to its substrate as well as its overall compliance with the requirements of this Section.

B. Tile work found loose, lacking proper mortar coverage, out of plane, misaligned or otherwise non-conforming must be removed and replaced at no additional cost to the Owner.

3.04 CLEANING

A. Upon completion of placement and grouting, clean tile installation as recommended by TCNA and manufacturers of proprietary materials. Tile must be cleaned with pH neutral solutions, free of both sodium and potassium, in accordance with the tile and grout manufacturer's printed instruction.

B. Leave finished installation clean and free of cracked, chipped, broken, un-bonded or otherwise defective tile work.

C. Protect installed tile work with non-staining Kraft paper, polyethylene sheeting, or other approved heavy covering during the construction period to prevent damage.

3.05 REPLACEMENT TILE

A. Provide the Owner with approximately 10% or 25 square feet (whichever is least) of each color and type tile used on the project for Owner's repair and replacement requirements.

END OF SECTION

SECTION 13 11 04
SWIMMING POOL CEMENTITIOUS FINISH

PART 1 - GENERAL

1.01 SUMMARY

A. Provide an aggregate plaster finish to the pool structure(s). Provide installation of bond coat prior to application of pool finishes in strict accordance with manufacturer's instructions. Provide ceramic tile trim on the depth markings, wall targets, floor lane markings and other tile installations as shown and detailed on the contract drawings and in strict accordance with these specifications.

B. The spa has a tile finish. Refer to the 131103 Swimming Pool Tile specification.

C. Provide water analysis and pre-fill requirements.

1.02 SUBMITTALS

A. Color Samples

1. Provide physical color samples for review and approval by the Owner/Architect.

B. Mockup

1. Prepare 12-inch square panel at the site showing color and texture for pool plaster for approval by the Owner/Architect. Finished cementitious finish work must match the approved sample panel.

C. Test Report

1. Submit results of domestic water analysis and calculation of amounts of chemicals required to balance pool water on initial fill of pool.

1.03 PRODUCT DELIVERY AND STORAGE

A. Deliver manufactured materials to site in manufacturers' original unbroken packages or containers bearing manufacturers' name and brand labels. Keep cementitious materials dry until ready to be used and stored off the ground, under cover and away from damp surfaces.

1.04 JOB CONDITIONS

A. Apply plaster in swimming pool only when ambient temperature is above 40 degrees F and below 90 degrees F and protect applied plaster from rapid drying by sun or wind until curing is completed or pool is filled with water. Confirm and comply with applicable manufacturer's installation requirements.

1.05 QUALITY ASSURANCE

A. The Contractor must have two years' experience in similar pool projects, for which the Owner may require written proof thereof and proper tools to install plaster.

PART 2 - PRODUCTS

2.01 DIAMOND BRITE

A. The Contractor must provide a slip-resistant proprietary plaster finish in the areas indicated on the drawings. Description: Diamond Brite finish must be a blend of selected quartz aggregates and fortified white Portland cement. Color and texture selected by the Owner/Architect. Confirm installation requirements with the manufacturer. PebbleQuartz by PebbleTech and KrystalKrete from CL Industries are equivalent products.

B. Surface Preparation

1. Surface must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion, free of dirt, oil, grease, curing compounds or other foreign materials. Sound and remove loose concrete to firm substrate. Surfaces must be roughened by sand blasting or water blasting. Shot blasting, scarifying, or grinding can also be accepted methods of surface preparation. Pressure-wash the entire surface. Wash with trisodium phosphate (TSP) using a stiff broom. Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate must be patched per manufacturer's recommendations. Lightly moisten walls and floors prior to application of Diamond Brite.

C. Bond Coat

1. Bond Kote by SGM, Inc., or approved equal, in strict accordance with manufacturer's instructions. Apply and cure bond coat per manufacturer's recommendations. After proper curing of bond coat, lightly moisten with clean potable water prior to application of cementitious finish. Ensure bond coat is free of foreign matter prior to plastering.

2. A bond coat must be installed over all interior pool surfaces prior to plaster application unless the surface profile is adequate to omit the bond coat in accordance with the manufacturer's recommendations. A manufacturer's representative must visit the site and provide written confirmation that the bond coat can be omitted, and all warranties will be maintained.

D. Mixing

1. Thoroughly mix Diamond Brite to a homogeneous lump-free consistency using 1-1/2 to 2 gallons of potable water per 80 lb. bag.

E. Application

1. Diamond Brite must be applied to a uniform thickness of 3/8" to 1/2" over the entire surface. The walls must be scratch coated followed by a finish coat. Material applied to the floor after the walls have been applied must be accelerated to assure uniform setting time throughout the pool surface.

F. Coverage

1. Each 80 lb. bag to cover approximately 25 square feet to a thickness of 3/8".

G. The proprietary plaster finish must be applied by a licensed applicator as approved by the manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES AND BOND COAT

A. Surface must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion, free of dirt, oil, grease, curing compounds or other foreign materials. Sound and remove loose concrete to firm substrate. Surfaces must be roughened by sand blasting or water blasting. Shot blasting, scarifying, or grinding can also be accepted methods of surface preparation. Pressure-wash the entire surface. Wash with trisodium phosphate (TSP) using a stiff broom. Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate must be patched per manufacturer's recommendations.

1. National Plasterers Council Surface Preparation Definitions

a. Pressure Washing: The washing or cleaning of a surface by a stream of water ejected from a nozzle at high velocity, typically in the range of 1,000 psi – 4,000 psi.

b. Water Blasting: The cutting, abrading, or removal of a surface or substrate by a stream of water ejected from a nozzle at ultra-high velocity, typically in the range of 10,000 psi – 40,000 psi.

2. Apply and cure bond coat in strict accordance with manufacturer's instructions. After proper curing of bond coat, lightly moisten with clean potable water prior to application of cementitious finish. Ensure bond coat is free of foreign matter prior to plastering.

B. Do not apply finish materials to base surfaces containing frost. Provide temporary coverings as required to protect adjoining surfaces from staining or damage by plastering operations.

C. Protect or mask adjacent surfaces that are not scheduled to receive cementitious finish. If expansion or construction joints exist in the areas where cementitious finish will be applied cover plastic joints for protection (if plastic joints are used). Additionally, mark joints for saw-cutting if area will be saw-cut.

D. Verify that concrete surfaces that are to receive a cementitious finish have cured for a minimum of 5 days. Consideration should be given for the application of a primer for concrete structures that is over 28 days old to improve bonding.

3.02 APPLICATION OF CEMENTITIOUS FINISH

A. General

1. Confirm application requirements with the manufacturer. Apply finish plaster to the properly prepared substrate at the minimum thickness required by the manufacturer, but no less than 3/8-inch thickness. Apply finish plaster by hand or machine. If plastering machine is used, control fluidity of plaster to have a slump not exceeding 2-1/2 inches when tested using a 2" by 4" by 6" high slump cone. Do not add additional water to the mix subsequent to determining water content to meet this slump. Perform slump test according to following procedure:

a. Place cone on level, dry non-absorptive base plate.

b. While holding cone firmly against base plate, fill cone with plaster taken directly from hose or nozzle of plastering machine, tamping with a metal rod during filling to release air bubbles.

c. Screed off plaster level with top of cone. Remove cone by lifting it straight up with a slow and smooth motion.

d. Place cone in a vertical position adjacent to freed plaster sample suing care not to jiggle base plate.

e. Lay straightedge across top of cone being careful not to vibrate cone, measure slump in inches from bottom edge of straightedge to the top of slumped plaster sample.

2. Mixing of materials and application procedures must be done in accordance with the manufacturer's recommendations and requirements. The manufacturer's representative must visit the site to verify field conditions, confirm materials and application requirements and ascertain that materials and systems are so installed. Documentation must be provided to this effect.

B. Workmanship

1. Unless otherwise required by the manufacturer, apply finish plaster in two coats by "double-back" method with second coat applied as soon as first coat is tamped and initially floated. Apply plaster with sufficient pressure to provide a good bond on bases. Work plaster to screeds at intervals of from 5 feet to 8 feet on straight surfaces. Apply smooth trowel finish without waves, cracks, trowel marks, ridges, pits, crazing, discoloration, projections, or other imperfections. Form plaster carefully around curves and angles, well up to screeds. Take special care to prevent sagging and consequent drooping of applications. Produce

surfaces free of visible junction marks in finish coat where one day's work adjoins another. Finish proprietary plaster as required by the manufacturer.

2. Cementitious finishes must be applied by a licensed applicator as approved by the manufacturer.

C. Curing

1. Curing cementitious finishes with fine fog water spray applied to finish coat as frequently as required to prevent dry-out of surface, or as directed by the manufacturer of the cementitious finish. Keep plaster damp until the pool is filled. Prevent damage or staining of plaster by troweling or curing.

D. Patching, Pointing, and Cleaning Up

1. Upon completion, cut out and patch loose, cracked, damaged, or defective plaster; patches matching existing plaster in texture, color, and finish, flush with adjoining plaster. Perform pointing and patching of surfaces and plasterwork abutting or adjoining other finish work in a neat and workmanlike manner. If 10 percent or more of the pools plaster finish is found to be defective, the plaster must be removed and replaced complete from surfaces. Remove plaster droppings or spattering from surfaces. Leave plaster surfaces in clean, unblemished condition ready for pool filling. Remove protective coverings from adjoining surfaces. Remove rubbish and debris from the site.

3.03 PRE-FILL SPECIFICATION

A. Contractor must employ a qualified water testing agency to analyze the domestic water with which the pool will be filled within 2 weeks of the plaster date and must employ a swimming pool experienced water chemistry consultant to determine types and quantities of chemicals required to ensure calcium-balanced water immediately upon the completion of water filling. Refer to section 131100 for water filling requirements.

1. Have on hand quantities of the chemicals as determine above, plus 25% overage for follow-up treatment. These chemicals, typically including calcium chloride, bicarbonate of soda, and muriatic acid are in addition to standard bromine/chlorine products and alkalizer/pH control products required elsewhere.

B. The pool(s) must not be plastered until directed by the Owner’s representative and the filtration system and chlorination system are complete and ready for start-up. The Contractor must supply chemicals required for treatment of the pool water.

C. The Contractor must submit domestic water analysis to the Owner and/or Architect at least 2 weeks prior to filling the pool(s).

END OF SECTION

SECTION 21 13 13
WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Pressure gauges.

1.03 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

D. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, or BIM model, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.

B. Qualification Data: For qualified Installer .

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

F. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.07 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. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.08 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13

C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Available fire-hydrant flow test records indicate the following conditions:
    a. Date: Insert test date.
    b. Time: [a.m.] [p.m.]
    c. Performed by: <Insert operator's name of Insert firm.
    d. Location of Residual Fire Hydrant R: Insert location.
    e. Location of Flow Fire Hydrant F: Insert location.
    f. Static Pressure at Residual Fire Hydrant R: Insert psig
    g. Measured Flow at Flow Fire Hydrant F: Insert gpm
    h. Residual Pressure at Residual Fire Hydrant R: Insert psig
2. Sprinkler system design shall be approved by authorities having jurisdiction.
    a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
    b. Sprinkler Occupancy Hazard Classifications:
        1) Building Service Areas: Ordinary Hazard, Group 1

2) Electrical Equipment Rooms: Ordinary Hazard, Group 1
3) General Storage Areas: Ordinary Hazard, Group 1
4) Libraries except Stack Areas: Light Hazard
5) Mechanical Equipment Rooms: Ordinary Hazard, Group 1
6) Office and Public Areas: Light Hazard

3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft area.
   c. .
   d. Special Occupancy Hazard: As determined by authorities having jurisdiction.

E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.02 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized and Black Steel Pipe: ASTM A53/A53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

C. Galvanized and Black Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

D. Galvanized and Uncoated Steel Couplings: ASTM A865/A865M, threaded.

E. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Malleable- or Ductile-Iron Unions: UL 860.

G. Cast-Iron Flanges: ASME 16.1, Class 125.

H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or EPDM rubber gasket.
   a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
   b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

I. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

J. Grooved-Joint, Steel-Pipe Appurtenances:

1. Products: Subject to compliance requirements, provide one of the following:
   a. American
   b. Anvil
   c. Groovjoint
   d. Shurjoint
   e.. Tyco
   f. Victaulic
   g. Viking Corp

2. Pressure Rating: 300-psig minimum.
3. Painted Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.03 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Victaulic
    b. Viking
    c. Tyco
2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber, and fill-line attachment with strainer.
5. Drip cup assembly pipe drain with check valve to main drain piping.

G. Automatic (Ball Drip) Drain Valves:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Victaulic
    b. Viking
    c. Tyco
2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.04 AIR VENT

A. Manual Air Vent/Valve:

1. Products: Subject to compliance requirements, provide one of the following:
    a. AGF manufacturering
    b. Tyco
    c. Viking
2. Description: Ball valve that requires human intervention to vent air.
3. Body: Forged brass.
4. Ends: Threaded.

5. Minimize Size: 1/2 inch.
6. Minimum Water Working Pressure Rating: 300 psig.

B. Automatic Air Vent:

1. Products: Subject to compliance requirements, provide one of the following:
    a. AGF manufacturering
    b. Potter
    c. Metravent (Metraflex Fire Protection Division)
2. Description: Automatic air vent that automatically vents trapped air without human intervention.
3. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler systems.
4. Vents oxygen continuously from system.
5. Float valve to prevent water discharge.
6. Minimum Water Working Pressure Rating: 175 psig.

2.05 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Products: Subject to compliance requirements, provide one of the following:
    a. American
    b. Anvil
    c. Groovjoint
    d. Shurjoint
    e. Tyco
    f. Victaulic
    g. Viking Corp
2. Standard: UL 213.
3. Pressure Rating: 300psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Products: Subject to compliance requirements, provide one of the following:
    a. AGF manufacturering
    b. Tyco
    c. Viking
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:
1. Products: Subject to compliance requirements, provide one of the following:
    a. AGF manufacturering
    b. Tyco
    c. Viking
2. Standard: UL 199.
3. Pressure Rating: 175 psig .
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:
1. Products: Subject to compliance requirements, provide one of the following:
    a. AGF manufacturering
    b. Tyco
    c. Viking
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:
1. Products: Subject to compliance requirements, provide one of the following:
    a. American
    b. Anvil
    c. Groovjoint
    d. Shurjoint
    e. Tyco
    f. Victaulic
    g. Viking Corp
2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:
1. Products: Subject to compliance requirements, provide one of the following:
    a. Tyco
    b. Victaulic

c. Viking Corp

2. Standard: UL 1474.

3. Type: 1NPS braided flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.

4. Pressure Rating: 175-psig minimum

5. Size: Same as connected piping, for sprinkler.

2.06 SPRINKLERS

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

a. Tyco

b. Victaulic

c. Viking Corp

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

D. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.

2. Nonresidential Applications: UL 199

3. Residential Applications: UL 1626

4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

E. Sprinkler Finishes: Coordinate with architect for finish color information.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Coordinate with architect for finish color information.

2. Sidewall Mounting: Coordinate with architect for finish color information.

G. Sprinkler Guards:

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

a. Tyco

b. Victaulic

c. Viking Corp

2. Standard: UL 199.

3. Type: Wire cage with fastening device for attaching to sprinkler.

4. To be used in areas where damage to sprinkler could occur (ie. Gyms etc.)

2.07 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

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

a. Potter Signal

b. Potter Roemer

c. Viking Corp

2. Standard: UL 753.

3. Type: Mechanically operated, with Pelton wheel.

4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 8-1/2-inches diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

C. Electrically Operated Notification Appliances:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Potter Signal
    b. Potter Roemer
    c. Viking Corp
2. Electric Bell:
    a. Standard: UL 464.
    b. Type: Vibrating, metal alarm bell.
    c. Size: 6-inch, 8-inch or 10-inch diameter.
    d. Voltage: 120 V ac, 60 Hz, 1 phase.
    e. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.
3. Strobe/Horn:
    a. Standard: UL 464.
    b. Tone: Selectable, steady, Temporal-3 (T-3) in accordance with ISO 8201 and ANSI/ASA S3.41, 2400 Hz, electromechanical, broadband.
    c. Voltage: 120 V ac, 60 Hz.
    d. Effective Intensity: 110 cd.
    e. Finish: Red, suitable for outdoor use with approved and listed weatherproof backbox. White letters on housing identifying device as for "Fire."
    f. Sign, Integrated: Mount between backbox and strobe/horn with text visible on both sides, above and below strobe/horn. Housing to be shaped to cover surface-mounted weatherproof backbox. Sign is to consist of white lettering on red plastic identifying it as a "Sprinkler Fire Alarm" and instructing viewers to call 911, police, or fire department.

D. Water-Flow Indicators:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Potter Signal
    b. Potter Roemer
    c. Viking Corp
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig
7. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Potter Signal
    b. Potter Roemer
    c. Viking Corp
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Potter Signal
    b. Potter Roemer
    c. Viking Corp
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.08 PRESSURE GAUGES

1. Products: Subject to compliance requirements, provide one of the following:
    a. Ametek
    b. FPPI
    c. Viking Corp

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gauge Range: 0 to 300 psig minimum

E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.02 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building.

B. Install shutoff valve, double check valve, alarm valve and other accessories indicated at connection to water-service piping.

3.03 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

M. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal and install where they are not subject to freezing.

N. Fill sprinkler system piping with water.

O. Install sleeves for piping penetrations of walls, ceilings, and floors.

P. Install sleeve seals for piping penetrations of concrete walls and slabs.

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.04 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. 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.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

J. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

K. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

L. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.05 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install double check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.

E. Air Vent:

1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.

3.06 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.07 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.09 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.11 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded; grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
4. Standard-weight, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.
5. Standard-weight, black-steel pipe with cut or roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
6. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger shall be one of the following:

1. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
2. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

3.12 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers
2. Rooms with Suspended Ceilings: Pendent sprinklers. Refer to sprinkler schedule in drawings for type of sprinkler.
3. Wall Mounting: Sidewall sprinklers.

END OF SECTION

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.
7. Sight flow indicators.

B. Related Requirements:

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 221119 "Domestic Water Piping Specialties" for water meters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch nominal size.
3. Case Form: Back angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.
    a. Design for Thermowell Installation: Bare stem.
8. Connector: 3/4 inch, 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.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Cast aluminum; 7-inch or 9-inch nominal size unless otherwise indicated.
3. Case Form: Adjustable angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass or plastic.
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.

2.02 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 or CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: ASME B1.20.1 pipe threads.
7. Internal Threads: 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.

2.03 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Liquid-filled or Sealed Open-front, pressure relief type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Metal, Brass or Stainless steel.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of or Grade B, plus or minus 2 percent of middle half of scale range.

2.04 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball with NPS 1/4, ASME B1.20.1 pipe threads.

2.05 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 1000 psig at 200 deg F.

E. Core Inserts: Chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber.

2.06 TEST-PLUG KITS

A. Furnish one test-plug kit(s) containing one 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.

Retain one of first two paragraphs below. If retaining both, indicate location of each on Drawings.

B. High-Range Thermometer: Small, bimetallic insertion type with 1 inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

C. Pressure Gage: Small, Bourdon-tube insertion type with 2-1/2-inch diameter dial and probe. Dial range shall be at least 0 to 160 psig.

D. Carrying Case: Metal or plastic, with formed instrument padding.

2.07 SIGHT FLOW INDICATORS

A. Description: Piping inline-installation device for visual verification of flow.

B. Construction: Bronze or stainless-steel body, with sight glass and ball or paddle wheel indicator, and threaded or flanged ends.

C. Minimum Pressure Rating: 125 psig.

D. Minimum Temperature Rating: 200 deg F.

E. End Connections for NPS 2 and Smaller: Threaded.

F. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.01 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 direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install test plugs in piping tees.

I. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

2. Inlet and outlet of each domestic hot-water storage tank.

J. 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.

3.02 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.03 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Metal case, compact or industrial-style, liquid-in-glass type.
2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

B. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:

1. Metal case, compact or industrial-style, liquid-in-glass type.
2. Test plug with chlorosulfonated polyethylene synthetic or Epdm self-sealing rubber inserts.

C. Thermometer stems shall be of length to match thermowell insertion length.

3.05 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.

3.06 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Water Piping: 0 to 200 psi.

END OF SECTION

SECTION 22 05 23
BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. CPVC ball valves.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61and NSF 372.

1.05 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

2.01 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 and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.02 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded or Soldered Ends:

1. Prdoucts: Subject to compliance requirements, provide one of the following:
    a. Apollo Valve
    b. Nibco
    c. Watts
2. Description:
    a. Standard: MSS SP-110 or MSS SP-145.
    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: Brass.
    h. Ball: Chrome-plated brass.
    i. Port: Full.

B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Press Ends:

1. Prdoucts: Subject to compliance requirements, provide one of the following:
    a. Apollo Valve
    b. Nibco
    c. Watts
2. Description:
    a. Standard: MSS SP-110 or MSS SP-145.
    b. CWP Rating: Minimum 200 psig.
    c. Body Design: Two piece.
    d. Body Material: Forged brass.
    e. Ends: Press.
    f. Press Ends Connections Rating: Minimum 200 psig
    g. Seats: PTFE or RPTFE.
    h. Stem: Brass.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

k. O-Ring Seal: Buna-N or EPDM.

2.03 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:

1. Prdoucts: Subject to compliance requirements, provide one of the following:
    a. Apollo Valve
    b. Nibco
    c. Watts
2. Description:
    a. Standard: MSS SP-110 or MSS-145.
    b. CWP Rating: 600 psig.
    c. Body Design: Two piece.
    d. Body Material: Bronze.
    e. Ends: Threaded and soldered.
    f. Seats: PTFE.
    g. Stem: Bronze or brass.
    h. Ball: Chrome-plated brass.
    i. Port: Full.

B. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Press Ends:

1. Prdoucts: Subject to compliance requirements, provide one of the following:
    a. Apollo Valve
    b. Nibco
    c. Watts
2. Description:
    a. Standard: MSS SP-110 or MSS-145.
    b. CWP Rating: Minimum 200 psig
    c. Body Design: Two piece.
    d. Body Material: Bronze.
    e. Ends: Press.
    f. Press Ends Connections Rating: Minimum 200 psig
    g. Seats: PTFE or RTPFE.
    h. Stem: Bronze or brass.
    i. Ball: Chrome-plated brass.
    j. Port: Full.
    k. O-Ring Seal: EPDM or Buna-N.

2.04 CPVC BALL VALVES

A. CPVC Union Ball Valves:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Apollo Valves
    b. Nibco
    c. Watts

a. Description:

b. Standard: MSS SP-122.

c. Pressure Rating and Temperature: **150 psig** at **73 deg F**

d. Body Material: CPVC.

e. Body Design: Union type.

f. End Connections for Valves NPS 2 and Smaller: Detachable, **socket**

g. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, **socket**

h. Ball: CPVC; full port.

i. Seals: PTFE or EPDM-rubber O-rings.

j. Handle: Tee shaped.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 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 or press-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.

3.04 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe:

1. Brass ball valves, two-piece with full port and brass trim. Provide with threaded, solder or press connection-joint ends.

2. Bronze ball valves, two-piece with full port and bronze or brass trim. Provide with threaded, solder or press connection-joint ends.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

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 Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

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. Include design calculations for designing trapeze hangers.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.05 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

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.

2.02 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, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
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 or/and stainless 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. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube 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 copper-coated steel and/or stainless steel.

2.03 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, 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.

2.04 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel, stainless-steel, Type 304, stainless-steel, Type 316, extruded-aluminum channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.

5. Channel Nuts: Formed or stamped 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 or stainless steel.
7. Metallic Coating: Hot-dip galvanized.
8. Paint Coating: Green epoxy, acrylic, or urethane.
9. Plastic Coating: PVC.
10. Combination Coating:

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel, stainless-steel channel with inturned lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped 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, stainless steel.
7. Metallic Coating: Hot-dip galvanized
8. Paint Coating: Green epoxy, acrylic, or urethane.
9. Plastic Coating: PVC.

2.05 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.06 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 anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.
2. Outdoor Applications: Stainless steel.

2.07 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.08 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.09 MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M).

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, 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

3.01 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. 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.

3.02 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. 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 A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

F. 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.

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.
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 of same thickness as piping insulation.

3.03 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.

3.04 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.

3.05 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.

3.06 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those 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, shop-painted areas on miscellaneous metal are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.07 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 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 finishes.

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 occurs.
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 occurs.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
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 occurs and vertical adjustment is unnecessary.
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, in addition to expansion and contraction, is required.

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 of 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-58 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 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.03 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

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch, stainless steel, 0.025-inch, aluminum, 0.032-inch, or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black or White
3. Background Color: Black, Blue, Red, White or Yellow
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. 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.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black or White

3. Background Color: Black, Blue, Red, White or Yellow
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. 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.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
B. Letter Color: Black or White
C. Background Color: Black, Blue, Red, White or Yellow.
D. Maximum Temperature: Able to withstand temperatures up to 160 deg F .
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
G. Fasteners: Stainless-steel rivets or self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

Do not use pipe labels or plastic tapes for bare pipes conveying fluids at temperatures of 125 deg For higher.

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover or cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping, at least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.04 VALVE TAGS

A. 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; stainless steel, 0.025-inch; aluminum 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) 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.

2.05 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire or Reinforced grommet and wire/string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.
B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting." or Section 099600 "High-Performance Coatings."
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 or Safety white
b. Letter Color: Black or White

3.05 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 or 2 inches round
b. Hot Water: 1-1/2 inches or 2 inches, round.

2. Valve-Tag Colors:

a. Cold Water: Natural or Safety green.
b. Hot Water: Natural or Safety green.

3. Letter Colors:

a. Cold Water: White
b. Hot Water: White

3.06 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Storm-water piping.
6. Roof drains and rainwater leaders.
7. Supplies and drains for handicap-accessible lavatories and sinks.

1.03 ACTION SUBMITTALS

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

1.04 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.

1.05 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 in accordance with ASTM E84 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.
    j. One union.
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.

1.06 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.

1.07 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.

1.08 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

2.01 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.

Products: Subject to compliance requirements, provide one of the following:
a. Johns Manville
b. Knauf
c. Owens Corning

1. Preformed Pipe Insulation: Type I, Grade A, with factory-applied ASJ
2. 850 deg F.
3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.

1. Provide from same manufacturer as insulation.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
C. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
D. PVC Jacket Adhesive: Compatible with PVC jacket.

2.04 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.
B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
2. Service Temperature Range: 0 to plus 180 deg F.
3. Color: White

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
2. Service Temperature Range: 0 to plus 180 deg F
3. Color: White

2.05 LAGGING ADHESIVES

A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
2. Service Temperature Range: 20 to plus 180 deg F.
3. Color: White.

2.06 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.
B. Joint Sealants:

1. Permanently flexible, elastomeric sealant.
2. Service Temperature Range: Minus 58 to plus 176 deg F
3. Color: White or gray.

C. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Fire- and water-resistant, flexible, elastomeric sealant.
2. Service Temperature Range: Minus 40 to plus 250 deg F.
3. Color: White.

2.07 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 C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.08 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches
2. Thickness: 11.5 mils
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.09 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 1/2 inch wide with wing seal.
2. Aluminum: ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 1/2 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Description: Manufactured enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.01 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.

3.02 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

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 of 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 of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.03 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 of 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 storage, application, and finishing. Replace insulation materials that get wet.

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 attached to structure with vapor-barrier mastic.
3. Install insert materials and 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, in accordance with 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 25 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 in similar fashion 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.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 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, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, 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 that of 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 that 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 that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 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 2 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, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
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.

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 that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 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.

3.06 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 that of 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 that of 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.

3.07 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

    a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.08 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

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B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.09 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.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Primary and Emergency Overflow Storm Drainage Piping:

1. Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

1. Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch 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 the following:

a. Preformed Molded under sink insulation

F. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. Piping joining materials.
4. Encasement for piping.
5. Transition fittings.
6. Dielectric fittings.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Pipe and tube.
2. Fittings.
3. Joining materials.
4. Transition fittings.

1.04 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

1.05 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than three days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.02 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type L .
B. Annealed-Temper Copper Tube: ASTM B88, Type K ASTM B88 and Type L
C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
G. Wrought Copper Unions: ASME B16.22.
H. Copper Tube, Pressure-Seal-Joint Fittings:

1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
2. Minimum 200-psig working-pressure rating at 250 deg F.

I. Copper-Tube, Push-on-Joint Fittings:

1. Description:

a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
b. Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.03 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51.
2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

E. Standard-Pattern, Push-on-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Gaskets: AWWA C111/A21.11, rubber.

F. Compact-Pattern, Push-on-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Gaskets: AWWA C111/A21.11, rubber.

G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

2.04 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 B32, lead-free alloys.
D. Flux: ASTM B813, water flushable.
E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.05 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105/A21.5.
B. Form: Sheet or tube.

2.06 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.
D. Plastic-to-Metal Transition Fittings:

1. Description:

a. One end with threaded brass insert and one solvent-cement-socket or threaded end.

2.07 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 150 psig minimum at 180 deg F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 150 psig minimum at 180 deg F
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Nonconducting materials for field assembly of companion flanges.
2. Pressure Rating: 150 psig
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
D. Under-building-slab, domestic water, building-service piping, shall be one of the following:

1. Annealed-temper copper tube, ASTM B88, Type K and ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Mechanical-joint, ductile-iron pipe; standard or compact pattern, mechanical-joint fittings; and mechanical joints.
3. Push-on-joint, ductile-iron pipe; standard or compact pattern, push-on-joint fittings; and gasketed joints.
4. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

E. Aboveground domestic water piping shall be one of the following:

1. Drawn-temper copper tube, ASTM B88, Type L; cast or wrought copper, solder-joint fittings; and brazed or soldered joints.
2. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

3.02 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.03 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A674 or AWWA C105/A21.5.
E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
F. Install domestic water piping level and plumb unless noted otherwise in drawings.
G. Install seismic restraints on piping.
H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. 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.
J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
K. Install piping to permit valve servicing.
L. 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.
M. Install piping free of sags and bends.
N. Install fittings for changes in direction and branch connections.
O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
P. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gages for Plumbing Piping."
Q. Install thermostats in hot-water circulation piping.
R. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
S. Install sleeves for piping penetrations of walls, ceilings, and floors.
T. Install sleeve seals for piping penetrations of concrete walls and slabs.
U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.04 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 B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.
G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
H. 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.
I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.05 INSTALLATION OF TRANSITION FITTINGS

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.

3.06 INSTALLATION OF DIELECTRIC FITTINGS

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, nipples or unions
C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits or nipples.

3.07 INSTALLATION OF HANGERS AND SUPPORTS

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 hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
C. Install hangers for copper tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
D. Support horizontal piping within 12 inches of each fitting.
E. Support vertical runs of copper tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.08 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.

3.09 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

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 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.

3.12 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.

END OF SECTION

SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers for domestic water piping.
7. Outlet boxes.
8. Wall hydrants.
9. Roof hydrants.
10. Drain valves.
11. Water-hammer arresters.
12. Trap-seal primer device.
13. Trap-seal primer systems.

B. Related Requirements:

1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
2. Section 220523.12 “Ball Valves for Plumbing Piping
3. Section 221116 "Domestic Water Piping"

1.03 DEFINITIONS

A. AMI: Advanced Metering Infrastructure.
B. AMR: Automatic Meter Reading.
C. FKM: A family of fluroelastomer materials defined by ASTM D1418.

1.04 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.

1.05 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.
B. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Watts
    b. Zurn Wilkens
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 or Chrome plated

B. Hose-Connection Vacuum Breakers:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Watts
    b. Zurn Wilkens
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 or Rough bronze

C. Pressure Vacuum Breakers:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Watts
    b. Zurn Wilkens
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Accessories:

    a. Valves: Ball type, on inlet and outlet.

D. Spill-Resistant Vacuum Breakers:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Watts
    b. Zurn Wilkens
2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.

4. Size: Same size as water line
5. Accessories:

    a. Valves: Ball type, on inlet and outlet.

2.04 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Ames
    b. Watts
    b. Zurn Wilkens
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Ames
    b. Watts
    b. Zurn Wilkens
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Body: stainless steel.
6. End Connections: flanged
7. Configuration: Designed for horizontal, straight-through flow or vertical for fire flow when listed for vertical installation.
8. Accessories:

    a. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

C. Dual-Check-Valve Backflow Preventers:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Ames
    b. Watts
    b. Zurn Wilkens
2. Standard: ASSE 1024.
3. Operation: Continuous-pressure applications.
4. Body: Bronze with union inlet.

D. Backflow-Preventer Test Kits:

1. Description: Factory calibrated, with gauges, fittings, hoses, and carrying case with test-procedure instructions.

2.05 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Watts
    b. Zurn Wilkens
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; bronze for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded or solder for NPS 2 and smaller; flanged or solder for NPS 2-1/2 and NPS 3.

2.06 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Apollo
    b. Bell and Gosset
    c. Watts
2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
3. Body: Brass or bronze.
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. Memory-Stop Balancing Valves:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Apollo
    b. Bell and Gosset
    c. Watts
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 or stainless steel.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.07 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices (point of use):

1. Products: Subject to compliance requirements, provide one of the following:
    a. Watts
    b. Zurn
2. Standard: ASSE 1070.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.

5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110 deg F maximum.
9. Tempered-Water Design Flow Rate: 0.5 gpm maximum.
10. Valve Finish: Chrome plated or bronze

B. Primary, Thermostatic, Water (master) Mixing Valves:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Lawler
    b. Leonard
    c. Powers
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110 deg F
9. Valve Finish: Chrome plated, Polished, chrome plated or Rough bronze
10. Piping Finish: Chrome plated or Copper

2.08 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers :

1. Products: Subject to compliance requirements, provide one of the following:
    a. Watts
    b. Zurn

2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated for NPS 2-1/2 and larger.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
5. Screen: Stainless steel with round perforations unless otherwise indicated.

2.09 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Guy Gray
    b. Oatey
    c. Water Tite
2. Mounting: Recessed; Fire rated if in rated wall assembly.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Drain Outlet Connection: NPS 2
6. Accessory: Water hammer arresters.
7. Supply Shutoff Fittings: NPS 1/2 ball valves and NPS 1/2 copper, water tubing.
8. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.

B. Icemaker Outlet Boxes:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Guy Gray
    b. Oatey
    c. Water Tite
2. Mounting: Recessed; Fire rated if in rated wall assembly.
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 ball valve and NPS 1/2 copper, water tubing.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants :

1. Products: Subject to compliance requirements, provide one of the following:
    a. Watts
    b. Woodford
    c. Zurn
2. Standard: ASME A112.21.3M for exposed outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4
7. Outlet, Exposed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Nozzle and Wall-Plate Finish: Polished nickel bronze or Chrome plated
9. Operating Keys(s): Two with each wall hydrant.

2.11 ROOF HYDRANTS

A. Nonfreeze, Sanitary-Type Roof Hydrants:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Woofdord
2. Standard: ASSE 1057.
3. Type: Nonfreeze, exposed-outlet roof hydrant with coated cast-iron head and lift handle with lock option. Provide with deck flange and under deck clamp.
4. Casing and Operating Rod: Bronze interior parts, galvanized-steel casing, and bronze valve housing designed with hole to drain.
5. Inlet: NPS 3/4.
6. Vacuum Breaker:

    a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.

2.12 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.

7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.13 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Products: Subject to compliance requirements, provide one of the following:
   a. PPP Inc
   b. Watts
   c. Zurn
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Piston
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.14 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device <Insert drawing designation if any>:

1. Products: Subject to compliance requirements, provide one of the following:
   a. PPP Inc
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.15 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems :

1. Products: Subject to compliance requirements, provide one of the following:
   a. PPP Inc
2. Standard: ASSE 1044.
3. Inlet Size: NPS 3/4, ASTM B88, Type L; copper, water tubing.
4. Cabinet: Surface-mounted steel box with stainless steel cover.
5. 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.

6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: Four
8. Size Outlets: NPS 1/2.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install 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. Water Regulators: Install with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.
C. Water Control Valves: Install with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.
D. Automatic Water Shutoff Valves: Test for signal strength before valve installation. Install automatic shutoff valve downstream from main domestic water shutoff valve. Install valve controller in an accessible location with sensors in areas where water is likely to accumulate.
E. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.
F. Temperature-Actuated, Water Mixing Valves: Install 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.

G. Y-Pattern Strainers: For water, install on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
H. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 1-1/2-by-3-1/2-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. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
J. Supply-Type, Trap-Seal Primer Device: Install 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.
K. Trap-Seal Primer Systems: Install 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.

3.02 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.03 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.04 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.05 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Outlet boxes.
7. Wall hydrants.
8. Roof hydrants.
9. Trap-seal primer device.
10. 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."

3.06 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.
D. Adjust each pressure vacuum breaker, reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly and, double-check, in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage, Engage a qualified testing agency to perform tests and inspections.
B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
E. Prepare test and inspection reports.

END OF SECTION

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Copper tube and fittings.
4. PVC pipe and fittings
5. Specialty pipe fittings.
6. Encasement for underground metal piping.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.04 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.

1.05 FIELD 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 Owner no fewer than three days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

1.06 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.01 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: 150 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.

2.02 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
B. 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.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

1. Products: Subject to compliance requirements, provide one of the following:
    a. Charlotte Pipe
    b. Tyler Pipe

B. Pipe and Fittings: ASTM A 74, Service class(es).
C. Gaskets: ASTM C 564, rubber.
D. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.04 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

1. Products: Subject to compliance requirements, provide one of the following:
    a. Charlotte Pipe
    b. Tyler Pipe

B. Pipe and Fittings: ASTM A 888 or CISPI 301.
C. CISPI, Hubless-Piping Couplings:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Charlotte Pipe
    b. Tyler Pipe
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.

2.05 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.
B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
C. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.06 PVC PIPE AND FITTINGS

A. PVC Pipe: All PVC Schedule 40 pipe shall be from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be

manufactured in strict compliance to ASTM D1785 consistently meeting and/or exceeding the quality assurance test requirements of these standards.

B. PVC DWV Fittings: All molded drain waste and vent fittings shall be manufactured in the U.S.A. from a PVC Type1 Grade I compound having a cell classification of 12454 conforming to ASTM D1784. DWV fittings shall meet the requirements of ASTM D2665 for Polyvinyl Chloride (PVC) Plastic DWV Molded Fittings and ASTM D3311 for DWV Fitting Patterns. DWV molded fittings shall be certified by NSF International to meet the requirements of D2665.

C. Adhesive Primer: All primer shall be suitable for all class and pipe schedules with interference fit. All primer shall be certified by NSF International for conformance to ASTM F656, The Uniform Plumbing Code (NSF® U.P.Code), NSF®/ANSI Standard 14, NSF/ANSI Standard 61 for use with potable water (PW) and certified for use in drain, waste, vent (DWV) and sewer (SW) applications (purple only). All primer shall be LEED® compliant, Low VOC emission product meeting the requirements of SCAQMD Rule 1168/316A. All primer shall be made in the U.S.A, be available in purple or clear and have a three (3) year shelf life in tightly sealed containers, as manufactured by Spears® Manufacturing Company.

D. Solvent Cement: All solvent cement shall be certified by NSF International for conformance to ASTM D2564, The Uniform Plumbing Code (NSF® U.P.Code), NSF®/ANSI Standard 14, NSF®/ANSI Standard 61 for use with potable water (PW) and certified for use in drain, waste, vent (DWV) and sewer (SW) applications. All solvent cement shall be LEED® compliant, Low VOC emission product meeting the requirements of SCAQMD Rule 1168/316A. All solvent cement shall be made in the U.S.A, be available in clear color and have a three (3) year shelf life in tightly sealed containers, as manufactured by Spears® Manufacturing Company.

E. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Shielded, Nonpressure Transition Couplings:
3. Products: Subject to compliance requirements, provide one of the following:
    a. Fernco
    b. Mifab

    c. Standard: ASTM C 1460.
    d. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    e. End Connections: Same size as and compatible with pipes to be joined.

4. Pressure Transition Couplings:
5. Products: Subject to compliance requirements, provide one of the following:
    a. Fernco
    b. Romac
    c. Victaulic

    d. Standard: AWWA C219.
    e. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
    f. Center-Sleeve Material: Manufacturer's standard
    g. Gasket Material: Natural or synthetic rubber.
    h. Metal Component Finish: Corrosion-resistant coating or material.

F. Dielectric Fittings:

1. Dielectric Unions:
2. Products: Subject to compliance requirements, provide one of the following:
    a. Fernco
    b. Mifab

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 250 psig at 180 deg F
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:
4. Products: Subject to compliance requirements, provide one of the following:
   a. Watts

   b. Description:

      1) Standard: ASSE 1079.
      2) Factory-fabricated, bolted, companion-flange assembly.
      3) Pressure Rating: 175psig at 180 deg F
      4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

5. Dielectric-Flange Insulating Kits:
6. Products: Subject to compliance requirements, provide one of the following:
   a. M&P

   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.

7. Dielectric Nipples:
8. Products: Subject to compliance requirements, provide one of the following:
   a. PPP Inc

   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.

2.07 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

PART 3 - EXECUTION

3.01 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. 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.
K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. 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.
2. 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.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

L. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 2 and smaller; 1 percent downward in direction of flow for piping NPS 3 to NPS 6; 1/2 percent downward in direction NPS 8 and larger.
2. 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 aboveground copper tubing according to CDA's "Copper Tube Handbook."
P. Install PVC piping in accordance with ASTM D 2665 and/or ASTM D 2321, and manufacturers recommendations..
Q. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
3. 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. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. 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 waste gravity-flow piping.

a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
U. Install sleeves for piping penetrations of walls, ceilings, and floors.
V. Install sleeve seals for piping penetrations of concrete walls and slabs.
W. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.03 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. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
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. PVC and CPVC, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Solvent cement joints: Join according to ASTM D2855 or F3328 and manufacturer recommendations.

3.04 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste 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 nipples/unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits and/or nipples.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.05 INSTALLATION OF HANGERS AND SUPPORTS

A. 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.

B. Install hangers for cast-iron, steel and copper soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for CPVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
F. Support vertical runs of cast iron, steel and copper soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
G. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.06 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 waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste 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 waste 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 or in pit with pit 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 waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.07 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.
B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.08 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 waste 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.

    a. 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 waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. 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.

    a. 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.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. 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.
7. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

    a. Isolate test source and allow to stand for four hours.
    b. Leaks and loss in test pressure constitute defects that must be repaired.

8. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
9. Prepare reports for tests and required corrective action.

3.09 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.
B. Protect sanitary waste and vent piping 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 PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
B. Aboveground, soil and waste piping 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 hubless; CISPI, hubless-piping couplings; and coupled joints.
3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
5. **PVC piping shall not be allowed for above ground piping.**

C. Underground, soil, waste, and vent piping shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed, calking materials; and calked joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.
3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashing assemblies.
2. Section 077200 "Roof Accessories" for preformed flashings.
3. Section 078413 "Penetration Firestopping" for through-penetration firestop assemblies.
4. Section 221423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.03 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.
B. PVC: Polyvinyl chloride.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings:

1. Show fabrication and installation details for frost-resistant vent terminals.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.02 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Watts
    b. Zurn
2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hub and spigot, Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed, open for airflow unless subject to backflow condition.
8. Extension: ASTM A74, Service Class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Watts
    b. Zurn Wilkens
2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze; made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

C. Extendable, Plastic Backwater Valves:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Rector Seal Clean Check
2. Size: Same as connected piping.
3. Body: PVC
4. Cover: Same material as body with threaded access to check valve.
5. Check Valve: Removable swing check.
6. End Connections: Socket type.

2.03 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Products: Subject to compliance requirements, provide one of the following:
    a. Mifab
    b. Watts
    c. Zurn Wilkens
2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

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

b. Watts
c. Zurn Wilkens

2. Standard: ASME A112.36.2M for adjustable housing, cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing Cast-iron soil pipe with cast-iron ferrule, Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Closure: Brass plug with tapered threads
7. Adjustable Housing Material: Cast iron] with threads
8. Frame and Cover Material and Finish: Nickel-bronze, copper alloy, Polished bronze
9. Frame and Cover Shape: Round.
10. Top-Loading Classification: Medium Duty.
11. Riser: ASTM A74, Service Class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Products: Subject to compliance requirements, provide one of the following:
   a. Mifab
   b. Watts
   c. Zurn Wilkens
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch] [Hubless, cast-iron soil pipe test tee] as required to match connected piping.
5. Closure Plug:

   a. [Brass] [Cast iron].
   b. [Countersunk] [or] [raised] head.
   c. Drilled and threaded for cover attachment screw.
   d. Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access, Cover Plate: Round, flat, stainless steel cover plate with screw.
7. Wall Access, Frame and Cover: Square, stainless steel wall-installation frame and cover.

2.04 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains :

1. Description: Shop or field fabricate from ASTM A74, Service Class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

   a. NPS 2: 4-inch minimum water seal unless noted otherwise.

C. Floor-Drain, Trap-Seal Primer Fittings :

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 6 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 2 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
E. Assemble open drain fittings and install with top of hub a minimum of 1 inch above floor.
F. Install deep-seal traps on floor drains and other waste outlets, if indicated.
G. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
I. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
J. Install vent caps on each vent pipe passing through roof.
K. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
L. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
M. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
N. Install wood-blocking reinforcement for wall-mounting-type specialties.
O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment, to allow service and maintenance.

3.03 LABELING AND IDENTIFYING

A. 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.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 42 13
COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Floor-mounted, bottom-outlet water closets.
2. Wall-mounted water closets.
3. Flushometer valves.
4. Toilet seats.
5. Supports.

B. Related Requirements:

1.03 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

1.04 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 water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.01 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets, Floor Mounted, Bottom Outlet, Close-Coupled Flushometer Tank:

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

a. American Standard
b. Kohler
c. Toto

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASSE/ASME 1037/CSA B125.37.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Gravity; Pressure assisted.
e. Rim Contour: Elongated.
f. Water Consumption: Maximum 1.25 gal per flush.
g. Color: White

3. Bowl-to-Drain Connecting Fitting: ASTM A1045 or ASME A112.4.3.
4. Toilet Seat: closed front with cover and self-sustaining check hinges.

2.02 WALL-MOUNTED WATER CLOSETS

A. Water Closets - Wall Mounted, Top Spud:

1. Products: Subject to compliance requirements, provide one of the following:
a. American Standard
b. Kohler
c. Toto
2. Source Limitations: Obtain water closets from single source from single manufacturer.
3. Bowl:

a. Material: Vitreous china.
b. Type: Siphon jet.
c. Style: Flushometer valve.
d. Mounting Height: **Standard and ADA compliant**. Refer to architectural series for mounting heights.
e. Rim Contour: Elongated.
f. Water Consumption: **1.28 gal.** per flush.
g. Spud Size and Location: NPS 1-1/2; top.
h. Color: **White**.

4. Toilet Seat: Open front, less cover with self-sustaining check hinges.
5. Support: Concealed floor mounted narrow wall w**ater-closet carrier**.

2.03 FLUSHOMETER VALVES

A. Flushometer Valves - Piston, Sensor Operated, Battery Powered:

1. Products: Subject to compliance requirements, provide one of the following:
a. American Standard
b. Kohler
c. Zurn
2. Source Limitations: Obtain flushometer valve from single source from single manufacturer.
3. Minimum Pressure Rating: 125 psig
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Style: **Exposed**.
7. Exposed Flushometer-Valve Finish: Chrome-plated.
8. Panel Finish: Chrome-plated or stainless steel.
9. Trip Mechanism: Battery-powered electronic sensor; listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and application.

10. Consumption: 1.**28 gal.** per flush.
11. Minimum Inlet: NPS 1
12. Minimum Outlet: NPS 1-1/4

2.04 TOILET SEATS

A. Toilet Seats :

1. Products: Subject to compliance requirements, provide one of the following:
    a. American Standard
    b. Bemis
    c. Church
    d. Kohler
    e. Toto
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial; Standard
5. Shape: Elongated rim, open front
6. Hinge: Self-sustaining, check
7. Hinge Material: Noncorroding metal.
8. Color: White

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
B. Examine walls and floors for suitable conditions where water closets will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.
E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.04 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
B. Adjust water pressure at flushometer valves to produce proper flow.
C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
B. Install protective covering for installed water closets and fittings.
C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 14
COMMERCIAL URINALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Wall-hung urinals.
2. Supports.

1.03 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 urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.01 WALL-HUNG URINALS

A. Urinals - Wall Hung, Back Outlet, Siphon Jet: Standard and ADA Compliant

1. Products: Subject to compliance requirements, provide one of the following:
    a. American Standard
    b. Kohler
    c. Toto
2. Fixture:

    a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5/CSA B45.15.
    b. Material: Vitreous china.
    c. Type: Washdown action
    d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.

e. Water Consumption: 0.5 gpf
f. Spud Size and Location: NPS 3/4; top
g. Outlet Size and Location: NPS 2; back
h. Color: White
i. Flush valve included with urinal.

3. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2.

4. Support: Type I urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.
5. Urinal Mounting Height: Refer to architectural series for mounting heights

2.02 SUPPORTS

A. Type I Urinal Carrier:

1. Products: Subject to compliance requirements, provide one of the following:
a. Mifab
b. Watts
c. Zurn
2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
B. Examine walls and floors for suitable conditions where urinals will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to rough-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC A117.1.
4. Install trap-seal liquid in waterless urinals.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 PIPING CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.04 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
B. Adjust water pressure at flushometer valves to produce proper flow.
C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
B. Install protective covering for installed urinals and fittings.
C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 16
COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Vitreous-china, counter-mounted lavatories.
2. Manually operated lavatory faucets.
3. Supply fittings.
4. Waste fittings.
5. Lavatory supports.

1.03 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 lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1.06 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.01 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory - Rectangular, Vitreous China, Undercounter Mounted:

1. Products: Subject to compliance requirements, provide one of the following:
    a. American Standard
    b. Kohler
    d. Toto
2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For undercounter mounting.
c. Nominal Size: Rectangular, 19 by 16 inches
d. Faucet-Hole Punching: No holes.
e. Faucet-Hole Location: On countertop.
f. Color: White
g. Mounting Material: Sealant and undercounter mounting kit.

2.02 ENAMELED, CAST-IRON, COUNTER-MOUNTED LAVATORIES

A. Lavatory - Enameled, Cast Iron, Undercounter Mounted:

1. Products: Subject to compliance requirements, provide one of the following:
   a. American Standard
   b. Kohler
   d. Toto
2. Fixture:

   a. Standard: ASME A112.19.1/CSA B45.2.
   b. Type: For undercounter mounting.
   c. Faucet-Hole Punching: No holes.
   d. Faucet-Hole Location: On countertop.
   e. Color: White.
   f. Mounting Materials: Sealant and undercounter mounting kit.

2.03 VITREOUS-CHINA, COUNTER MOUNTED LAVATORIES

A. Lavatory - Self-Rimming, Vitreous China, Counter Mounted:

1. Products: Subject to compliance requirements, provide one of the following:
   a. American Standard
   b. Kohler
   c. Zurn
2. Fixture:

   a. Standard: ASME A112.19.2/CSA B45.1.
   b. Type: Self-rimming for above-counter mounting.
   c. Faucet-Hole Punching: One hole; Three holes, 4-inchcenters; Three holes, 8-inch centers.
   d. Faucet-Hole Location: Top.
   e. Color: White.
   f. Mounting Material: Sealant.

2.04 MANUALLY OPERATED LAVATORY FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets - Manual Type: Two-Handle Mixing; Commercial:

1. Products: Subject to compliance requirements, provide one of the following:
   a. American Standard
   b. Delta

c. Kohler
d. Moen
2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: Widespread
5. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
6. Finish: Polished nickel and Matte Black
7. Maximum Flow Rate: 1.2 gpm.
8. Mounting Type: Deck, exposed
9. Valve Handle(s): lever.
10. Spout: Rigid; Rigid
11. Spout Outlet: Aerator
12. Operation: Compression, manual

2.05 AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
B. Lavatory Faucets - Automatic Type: Battery Electronic Sensor Operated, Nonmixing:

1. Products: Subject to compliance requirements, provide one of the following:
a. American Standard
b. Delta
c. Kohler
d. Moen
2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. 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.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole
6. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
7. Finish: Champagne Bronze.
8. Maximum Flow Rate: 0.5 gpm.
9. Mounting Type: Deck.
10. Spout: Rigid, gooseneck type.
11. Spout Outlet: Laminar flow.
12. Drain: Grid drain with overflow and tailpiece with brushed modern brass finish

2.06 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
B. Standard: ASME A112.18.1/CSA B125.1.
C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
E. Operation: Loose key; Wheel handle

F. Risers:

1. NPS 1/2
2. Chrome-plated, soft-copper flexible tube

2.07 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.
B. Drain: Grid type with NPS 1-1/4 straight tailpiece.
C. Trap:

1. Size: NPS 1-1/4
2. Material:

a. Polished nickel finish in public areas and chrome plated in non public areas, two-piece, cast-brass trap and swivel elbow with brass tube to wall and polished nickel finish in public areas and chrome-plated in non public areas, brass wall flange.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
B. Examine counters and walls for suitable conditions where lavatories will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install lavatories level and plumb in accordance with roughing-in drawings.
B. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.
C. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.
B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.
D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 23
COMMERCIAL SHOWERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Individual showers.
2. Shower heads and shower valves.
3. Shower basins.
4. Group showers.
5. Outdoor showers.
6. Grout.

B. Related Requirements:

1.03 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.
B. PMMA: Polymethyl methacrylate; also known as "acrylic."

1.04 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 showers.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower valves to include in maintenance manuals.

1.06 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. Shower Valve Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Shower Valve Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Shower valves intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by

an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.02 SHOWER HEADS AND SHOWER VALVES

A. Shower Head with Single-Handle, Pressure-Balanced Mixing Valve:

1. Products: Subject to compliance requirements, provide one of the following:
    a. American Standard
    b. Delta faucet
    c. Kohler
    d. Moen
    e. Proflo
    f. Symmons
2. Source Limitations: Obtain shower heads and shower valves from single source from single manufacturer.
3. Description: Single-handle, accessible, pressure-balance mixing valve with hot- and cold-water indicators; diverting valve, check stops; and hose with handheld shower head on sliding rod shower head.
4. Shower Valve:

    a. Standards:ASME A112.18.1/CSA B125.1and
       ASSE 1016/ASME A112.1016/CSA B125.16.
    b. Body Material: Solid brass.
    c. Finish: Polished nickel finish or matte black
    d. Mounting: Exposed
    e. Antiscald Device: Integral with mixing valve
    f. Check Stops: Check-valve type, integral with or attached to body.

5. Supply Connections: NPS 1/2
6. Shower Head:

    a. Standard: ASME A112.18.1/CSA B125.1.
    b. Type: Fixed and Handheld
    c. Shower Head Maximum Flow Rate: 1.75 gpm,
    d. Shower Head Material: Metallic with polished nickel finish or matte black
    e. Spray Pattern: Adjustable Fixed

2.03 GROUT

A. Standard: ASTM C1107/C1107M, 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

3.01 EXAMINATION

A. Examine rough-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.
B. Examine walls and floors for suitable conditions where showers will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.
B. Install showers level and plumb.
C. Install ball valves in water-supply piping to the shower if supply stops are specified with the shower valve. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping". Install valves in locations that are accessible for ease of operation.
D. Install shower flow-control fittings with specified maximum flow rates in shower arms.
E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.
F. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.
B. Adjust water pressure at shower valves to produce proper flow.

3.05 CLEANING AND PROTECTION

A. After completing installation of showers and basins, inspect and repair damaged finishes.
B. Clean showers and basins, shower valves, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed fixtures and fittings.
D. Do not allow use of showers and basins for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 01 00
GENERAL PROVISIONS, MECHANICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
   1. Mechanical work covered by all sections within DIVISION 23 - MECHANICAL of these Specifications, including but not limited to:
      a. Heating, ventilating, and air conditioning systems and equipment.
      b. Plumbing systems and equipment.

1.02 REFERENCE STANDARDS, CODES, FEES AND UTILITY CONNECTION CHARGES

A. Local codes.
B. Standard Building Codes.
C. State Codes.
D. FM - Factory Mutual.
E. Federal Codes.
F. ASME Boiler Code.
G. AGA - American Gas Association.
H. ASH RAE - American Society of Heating, Refrigerating and Air Conditioning Engineers.
I. AABC - Associated Air Balance Council.
J. ADC - Air Diffusion Council.
K. IEEE - Institute of Electrical Electronic Engineers.
L. ANSI - American National Standards Institute.
M. ASME - American Society of Mechanical Engineers.
N. NEMA - National Electrical Manufacturer's Association.
0. NFPA - National Fire Protection Association.
P. ARI - Air-Conditioning and Refrigeration Institute.
Q. UL - Underwriters Laboratories, Inc.
R. NBC - National Building Code.
S. NMC - National Mechanical Code.
T. NPC - National Plumbing Code.
U. OSHA - Occupational Safety and Health Act.
V. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc.
W. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories (UL), proof of such conformance shall be submitted for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified.
X. Contractor shall make arrangements with utility company(ies) for their services and metering work. Pay all charges therefor and include the cost thereof in the contract price.

1.03 QUALITY ASSURANCE

A. Supply all equipment and accessories new and free from defects.
B. Products Criteria:

   1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least two years

prior to bid opening. Provide list of users upon request.

2. Equipment having less than a two-year use record, which in the opinion of the Engineer, provides significant benefits to the Owner such as improved energy efficiency, will be acceptable if it is a product of a manufacturer who has been regularly engaged in the manufacture of that specific type of product which has been used in similar applications for a period of two years. The Architect/Engineer reserves the right to require the Contractor to submit evidence to this effect for his approval.
3. Equipment Service: Products shall be supported by a service organization which maintains an adequate inventory of repair parts and is located, in the opinion of the Architect/Engineer, reasonably close to the site.
4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

C. Equipment Vibration Tolerance:
   1. After air and/or water balance work is completed and permanent drive mechanisms are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

D. Welding: Before any welding is performed submit a copy of the Welding Procedure Specification (WPS) together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code.

   1. Before any welder performs any welding, submit a copy of the Manufacturer's Record of Welder or Welding Operator Qualification Tests as required by Section IX of the ASME Boiler and Pressure Vessel Code. The letter or symbol (as shown on the qualification test form) shall be used to identify the work of that welder and shall be affixed in accordance with appropriate construction code, to each completed weld.
   2. The types and extent of non-destructive examinations required for pipe welds are shown in Table 136.4 of the Code for Pressure Piping, ANSI/ASME B31.1.

E. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.3 of this section and with all applicable national, state, and local codes.

F. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished for record to the Architect/Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations may be cause for rejection of the material.

G. When included, reflected ceiling plan drawings shall govern over mechanical and electrical drawings for location of ceiling-installed elements.

H. In addition to all requirements specified hereinafter, each material and equipment item shall have all features as standard with its manufacturer and/or required for the complete operational system.

I. Capacities, ratings, sizes, and other requirements not specified hereinafter shall be as scheduled or otherwise indicated on the drawings.

J. Should the Contractor at any time discover a discrepancy in the drawings or with respect to a variance of code requirements, he shall notify the Architect/Engineer for clarification and shall not proceed with the work affected until clarification has been made.

1.04 SUBMITTALS

A. Submittals and shop drawings shall be submitted in accordance with these CONTRACT DOCUMENTS and in accordance with the following:

1. Submit shop drawings, manufacturers data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and have them approved before procurement, fabrication, or delivery of the items to the job site. Partial submittals will not be acceptable and will be returned without review. All equipment, material, and manufacturer's literature shall be submitted for approval at one time and in a tabulated binder. Control drawings and the controls equipment submittal may be submitted at a later time, but as soon as practical after the contract has been awarded and after the general equipment submittal has been made. However, every attempt shall be made to include the complete controls submittal with the general equipment submittal at one time.
2. The submittal shall include summary cover sheet(s) and manufacturer’s literature under each tab of the submittal binder which together clearly indicate compliance or deviation from the specifications and drawings.
3. Submission material and all shop drawings shall be marked with the appropriate identification relating the equipment to the drawings. Mark and reference each item on the submittal summary sheet and the manufacturer's literature to the appropriate paragraph number in the specifications. Manufacturer's standard catalogs will not be accepted.
4. Failure to comply with the above for a complete and clear submittal may result in resubmittal.

B. Operating instructions and parts lists.

1. Before requesting acceptance of work, furnish the number of printed and hardback bound sets required.
2. Equipment and systems.
   a. Complete description of equipment and systems and basic operating features.
   b. Manufacturer's name, model number, service manual, spare parts list, and descriptive literature for all components
3. Maintenance instructions.
4. Listing of possible breakdown and repairs.
5. Instruction for starting and operation.
6. Detailed and simplified one line, color coded flow and wiring diagrams.
7. Schedule of valve identification.

1.05 JOB CONDITIONS

A. Examine related work and surfaces before starting work of any section.

1. Report in writing, conditions which will prevent proper provision of this work.
2. Installed work which interferes with architectural or any other work, or which deviates from drawings and specifications without prior approval, shall be altered by contractor, without cost to Owner, to clear such interferences, or to comply with the drawings and specifications. Interferences or discrepancies which may be discovered or anticipated shall be reported promptly. Architect/Engineer shall have privilege of making minor changes without additional cost, provided that such changes are made before commencing work on items involved.

B. Continuity of Services and Connections to Existing Work:

1. At no additional cost to Owner, provide all necessary temporary connections and temporary facilities to accomplish the required continuity of services and existing operations.
2. Arrange all work to interfere as little as possible with the normal existing operations. Do not interrupt any existing utility or other service or existing operation at any time without Owner's prior approval. After each interruption has been made, make all necessary connections and alterations, and restore services and avoid interferences with normal existing operations as quickly as possible.
3. Install new work and connect to existing work with minimum interference to existing facilities and maintain water and air tightness when applicable.
4. Temporary shutdowns of existing services:
   a. At no additional charges.
   b. At times not to interfere with normal operation of existing facilities.
   c. Only with written consent of Owner.
5. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.
6. Connect new work to existing work in neat and satisfactory high quality workmanship manner.
7. Restore existing disturbed work to original or better conditions.

1.06 ACCURACY OF DATA AND DRAWINGS

A. Drawings are generally diagrammatic, and where not dimensioned or detailed, indicated approximate locations of work. Examine carefully existing buildings and structures, existing systems, and all other contract drawings, and install work to conform as nearly as possible to locations and arrangements indicated, with only such minor adjustments as necessary to coordinate mechanical work with other work, and to avoid interferences therewith. All piping and ductwork, offsets, rises, and fittings are not necessarily shown; however, provide these as required by the conditions involved.

B. Building and structure dimensions: TAKE THESE FROM ARCHITECTURAL AND FROM ACTUAL MEASUREMENTS OF EACH EXISTING BUILDING AND EACH EXISTING STRUCTURE INVOLVED.

1.07 COORDINATION

A. Carefully examine the architectural, electrical, heating and air-conditioning, plumbing, fire protection, structural, and site plan drawings and specifications, and coordinate this work among trades to avoid delay.

B. In general, permanent openings or knockout panels are provided to permit only future service or replacement of system components, not the entire assembly. The Contractor shall coordinate his equipment delivery with construction progress so that installation may be made in an orderly manner.

C. The structural design is based on installed locations of the equipment only. Any necessary shoring or other protection necessary for moving heavy equipment to installed location is the responsibility of the Contractor. Take extra precautions in using any existing structure for hoisting or temporary support.

D. Wherever piping, conduits, ducts, or other items are to run in the same general direction, elevation, or location, coordinate for the proper allocation of the space position. If necessary, consult the Architect/Engineer, whose decision shall be final.

E. Wherever work is to be concealed or installed above ceilings, maintain adequate clearance to allow for access, repairs, and removal of all devices.

F. Coordinate setting of sleeves, anchor bolts, and inserts as required to accommodate equipment before concrete is set and masonry is placed.

1.08 ELECTRICAL CHARACTERISTICS, MOTORS, MOTOR STARTERS, CONTROLS, AND WIRING

A. Electrical Characteristics: Refer to electrical section for electrical characteristics of motors specified or scheduled under the Mechanical Section.
B. Motor Sizes: Motor horsepowers specified in Mechanical Section and/or indicated on mechanical drawings are approximate and are not intended to limit motor sizes. Each motor shall be of proper size to operate continuously the actual equipment driven thereby, without overload on motor under all operating conditions, except as otherwise specified.
C. Motor starters and other electrical control devices: Generally, motor starters for equipment motors shall be furnished by contractor. Also, provide electrical control devices required for the Mechanical system, unless otherwise specified.
D. All motor starters shall comply with specifications for motor starters as specified in DIVISION 23.
E. In addition to the items specified in DIVISION 23, starters that operate in parallel with other starters shall be equipped with auxiliary contacts on the main disconnect for breaking one leg of the control power. In these cases, the secondaries of the starter transformers shall be properly phased.
F. Installation of electrical devices, EXCEPT those factories mounted on equipment: electrical control devices which require electrical connections ONLY, shall be installed by contractor; electrical control devices which required piping, linkage, remote bulb, or other mechanical connections IN ADDITION TO electrical connections, shall be installed by contractor, ready for electrical connections. Electric wiring: All electric wiring required to operate the mechanical systems, EXCEPT wiring which is factory installed on equipment, shall be done by contractor, in accordance with approved wiring diagrams which shall be furnished by this Section.
G. Install name plates with full data on all motors, starters, and disconnect switches.

1.09 TRANSPORTATION AND HANDLING

A. Pay all transportation and handling charges. Immediately report any damage to equipment received to the carrier so that job progress will not be delayed.
B. All items received by the Contractor shall be left in their original containers, or as shipped, where possible, until installed in final locations.
C. All items shall be protected from the elements. If stored outside, provide blocking to raise the base of each item well above ground and/or water levels.
D. Provide additional protection for items subject to damage, where necessary, so that when installed, the items will be in new condition.
E. Supply electrical items that might be damaged by condensation with heated air in an enclosed area until placed into service.

1.10 CUTTING AND PATCHING

A. Execute cutting (including excavating), fitting, and patching of work required to:

1. Make several parts fit properly.
2. Uncover work to provide for installation of ill-timed work.
3. Remove defective work.
4. Remove work not complying with the requirements of the contract documents.
5. Remove samples of installed work as specified for testing.
6. Where work is cut for any reason, restore cut and damaged areas with new materials meeting requirements of the contract documents.

B. In addition to the requirements above and upon written instructions of the Architect/ Engineer, provide cutting, fitting, and patching to:

1. Uncover work to provide observation of covered work.
2. Remove samples of installed materials for testing.

C. Do not endanger work by cutting or altering work or any part of it.

D. Prior to cutting that affects structural safety of project, submit written notice to Architect/Engineer requesting consent to proceed with cutting, including:

1. Identification of project.
2. Description of affected work.
3. Necessity for cutting.
4. Effect on other work and on structural integrity of project.
5. Description of proposed work. Designate scope of cutting and patching, trades to execute work, products proposed to be used, and extent of refinishing.
6. Alternatives to cutting and patching.
7. Designation of party responsible for cost of cutting and patching.

E. Prior to cutting and patching done on the instruction of the Architect/Engineer, submit cost estimate.

F. Should conditions of work or schedule indicate the need for change of materials or methods, submit written recommendations Architect/Engineer, including conditions indicating the need for change, recommendations for alternative materials or methods, submittals as required for substitution of materials, and cost estimate for changing materials or methods.

G. Submit written notice designating time work will be uncovered to provide for observation.

H. Costs caused by ill-timed or defective work and work not complying with requirements of the contract documents, including costs of additional services of Architect/Engineer, shall be borne by the party responsible for the ill-timed, defective, or non-complying work.

1.11 INSTRUCTION TO OWNER/OPERATING PERSONNEL

A. The Contractor shall furnish the services of factory trained instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. The instruction will be for a minimum of 8 hours unless otherwise noted. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given after the equipment or system has been accepted for regular operation. When significant changes or modifications in the equipment or system are made under the terms of the contract, additional instruction shall be provided to acquaint the operating personnel with the changes or modifications.

PART 2 PRODUCTS

2.1 MATERIALS, SUBSTITUTIONS, AND PRODUCT OPTIONS

A. Manufacturers or Trade Names:

1. The use of manufacturer's names and catalog numbers in these specifications or on the drawings indicates the type, size, rating, capacity, design, quality, or kind of materials required, and a closed specification is not intended, and similar and equal products of any reputable manufacturer which will satisfactorily perform the required functions will be acceptable, unless otherwise indicated by the words NO SUBSTITUTES, or unless otherwise specifically stated. The Architect/Engineer reserves the right to reject all materials which he deems not equal to those specified, or which he decides will not satisfactorily perform the required functions.
2. Any manufacturer providing equipment for this project shall provide a written guarantee to the Contractor stipulating that any parts used in the equipment so provided will be readily available for a minimum of ten years from date of shipment from the factory. The Contractor shall, in turn, provide the Owner with these guarantees in the brochures submitted covering all the equipment used.

PART 3 EXECUTION

3.01 FIELD TESTS

A. All piping shall be free of leaks, and test gauges shall show no loss of pressure for at least 30 minutes after source of test pressure has been cut off, or as noted. Pipes may be tested in sections as the work progresses. Repair and retest all sections failing to pass tests, as required to obtain approval of tests. No caulking, welding, or brazing will be permitted on threaded pipe or fittings to stop leaks. Replace with new material all cracked or otherwise defective pipe and fittings of all types, as approved. Furnish suitable testing equipment, give all applicable authorities ample advance notice of all proposed tests and readiness of work for inspections, and advance notice of all proposed tests and readiness of work for inspections, and conduct each test in their presence, as approved. Do not conceal or insulate piping and do not conceal ductwork until all inspections have been made and all required tests have been approved by all applicable authorities. Submit results for review.

B. Provide required labor, material, equipment, and connections.

C. Test all piping, EXCEPT as otherwise specified below, as follows: hydrostatic test, at 150 percent of normal operating pressure of piping involved, or 100 psi, whichever is higher, AFTER removing all air from piping involved in test.

1. Natural gas and fuel oil piping: 50 psi test using air or inert gas.
2. Test all equipment in accordance with sections specified hereinafter.

D. Test all ductwork in accordance with leakage test method recommended in latest edition of SMACNA "HVAC Duct Construction Standards - Metal and Flexible". After remedying audible leaks, total leakage on system shall not exceed one percent of system total design air flow rate.

3.02 ADJUSTING AND CLEANING

A. Flush or blow all welding slag, pipe joint compound, loose scale, and other debris from pipework before connecting equipment thereto.

B. After systems have been tested and before any field painting is commenced, clean up all work thoroughly. Remove all foreign matter which has accumulated in ducts, casings, enclosures, fixtures, and equipment. Clean and polish all valves, plates, and other surfaces that are not to be painted, so that they present a new and acceptable appearance.

C. Put systems in operation, test all fixtures and other equipment, remedy all leaks and defects, make all necessary adjustments, and remove all air from water circulating systems. Adjust all air and water flows to indicated and/or required quantities, and adjust all controls and other items as required to balance system and provide uniform air flows and uniform temperatures in air conditioned areas. Demonstrate that all controls and mechanical equipment function satisfactorily, as specified, as indicated, and as approved.

D. Strainers and Dirt Pockets: Clean out each of these; REMOVE EACH STRAINER SCREEN FOR CLEANING.

E. Circulating Water Systems: Completely drain each of these, and refill with clean water.

F. Gas piping shall be cleaned in accordance with the requirements.

G. After systems have been tested and before putting any part of or the entire system in operation for Owner's beneficial use, ensure that all necessary adjustments have been made.

1. Bearings and other items requiring lubrication, except factory permanently lubricated type: lubricate each of these as recommended by its manufacturer; this includes lubricated type plug valves.
2. Belts: adjust each of these to proper tension.
3. Filters: replace each disposable ("throw-away") filter with a new clean filter (except blanket roll and high efficiency type). Clean each cleanable filter. NOTE: ALL FILTERS SHALL

BE IN PLACE DURING TESTING AND ADJUSTING.

4. Motor load tests: make an ammeter check of actual running current of each motor in mechanical system under operating conditions. Correct all motors which are found to be overloaded, as approved.

3.03 INSTALLATION

A. Equipment rooms and other areas in which equipment is to be installed have limiting dimensions - Install all mechanical work within these areas substantially as indicated, with ample unobstructed access space around each piece of equipment to facilitate proper installation, operation, and maintenance of equipment, and to allow ample space for plumbing, electrical, and other equipment indicated to be installed therein. Minor revisions in layout may be made subject to approval, but major changes in layout to accommodate proposed equipment which differs substantially from specified equipment in size and arrangement may not be considered or will be subjected to the provisions hereinbefore. Each bidder shall determine before bidding that equipment upon which he proposes to base his bid will conform to these requirements. Install each equipment item in accordance with its manufacturer's recommendations, and as indicated on the drawings, and/or specified. If the drawings and/or specifications conflict with the manufacturer's recommendations, report this to the Architect/Engineer for his decision before proceeding with the work involved.

B. Generally, install pipework and ductwork as follows unless otherwise indicated.

1. Finished areas: conceal pipework and ductwork within pipe chases, above suspended ceiling, and within other building construction, and other finished areas, unless otherwise indicated.
2. Unfinished areas: install aboveground pipework and ductwork exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impracticable, in mechanical and electrical equipment rooms, manufacturing areas, warehouse, or storage areas, and other unfinished areas.
3. ALL areas: install pipework and ductwork parallel or at right angles with beams, walls, ceilings, and other building lines, in straight lines between required direction changes, with vertical runs plumb. Install exposed pipework and ductwork as close as practicable to walls, columns, ceilings, and overhead construction, and to provide maximum headroom and minimum interference with usable building space.

3.04 REMOVAL AND RELOCATION OF EXISTING WORK

A. Disconnect, remove or relocate material, equipment, piping, and other work noted and required by removal or changes in existing construction.

B. Provide new material and equipment related for relocated equipment.

C. Plug or cap active piping or ductwork behind or below finish.

D. Do not leave long dead end branches:

1. Cap or plug as close to active line as possible.

E. Salvaged Existing Mechanical Materials and Equipment: Promptly haul away from Owner's premises all materials and equipment which are removed from existing system and are neither indicated nor required to be reused in the completed project, EXCEPT as otherwise specified. Owner may select certain removed existing materials and equipment and retain them for his future use. Before removing any existing materials and equipment, determine from Owner which of these materials and equipment he desires to retain. Remove all Owner selected materials and equipment without unnecessary damage thereto, and safely store them at locations designated by Owner.

3.05 CUTTING AND PATCHING

A. Inspect existing conditions of work, including elements subject to movement or damage during cutting and patching and excavating and backfilling.
B. After uncovering work, inspect conditions affecting installation of new products.
C. Provide shoring, bracing, and support required to maintain structural integrity of the project.
D. Provide protection for other portions of the project.
E. Provide protection from the elements.
F. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances and finishes.
G. Execute cutting and demolition by methods that prevent damage to other work and provide proper surfaces to receive installation of repairs and new work.
H. Refinish the entire surfaces where cutting and patching work occurs to provide an even, continuous surface to the nearest intersections. Where assemblies are damaged by cutting and patching, refinish entire assemblies.

3.06 PAINTING

A. All equipment shall be factory prime coated and painted, however, the following may be shop prime coated and made ready for painting:

1. Tanks.
2. Structural supports and frames.

B. Uncoated Hangers, Supports, Rods, and inserts shall be prime coated.
C. Exposed, uninsulated black steel piping, pipe supports, and pipe braces shall be prime coated.
D. Marred surfaces of prime coated or factory painted surfaces shall be painted and/or primed to match adjacent coat.

END OF SECTION

SECTION 23 05 00
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Concrete base construction requirements.
   3. Dielectric fittings.
   4. Flexible connectors.
   5. Mechanical sleeve seals.
   6. Equipment nameplate data requirements.
   7. Labeling and identifying mechanical systems and equipment is specified in Division 23 Section "Mechanical Identification."
   8. Nonshrink grout for equipment installations.
   9. Field-fabricated metal and wood equipment supports.
   10. Installation requirements common to equipment specification sections.
   11. Cutting and patching.
   12. Painting and finishing.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Construction Agreement and Division 1 Specification Sections, apply to this Section.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
D. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylonitrile-butadiene-styrene plastic.
   2. CPVC: Chlorinated polyvinyl chloride plastic.
   3. PVC: Polyvinyl chloride plastic.
E. The following are industry abbreviations for rubber materials:
   1. CR: Chlorosulfonated polyethylene synthetic rubber.
   2. EPDM: Ethylene propylene diene terpolymer rubber.

1.04 SUBMITTALS

A. Submittals and shop drawings shall be submitted in accordance with Division 1 - SUBMITTALS.

B. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and

identification materials and devices.

C. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

D. Coordination Drawings: For access panel and door locations.

1.05 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1. Dielectric Unions:
   a. Hart Industries International, Inc.
   b. Watts Industries, Inc.; Water Products Div.
   c. Zurn Industries, Inc.; Wilkins Div.
2. Dielectric Flanges:
   a. Capitol Manufacturing Co.
   b. Central Plastics Co.
   c. Watts Industries, Inc.; Water Products Div.
3. Dielectric Nipples:
   a. Grinnell Corp.; Grinnell Supply Sales Co.
   b. Perfection Corp.
   c. Victaulic Co. of America.

4. Metal, Flexible Connectors:
   a. Metraflex Co.
   b. Proco Products, Inc.
   c. Uniflex, Inc.
5. Mechanical Sleeve Seals:
   a. Calpico, Inc.
   b. Metraflex Co.
   c. Thunderline/Link-Seal.

2.02 PIPE AND PIPE FITTINGS

A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.
B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
E. Solder Filler Metals: ASTM B 32.
   1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
   2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
   3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.

4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: AWS A5.8.
1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvent cements for the following:
1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.04 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.05 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
   1. 2-Inch NPS (DN50) and Smaller: Threaded.
   2. 2-1/2-Inch NPS (DN65) and Larger: Flanged.
   3. Option for 2-1/2-Inch NPS (DN65) and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

2.06 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.07 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
   3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.08 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 3000-psi (34.5-MPa), 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise.

B. General Locations and Arrangements: 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.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and

service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Sleeves are not required for core drilled holes.

N. Permanent sleeves are not required for holes formed by PE removable sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. 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 (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
    b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
3. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
4. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

Q. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

T. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

5. 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:
   a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. 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.
6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. ABS Piping: ASTM D 2235 and ASTM D 2661.
   c. CPVC Piping: ASTM D 2846 and ASTM F 493
   d. PVC Pressure Piping: ASTM D 2672.
   e. PVC Nonpressure Piping: ASTM D 2855.
   f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.
9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
   a. Plain-End Pipe and Fittings: Use butt fusion.
   b. Plain-End Pipe and Socket Fittings: Use socket fusion.

U. Piping Connections: Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
   2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
   3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
   4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.02 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Designer.
C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
E. Install equipment giving right of way to piping installed at required slope.
F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.03 PAINTING AND FINISHING

A. Apply paint to exposed piping according to the following, unless otherwise indicated:
   1. Interior insulated piping: Use two coats of semi-gloss, acrylic-enamel finish. Paint to match the existing.
   2. Interior or Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer. Paint to match existing.
   3. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
   4. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

B. Paint piping specialties to match piping.
C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.04 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.05 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
B. Repair cut surfaces to match adjacent surfaces.

3.06 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
B. Clean surfaces that will come into contact with grout.
C. Provide forms as required for placement of grout.
D. Avoid air entrapment during placing of grout.
E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.
G. Place grout around anchors.
H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

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. Equipment supports.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 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 HVAC 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.

1.05 ACTION SUBMITTALS

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

1.06 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.07 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

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.02 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.

2.03 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

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

    a. Cooper B-Line, Inc.
    b. Unistrut Corporation; Tyco International, Ltd.
    c. 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.

2.04 THERMAL-HANGER SHIELD INSERTS

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

1. Piping Technology & Products, Inc.
2. Rilco Manufacturing Co., Inc.
3. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.
C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa 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 (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [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.

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 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 (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 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.

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 (100 mm) 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. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
I. Install lateral bracing with pipe hangers and supports to prevent swaying.
J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
M. 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 (DN 100) 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 (DN 100) 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 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

5. Pipes NPS 8 (DN 200) 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.

3.02 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.

3.03 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.

3.04 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 (40 mm)
C. PAINTING

D. 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 (0.05 mm).

E. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.05 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. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
3. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
6. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

E. 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 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

F. 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 (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) 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 (49 to 232 deg C) piping installations.

G. 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 (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

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.

H. 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.

I. 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 (32 mm).
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 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.
7. 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.

J. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
K. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

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. Air-spring isolators.
11. Restrained-air-spring isolators.
12. Elastomeric hangers.
13. Spring hangers.
14. Snubbers.
15. Restraint channel bracings.
16. Restraint cables.
17. Seismic-restraint accessories.
18. Mechanical anchor bolts.
19. Adhesive anchor bolts.
20. Vibration isolation equipment bases.
21. Restrained isolation roof-curb rails.

1.03 DEFINITIONS

A. IBC: International Building Code.
B. ICC-ES: ICC-Evaluation Service.
C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer

C. Welding certificates.

D. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For restrained-air-spring mounts to include in operation and maintenance manuals.

1.07 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 professional engineer.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: See structural.

2. Assigned Seismic Use Group or Building Category as Defined in the IBC: See structural.

2.02 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

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

a. Kinetics Noise Control, Inc.
b. Mason Industries, Inc.

c. VMC group

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: Waffle pattern.

6. Infused nonwoven cotton or synthetic fibers.

7. Load-bearing metal plates adhered to pads.

2.03 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

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

a. Kinetics Noise Control, Inc.
b. Mason Industries, Inc.
c. VMC Group

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.

2.04 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 the following:

a. VMC Group
b. Kinetics Noise Control, Inc.
c. Mason Industries, 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 of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
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.

2.05 SNUBBERS

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

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. VMC Group

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.

2.06 RESTRAINT CABLES

A. Provide no aircraft cable restraints. All seismic bracing to be rigid supports.

2.07 SEISMIC-RESTRAINT ACCESSORIES

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

1. VMC Group.
2. Kinetics Noise Control, Inc.
3. Mason Industries, 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 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 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.

2.08 MECHANICAL ANCHOR BOLTS

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

1. VMC Group.
2. Kinetics Noise Control, Inc.
3. 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.

PART 3 - EXECUTION

3.01 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 been corrected.

3.02 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

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.

3.03 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 Division 3.
B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
C. Equipment Restraints:

1. Install seismic snubbers on HVAC 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 (3.2 mm).
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

D. Piping Restraints:

1. Comply with requirements in MSS SP-127.

2. Space lateral supports a maximum of 40 feet on center, and longitudinal supports a maximum of 80 feet on center
3. Brace a change of direction longer than 12 feet (3.7 m).

E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.
F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
G. 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.

H. 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.

I. 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.

3.04 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 23 05 53
MECHANICAL IDENTIFICATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section includes mechanical identification materials and devices.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Construction Agreement and Division 1 Specification Sections apply to this Section.

1.03 SUBMITTALS

A. Submittals and shop drawings shall be submitted in accordance with Division 01.
B. Product Data: For identification materials and devices.

1.04 QUALITY ASSURANCE

A. Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

1.05 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 – PRODUCTS

2.01 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are for applications referenced in other Division 23 Sections. If more than single type is specified for listed applications, selection is Installer's option.
B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
   1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
   2. Location: Accessible and visible.
C. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
D. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive, vinyl type with permanent adhesive.
E. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.
F. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least 3 times letter height and of length required for label.
G. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
   1. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.

H. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3 mils (0.08 mm) thick.
   1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
   2. Color: Comply with ASME A13.1, unless otherwise indicated.

I. Valve Tags: Stamped or engraved with 1/4-inch (6-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
   1. Material: 3/32-inch- (2.4-mm-) thick plastic laminate with 2 black surfaces and a white inner layer.
   2. Material: Valve manufacturer's standard solid plastic.
   3. Size: 1-1/2-inches (40-mm) diameter, unless otherwise indicated.
   4. Shape: As indicated for each piping system.

J. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
K. Valve Tag Fasteners: Brass, wire-link chain; beaded chain; or S-hooks.
L. Access Panel Markers: 1/16-inch- (2-mm-) thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch (3-mm) center hole for attachment.
M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

   1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
   2. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
   1. Green: Cooling equipment and components.
   2. Yellow: Heating equipment and components.
   3. Brown: Energy reclamation equipment and components.
   4. Blue: Equipment and components that do not meet criteria above.
   5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
   6. Terminology: Match schedules as closely as possible. Include the following:
      a. Name and plan number.
      b. Equipment service.
      c. Design capacity.
      d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
   7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
   1. Size: 3-1/4 by 5-5/8 inches (85 by 145 mm).
   3 Fasteners: Brass grommets and wire.
   4 Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of me-

chanical systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

PART 3 – EXECUTION

3.01 LABELING AND IDENTIFYING PIPING AND DUCT SYSTEMS

A. Install pipe markers on each system. Include arrows showing normal direction of flow.
B. Marker Type: Stenciled markers complying with ASME A13.1.
C. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, non-insulated pipes.
D. Fasten markers on pipes and insulated pipes smaller than 6 inches (150 mm) OD by one of following methods:
   1. Snap-on application of pretensioned, semirigid plastic pipe marker.
   2. Adhesive lap joint in pipe marker overlap.
   3. Laminated or bonded application of pipe marker to pipe or insulation.
   4. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 3/4 inch (20 mm) wide, lapped a minimum of 1-1/2 inches (40 mm) at both ends of pipe marker, and covering full circumference of pipe.

E. Fasten markers on pipes and ducts 6 inches and larger by one of following methods:
   1. Laminated or bonded application of pipe marker to pipe or insulation.
   2. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 1-1/2 inches (40 mm) wide, lapped a minimum of 3 inches (75 mm) at both ends of pipe marker, and covering full circumference of pipe.
   3. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.

F. Locate markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations according to the following:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
   3. Near penetrations through walls, floors, ceilings, or non-accessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at a maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.02 VALVE TAGS

A. Install on control valves and control devices in piping systems.
B. Valve Tag Application Schedule: Tag valves according to size, shape, color scheme, and with captions similar to those indicated in the following:
C. Tag Material: Brass.
D. Tag Size and Shape: According to the following:
   1. Cold and Hot Water: 2 inches (50 mm), round.

E. Tag Color: According to the following:
   1. Cold Water: Blue.
   2. Hot Water: Red

F. Letter Color: According to the following:
   1. Cold and Hot Water: White.

G. Install mounted valve schedule in each major equipment room.

3.03 EQUIPMENT SIGNS AND MARKERS

A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:

   1. Pumps, chillers, condensers, and similar motor-driven units.
   2. Heat exchangers, cooling towers, and similar equipment.
   3. Fans, blowers, primary balancing dampers, and mixing boxes.
   4. Water-treatment systems, and similar equipment.
   5.

B. Plasticized Tags: Install within concealed space, to reduce amount of text in exposed sign outside concealment, if equipment to be identified is concealed above acoustical ceiling or similar concealment.

   1. Identify operational valves and similar minor equipment items located in unoccupied spaces, including machine rooms, by installing plasticized tags.

3.04 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.
B. Clean faces of identification devices and glass frames of valve charts.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

A. AABC: Associated Air Balance Council..
B. TAB: Testing, adjusting, and balancing.
C. TAB Specialist: An entity engaged to perform TAB Work.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
B. Certified TAB reports.

C. Sample report forms.
D. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.04 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

E. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.05 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.06 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
B. Perform TAB after leakage and pressure tests on distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
G. Examine test reports specified in individual system and equipment Sections.
H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.
J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
L. Examine operating safety interlocks and controls on HVAC equipment.
M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.
B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

C. Take and report testing and balancing measurements in inch-pound units.

3.04 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.05 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.

6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.06 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10
2. Air Outlets and Inlets: Plus or minus 10 percent

3.07 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.08 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Designer’s name and address.
6. Contractor's name and address.

7. Report date.
8. Signature of TAB supervisor who certifies the report.
9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
10. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer's name, type, size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from indicated values.
14. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.
8. Test Data (Indicated and Actual Values):

    a. Total air flow rate in cfm (L/s).
    b. Total system static pressure in inches wg (Pa).
    c. Fan rpm.
    d. Discharge static pressure in inches wg (Pa).
    e. Filter static-pressure differential in inches wg (Pa).
    f. Preheat-coil static-pressure differential in inches wg (Pa).
    g. Cooling-coil static-pressure differential in inches wg (Pa).
    h. Heating-coil static-pressure differential in inches wg (Pa).
    i. Outdoor airflow in cfm (L/s).
    j. Return airflow in cfm (L/s).
    k. Outdoor-air damper position.
    l. Return-air damper position.
    m. Vortex damper position.

E. Apparatus-Coil Test Reports:

1. Coil Data:

    a. System identification.
    b. Location.
    c. Coil type.

d. Number of rows.
e. Fin spacing in fins per inch (mm) o.c.
f. Make and model number.
g. Face area in sq. ft. (sq. m).
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Water flow rate in gpm (L/s).
i. Water pressure differential in feet of head or psig (kPa).
j. Entering-water temperature in deg F (deg C).
k. Leaving-water temperature in deg F (deg C).
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig (kPa).
n. Refrigerant suction temperature in deg F (deg C).
o. Inlet steam pressure in psig (kPa).

F. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h (kW).
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches (mm), and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm (L/s).
b. Entering-air temperature in deg F (deg C).
c. Leaving-air temperature in deg F (deg C).
d. Air temperature differential in deg F (deg C).
e. Entering-air static pressure in inches wg (Pa).
f. Leaving-air static pressure in inches wg (Pa).
g. Air static-pressure differential in inches wg (Pa).
h. Low-fire fuel input in Btu/h (kW).
i. High-fire fuel input in Btu/h (kW).

j. Manifold pressure in psig (kPa).
k. High-temperature-limit setting in deg F (deg C).
l. Operating set point in Btu/h (kW).
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h (kW).

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

H. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Entering-air temperature in deg F (deg C).
c. Leaving-air temperature in deg F (deg C).

I. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

2. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

J. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

K. Prepare test and inspection reports.

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor/Outdoor supply, return, exhaust and outdoor air duct insulation.

1.03 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).

1.04 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.

1.05 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.

1.06 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.

1.07 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork 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.

1.08 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

2.01 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type II for sheet materials.

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

    a. Aeroflex USA
    b. Armacell LLC
    c. K-Flex USA

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin and factory applied FSK jacket. Comply with ASTM C553, Type II and ASTM C1290. Factory-applied jacket requirements are specified in “Factory-Applied Jackets” article.

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

    a. CertainTeed Corp.; SoftTouch Duct Wrap.
    b. Johns Manville; Microlite.
    c. Owens Corning; SOFTR All-Service Duct Wrap.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
    b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-03/11-70.Mon-Eco Industries, Inc.; 22-25.

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).

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.

2.03 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).

2.04 JACKETS

A. Insulation system indicate with factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.05 FIELD-APPLIED JACKETS

A. Metal Jacket:

1. Provide jacket equal to RPR Products Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B209 Alloy 3003 with an H-14 temper, 0.016” thickness

PART 3 - EXECUTION

3.01 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.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout the length of ducts and fittings.
B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Keep insulation materials dry during application and finishing.
G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
H. Install insulation with least number of joints practical.
I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) on center.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) on center

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 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 (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Section 078413 "Penetration Firestopping" Firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) on center
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) on center each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not over compress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) on center Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) on center
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) on center

3.06 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.

3.07 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 (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) 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 (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) on center and at end joints.

3.08 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
B. Insulate duct access panels and doors to achieve same fire rating as duct.
C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.09 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below

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.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. All Supply return, and Outside air ducts.
2. Exhaust ductwork connected to energy recovery unit.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.

6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.11 DUCT AND PLENUM INSULATION SCHEDULE

A. Round and rectangular concealed and exposed single wall supply, outside air, return, make-up air, and exhaust air ducts connected to ERV shall be insulated with 2” thick mineral fiber blanket with “K” value of 0.27 at 75 degrees F, minimum 0.75 PCF density, and minimum “R” value of 6.0 per inch thickness at 75 degrees F.

B. Plenums shall be insulated with 1” thick flexible elastomeric insulation with “R” value of 4.2 per inch thickness at 75 degrees F, maximum service temperature of 250 degrees F, maximum density of 3.0 PCF, maximum velocity on coated air side of 6,000 FPM.

C. Internal lining in rectangular supply, outside air, return, make-up air, and exhaust ducts connected to ERV shall be 1” thick flexible elastomeric with “R” value of 6 per inch thickness at 75 degrees F, maximum service temperature of 250 degrees F, maximum density of 3.0 PCF, maximum velocity on coated air side of 6,000 FPM.

D. Return transfer ducts shall be lined with ½” thick flexible elastomeric with “R” value of 4.2 per inch thickness at 75 degrees F, maximum service temperature of 250 degrees F, maximum density of 3.0 PCF, maximum velocity on coated air side of 6,000 FPM.

E. Round and rectangular concealed and exposed single wall supply, outside air, return, make-up air, and exhaust air ducts connected to ERV located outside of building shall be insulated with 3” thick mineral fiber blanket with minimum “R” value of 8.0 per inch thickness at 75 degrees F.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes insulating HVAC piping systems

1.02 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.

1.03 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 and inspecting 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.

1.04 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.

1.05 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC 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.

1.06 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

2.01 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. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

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

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber, Preformed Pipe Insulation:

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

a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000-Degree Pipe Insulation.
c. Owens Corning; Fiberglas Pipe Insulation.

2. Preformed Pipe Insulation: Type I, Grade A with factory applied ASJ
3. 850 deg F (454 deg C).
4. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 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.

2.03 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).

2.04 FACTORY-APPLIED JACKETS

A. 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.

PART 3 - EXECUTION

3.01 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.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) 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.

3.03 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- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) on center
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) on center.

    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 (100 mm) 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. Manholes.
5. Handholes.
6. Cleanouts.

3.04 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 (50 mm) 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 (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07.

3.05 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 (50 mm) 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.

3.06 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.

3.07 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 (150 mm) on center
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 (25 mm), 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.

3.08 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.

3.09 PIPING INSULATION SCHEDULE

A. All chilled water piping shall be insulated with mineral-fiber, preformed pipe insulation 1-1/2” thick.

B. Hot water piping 3/4” and smaller than 1-1/2” shall be insulated with mineral-fiber, preformed pipe insulation 1-1/2” thick.

C. Hot water piping greater than or equal to 1-1/2” shall be insulated with mineral-fiber, preformed pipe insulation 2” thick.

D. Condensate piping shall be insulated with mineral-fiber, preformed pipe insulation 1” thick.

E. Refrigerant piping and tubing shall be insulated with flexible elastomeric insulation 1/2” thick. Insulation located outdoors shall be rated for outdoor applications. Exterior exposed insulation shall be UV resistant or provided with paint/shield to protect against UV radiation.

3.10 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. Provide as indicated on drawings.

END OF SECTION

SECTION 23 11 23
FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Manual gas shutoff valves.
5. Earthquake valves.
6. Pressure regulators.
7. Dielectric fittings.

1.02 DEFINITIONS

A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/8 inch per foot

C. Delegated-Design Submittal: For natural-gas piping and equipment 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 seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

C. Qualification Data: For qualified professional engineer.

D. Welding certificates.

E. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Steel Support 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.

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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating and protect from direct sunlight.

1.07 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted by Owner.

PART 2 - PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, seamless, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
3. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless-steel underground.

B. PE Pipe: ASTM D2513, SDR 11.

1. PE Fittings: ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11; and steel pipe complying with ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
    a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet.
    b. Aboveground Portion: PE transition fitting.
    c. Outlet shall be threaded or flanged or suitable for welded connection.
    d. Tracer wire connection.

e. Ultraviolet shield.
f. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated and leak tested.
   a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet connected to steel pipe complying with ASTM A53/A53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
   b. Outlet shall be threaded or flanged or suitable for welded connection.
   c. Bridging sleeve over mechanical coupling.
   d. Factory-connected anode.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
5. Plastic Mechanical Couplings, NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.
   a. PE body with molded-in, stainless-steel support ring.
   b. Buna-nitrile seals.
   c. Acetal collets.
   d. Electro-zinc-plated steel stiffener.
6. Plastic Mechanical Couplings, NPS 2 (DN 50) and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   a. Fiber-reinforced plastic body.
   b. PE body tube.
   c. Buna-nitrile seals.
   d. Acetal collets.
   e. Stainless-steel bolts, nuts, and washers.
7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   a. Stainless-steel flanges and tube with epoxy finish.
   b. Buna-nitrile seals.
   c. Stainless-steel bolts, washers, and nuts.
   d. Factory-installed anode for steel-body couplings installed underground.

2.02 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. End Fittings: Zinc-coated steel.
3. Threaded Ends: Comply with ASME B1.20.1.

2.03 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

2.04 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Cast-aluminum body with nickel-plated chrome steel internal parts.
2. Nitrile-rubber valve washer.
3. Sight windows for visual indication of valve position.
4. Threaded end connections complying with ASME B1.20.1.
5. Wall mounting bracket with bubble level indicator.

2.05 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.

B. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A 126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.06 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. Description:

a. Standard: ASSE 1079.

b. Pressure Rating: 125 psig minimum End Connections: Solder-joint copper alloy and threaded ferrous.

2.07 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

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

3.02 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

3.03 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
E. 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.
F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
G. Locate valves for easy access.
H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
I. Install piping free of sags and bends.
J. Install fittings for changes in direction and branch connections.
K. Verify final equipment locations for roughing-in.
L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
    1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
Q. Connect branch piping from top or side of horizontal piping.
R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
S. Do not use natural-gas piping as grounding electrode.
T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

3.04 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
B. Install underground valves with valve boxes.
C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.05 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.
B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
C. Threaded Joints:
    1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
    2. Cut threads full and clean using sharp dies.
    3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
    4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
    5. 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.
D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.06 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

3.07 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.
B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
C. Install piping adjacent to appliances to allow service and maintenance of appliances.
D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

3.09 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.10 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, piping.

1. Steel pipe with malleable-iron fittings and threaded joints.

3.11 INDOOR PIPING SCHEDULE FOR SYSTEM GREATER THAN 0.5 PSIG

A. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.

3.12 BELOW GRADE PIPING SCHEDULE

A. PE piping.

END OF SECTION

SECTION 23 31 13
METAL DUCTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
B. Single-wall rectangular ducts and fittings.
C. Double-wall rectangular ducts and fittings.
D. Single-wall round and flat-oval ducts and fittings.
E. Double-wall round and flat-oval ducts and fittings.
F. Sheet metal materials.
G. Sealants and gaskets.
H. Hangers and supports.
I. Seismic-restraint devices.

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7. Retain one of three subparagraphs below if retaining "SMACNA's 'Seismic Restraint Manual: Guidelines for Mechanical Systems'" option in paragraph above. If using other seismic design criteria, delete three subparagraphs below.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

B. Welding certificates.
C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

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

    a. Lindab Inc.
    b. SEMCO Incorporated.
    c. Sheet Metal Connectors, Inc.
    d. Spiral Manufacturing Co., Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

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

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Sheet Metal Connectors, Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: as noted on plans

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

2.04 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.05 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Sealant: Modified styrene acrylic.
3. Water resistant.
4. Mold and mildew resistant.
5. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
6. Service: Indoor and outdoor.
7. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
9. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.

2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
C. Install round and flat-oval ducts in maximum practical lengths.
D. Install ducts with fewest possible joints.
E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).
K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials during and after construction. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet (5 m).
F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Ductwork Accessories."
B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09.

3.07 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Duct System Cleanliness Tests:
   1. Visually inspect duct system to ensure that no visible contaminants are present.
   2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
      a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
C. Duct system will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

3.08 DUCT CLEANING

A. Clean duct system(s) before testing, adjusting, and balancing.
B. Use service openings for entry and inspection.
   1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Ductwork Accessories" for access panels and doors.
   2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
   3. Remove and reinstall ceiling to gain access during the cleaning process.
C. Particulate Collection and Odor Control:
   1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
   2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
D. Clean the following components by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
   4. Coils and related components.

5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.09 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION

SECTION 23 33 00
DUCTWORK ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling radiation dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Turning vanes.
10. Duct-mounted access doors.
11. Flexible connectors.
12. Duct accessory hardware.

1.03 ACTION SUBMITTALS

A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors.

e. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.06 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.01 ACCESS DOORS

A. Fabricate rigid and close-fitting hinged doors of galvanized steel with sealing gaskets and quick fastening cam locking devices. For insulated ductwork, install minimum 1 inch thick insulation with sheet metal cover.

B. Provide two hinges and two sash locks for sizes up to 18 inch square, two hinges and two compression latches with outside and inside handles for sizes up to 24 inch x 48 inch.

C. Sizes:

1. For 6" to 8" ducts: 6" x 6" (1 latch and 2 hinges)
2. For 10" to 12" ducts: 10" x 10" (1 latch and 2 hinges)
3. For 12" to 16" ducts: 12" x 12"(2 latches and 2 hinges).

D. Install at all fire dampers, smoke dampers, back draft, dampers, control dampers and all temperature controls otherwise not accessible.

E. Ceiling, wall, and floor access panels must line up with duct access doors.

2.02 FIRE DAMPERS

A. Fire Rating

1. Rated at 1-1/2 hours and so labeled.
2. Rated at 1-1/2 hours and so labeled for up to 2 hour walls.
3. Rated at 3 hours and so labeled for over 2 hour walls to 4 hour walls.

B. Frame: Curtain type with blades outside airstream fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.

C. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.

D. Mounting Orientation: Vertical or horizontal as indicated.

E. Blades: Roll-formed, interlocking, galvanized sheet steel; gauge in accordance with UL listing.

F. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

G. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

H. Fire dampers size shall be the same size as connecting ductwork. Duct liner shall be interrupted at each fire damper.

I. Provide separate or integral collars as required with wall retaining angles, on both sides of walls, floors, ceilings, etc.

J. Contractor to verify location to make sure that dampers are in correct location in fire walls or ceilings before installation. Discuss location with General Contractor before installation.

K. Provide access panels at all fire dampers. Label these access panels "F.D." Access panels must be located to provide access to the fusible links and resetting devices. Grilles are acceptable as access.

L. All fire dampers to be dynamic type, rated and labeled according to UL 555.

M. Closing rating in ducts up to 4-inch wg (static pressure class and minimum 2000-fpm velocity)

2.03 COMBINATION FIRE AND SMOKE DAMPERS

A. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

B. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm

C. Fire Rating

1. Rated at 1-1/2 hours and so labeled.
2. Rated at 1-1/2 hours and so labeled for up to 2 hour walls.
3. Rated at 3 hours and so labeled for over 2 hour walls to 4 hour walls.

D. Frame: Hat-shaped, galvanized sheet steel, with [welded] [interlocking, gusseted] [or] [mechanically attached] corners[and mounting flange]; gauge in accordance with UL listing.

E. Heat-Responsive Device: Replaceable 165 deg F rated, fusible links

F. Smoke Detector: Integral, factory wired for single-point connection.

G. Blades: Roll-formed, horizontal, interlocking overlapping, galvanized sheet steel; gauge in accordance with UL listing.

H. Leakage: Class II

I. Rated pressure and velocity to exceed design airflow conditions.

J. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application, gauge in accordance with UL listing.

K. Master control panel for use in dynamic smoke-management systems.

L. Damper Motors: two-position action.

M. Damper shall be automatic remote resettable after test, detection, or power failure.

2.04 MANUAL DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating, with linkage outside airstream.
2. Suitable for horizontal or vertical applications.
3. Frames:
    a. Mitered and welded corners.
    b. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:
    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized steel, 0.064 inch (1.62 mm) thick.
5. Bearings:
    a. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
6. Tie Bars and Brackets: Galvanized steel.
7. Provide extended quadrant where damper is installed in insulated duct so adjustments can be made without disturbing insulation.

2.05 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

2.06 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

B. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated

faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Double wall.

E. FLEXIBLE DUCTS

1. Insulated, 1", Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
2. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
3. Maximum Air Velocity: 4000 fpm.
4. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
5. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

2.07 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire dampers according to UL listing.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. At outdoor-air intakes and mixed-air plenums.
2. At drain pans and seals.
3. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
4. At each change in direction and at maximum 50-foot spacing.

5. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Install flexible connectors to connect ducts to equipment.

J. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

K. Connect terminal units to supply ducts with maximum 3’ lengths of flexible duct. Do not use flexible ducts to change directions.

L. Install duct test holes where required for testing and balancing purposes.

M. Install turning vanes in mitered elbows that have a velocity greater than 1000 feet per minute.

N. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 26 01 00
GENERAL PROVISIONS, ELECTRICAL

PART 1 GENERAL

1.01 CONTRACTOR'S RESPONSIBILITY

A. Contractor agrees to assume responsibility for liability, workmanship, and quality of materials concerning work sublet to others. Before contract is sublet, submit in writing the names of proposed subcontractor and obtain written approval.

1.02 CODES AND FEES

A. All work shall be installed in accordance with the applicable provisions of the local codes, the National Electrical Code, and the National Electrical Safety Code.
B. All electrical materials shall have Underwriters' approval where applicable and shall be so labeled where UL labeling is customary.
C. All electrical equipment shall conform to applicable NEMA Standards whether specified hereinafter or not, and to other applicable Standards which may be specified hereinafter.
D. Make all arrangements with electric utility company for their services and metering work, PAY ALL CHARGES, AND INCLUDE THE COST IN CONTRACT PRICE.
E. The Contractor shall be responsible for obtaining local permits, payment of fees and notification for inspection by code authorities consistent with the schedule of work. The contractor shall be responsible for obtaining state permits, payment of fees and notification for inspection by code authorities as required by the project.

1.03 EQUIPMENT LISTS, SHOP DRAWINGS, SAMPLES AND SUBMITTALS

A. Submit under provisions of DIVISION 01 and General Conditions.
B. Submit to the Architect for approval, within 30 days after receipt of Notice to Proceed with the work, a complete list of materials, equipment and accessories proposed for use, including complete descriptions and specifications of any proposed substitutions, manufacturer's shop drawings, and roughing-in work. Submit five (5) copies of all items for approval and furnish additional copies if required for installation purposes. Electronic submittals are acceptable in PDF format.
C. Submission material and all shop drawings for the various items of equipment shall indicate section number and shall be marked with the respective mark number or identification of the equipment shown on the drawings or specified. The shop drawings shall list all ratings, capacities, accessories, and other pertinent data to show that the proposed item is as called for and as specified.
D. Shop drawings shall show sizes and details of required concrete and steel machine foundation, locations of anchor bolts, physical dimensions of equipment, capacity characteristics of equipment, and all other work pertinent to details. Concrete foundations are specified under "Concrete Work" section, but steel racks or stands for mechanical apparatus shall be furnished and installed as part of the mechanical work.

1.04 QUALITY CONTROL

A. Comply with Section GENERAL CONDITIONS.
B. Qualifications: Where specific qualifications are specified in individual specification section, provide required data with Subcontractor list.
C. Comply with Section GENERAL CONDITIONS

PART 2 NOT USED

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Install all equipment in accordance with applicable manufacturer's drawings and recommendations.
B. Identification of circuits and equipment: Identification designations shall correspond to those indicated on electrical drawings and as specified in corresponding articles describing the equipment.

3.02 TEMPORARY LIGHTS AND POWER

A. Provide temporary lights and power. Lights shall be one pigtail socket and lumens equivalent to a 150W incandescent lamp for each 500 sf building space, minimum one per room. Power outlets shall be provided as coordinated with construction. Temporary service connections and electrical charges shall be paid by the Contractor.

3.03 TEST, INSPECTIONS, ADJUSTMENTS, AND CLEANUP

A. Wiring, 600 volts and less: Make insulation tests with a "Megger", demonstrate that neither short circuits nor ground faults exist, and that wiring complies with NEC. Provide a copy of the insulation tests in the Close-Out documents.
B. Furnish suitable testing equipment, give the Engineer and all applicable authorities ample advance notice of all proposed tests and readiness of work for inspections, and conduct each test in their presence, as approved. Do not conceal electrical work until all necessary inspections have been made and all required tests have been approved by the Owner's Representative and all applicable authorities.
C. Put entire electrical system in operation, test all equipment, remedy all defects, and make all necessary adjustments. Demonstrate that the entire system functions satisfactorily, as specified, as indicated, and as approved.
D. After electrical system has been tested and before any field painting is commenced, clean up all electrical work thoroughly. Remove all foreign matter which has accumulated in all fixtures, equipment, and enclosures. Clean all fixture glassware and reflectors, and clean and polish all other surfaces that are not to be painted so that they present a new and acceptable appearance.

3.04 PROTECTION AND CLEANING

A. Work shall be protected at all times. Conduit openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered, if necessary, to protect against dirt, water, chemical or mechanical damage or defacement. The installation of fixtures liable to damage shall be coordinated with installing UL fire protective barriers and ceiling systems.
B. Electrical equipment rooms shall be cleaned up prior to energizing equipment and shall not be used for storage or other purposes after power is applied to the electrical equipments.

3.05 OPERATING INSTRUCTIONS

A. Furnish the services of personnel with experience in the operation of an electrical system to instruct the Owner's personnel in the proper operation and maintenance of all equipment, for a period of not less than five working days.
B. Furnish and deliver to the Owner three sets of operating instructions for all equipment installed under this contract, including shop drawings, piping diagrams, wiring diagrams, maintenance recommendations and information concerning replacement parts.
C. All floor mounted electrical equipment shall be provided with 4” thick housekeeping pads which are 4 inches larger than the equipment.

END OF SECTION

SECTION 26 05 00
BASIC MATERIALS AND METHODS, ELECTRICAL

PART 1 GENERAL

1.01 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

1.02 O&M MANUAL

A. The preliminary O&M Manuals shall be submitted thirty (30) days after final submittal approval.
B. Provide an electronic copy in searchable Adobe PDF format.

1.03 ELECTRICAL WIRING FOR EQUIPMENT OF OTHER SECTIONS

A. General:

1. All electrical wiring of every description required to operate all equipment furnished by other Sections shall be done by the Electrical Section, except as otherwise specified hereinafter. Read carefully all other Sections in which electrically operated equipment is specified, and include in the electrical work all electric wiring required for the proper operation of the equipment, whether indicated on the electrical drawings or not. Coordinate the Electrical section work with that of all other Sections that furnish equipment requiring electrical connections.
2. All control devices required to operate the equipment shall be furnished by the Section that furnishes the equipment, unless otherwise specified. All control devices which are not factory mounted on the equipment and require electrical connections ONLY shall be installed by the Electrical Section. All control devices which are not factory mounted on the equipment and require piping, linkage, remote bulb, or other mechanical connections as well as electrical connections shall be installed by the Section that furnishes the equipment involved, ready for electrical connections.
3. Outlet locations indicated on the electrical drawings for motors, controls, and other electrically operated items of other Sections are APPROXIMATE ONLY, as the actual wiring requirements are not necessarily identical for the various makes of each item of equipment involved. However, the Electrical Section shall locate all outlets and arrange all wiring to properly serve the equipment ACTUALLY INSTALLED, generally as indicated on the electrical drawings, but EXACTLY in accordance with rough-in sheets and/or wiring diagrams furnished by the other Sections involved.
4. The necessary wiring diagrams shall be furnished by the Section that furnishes the equipment involved, and after these are approved, do all wiring accordingly.

B. Wiring NOT Included: Wiring which is factory installed on equipment.
C. Wiring Included: Generally equipment of other Sections requiring wiring, includes but shall not be limited to the following items:

1. Plumbing: water heater.
2. Door installation: automatic door equipment.
3. Food service: equipment connections.
4. Special construction: equipment connections.
5. Special type wire (other than type MTW): If any of this is required for other Divisions, that wire shall be furnished by the other Divisions and installed under this Division.

PART 2 PRODUCTS

2.01 HANGERS, SUPPORTS, AND SLEEVES

A. Securely attach all hangers, supports, and devices to the building structure with anchors suitable for the types of building construction involved. Provide all necessary pipe, angle iron, "Unistrut", "Kindorf", or other suitable steel auxiliary supports for the electrical work.

B. Hangers or supports for conduits and raceways shall be standard conduit or raceway straps, or other suitable clamping devices. Trapeze hangers may be used for groups of suspended horizontal conduits, with each conduit clamped to each trapeze bar. Perforated strap iron hangers will not be permitted.

C. Maximum hanger or support spacing for all conduits shall be as required by the Codes. Support non-concrete encased underground conduits by laying with full length bearing on firm trench bottoms. Support each riser conduit at each building floor level within one foot of floor, one foot of boxes, and every ten feet for vertical and horizontal runs; each run shall have at least one support.

D. Adequately support all boxes, gutters, panelboards, switches, starters, fixtures, and other devices, and equipment. Where supporting method is indicated or detailed, provide supports accordingly; OTHERWISE, supports shall be as required by the Codes, and as approved.

E. Provide all necessary sleeves for conduits and other electrical items passing through concrete and masonry construction, where electrical items are not installed prior to concrete placing and masonry laying. Sleeves through concrete walls, concrete columns, and concrete beams shall be IPS steel pipe or rigid steel conduit, flush with finished concrete surfaces. Sleeves for all exposed conduits passing through floors (except slabs on ground) where water on floor can pass through the opening shall be galvanized IPS pipe or galvanized rigid steel conduit extending two inches above finished floor, and flush with slab below. Other sleeves may be sheet metal or plastic.

2.02 CONDUIT AND FITTINGS, EXCEPT UNDERGROUND DUCTS

A. Conduits: These shall be zinc coated rigid steel, zinc coated steel electrical metallic tubing (hereinafter referred to as "thin wall conduit"), ANSI Specification C80.5 rigid aluminum, Carlon Schedule 40 Certainteed PVC Schedule 40 or Cantex PVC Schedule 40 as approved UL listed heavy wall rigid PVC, as applicable. In each case where the conduit type is indicated, specified, or required by the Codes, install only the indicated, specified, or Code required type; OTHERWISE, conduit usage shall be as follows:

1. Embedded in concrete: rigid steel coated with bituminous compound or PVC coated.
2. Conduit below grade shall be PVC encased in concrete as indicated.
3. For supporting fixture, outlet boxes, and other devices and equipment which are not directly anchored to the building structure: rigid steel or rigid aluminum conduit, with all joints and connections threaded.
4. Flexible connections: flexible steel conduit ("Greenfield"), in short lengths only, at each motor connection and other location requiring flexibility; of liquid tight type where exposed to weather or excessive moisture.
5. PVC conduit shall not be used in return air ceilings or plenums.
6. Rigid metal conduit shall be used for service conductors entering and inside building.
7. Rigid metal conduit shall be used for fire pump service wiring and all runs between controller and pump and other equipment. All conduit within a fire pump room shall be rigid metal conduit except flexible connections to motors may be liquid tight type flexible steel conduit.
8. All other locations: thin wall or rigid steel, as applicable.
9. DO NOT INSTALL ALUMINUM CONDUIT UNDERGROUND, IN CONTACT WITH GROUND, OR EMBEDDED IN CONCRETE.
10. MC Cable is unacceptable, unless otherwise indicated on the drawings. MC Cable allowed on the documents shall be supported at twice the NEC recommendations and shall be used for runouts only. All homeruns shall be EMT.
11. Minimum 0.75” conduit except switch legs may be 0.5” conduit.

B. Conduit Fittings: For metallic conduit, fittings shall be zinc coated steel, cast aluminum, or cast zinc. For PVC conduit, fittings shall be of the same materials and make as those of the conduit. All fittings exposed to weather shall be weatherproof type.

C. Installation:

1. General: ream ends of all conduits after cutting. Prior to wire pulling, keep all open conduit ends plugged, and swab out all trapped conduits in which water or moisture has collected. Where conduits are concealed in walls, install these conduits so that the exposed wall faces will not be marred.
2. PVC conduits: solvent weld all joints between PVC materials, with cement furnished by the conduit manufacturer. Provide suitable adapters where PVC conduits are coupled to metallic conduits. Provide a rigid steel elbow at the base of each exposed riser from below ground and below floor to above ground and above floor.
3. Conduit routing, general: see TYPE OF SYSTEM, METHOD OF WIRING hereinbefore for locations where concealed and exposed conduits are required and/or permitted. Where conduit routings are detailed or dimensioned install conduits accordingly; OTHERWISE, install concealed conduits with the shortest practicable path, and install all exposed conduits in straight, level, and plumb lines, parallel with or at right angles with beams, walls, ceilings, and other building lines.
4. Branch circuit conduit routings: except where detailed or dimensioned, the indicated branch circuit conduit routings are generally diagrammatic, and are intended to show the required circuitry from panelboards to outlets. However, if necessitated by job conditions, deviations from the indicated routings may be made, provided that regardless of the actual installed arrangement of the conduits: each outlet marked with the same circuit number is connected to the same corresponding numbered circuit; outlets are switched and controlled as indicated; and no home run is brought into any switch box unless otherwise indicated.
5. Thin wall conduit: Use compression type fittings with proper tools for all joints and terminations. Point screw type fittings are allowed with proper installation methods.

2.03 UNDERGROUND DUCTS

A. General: Where indicated on the electrical drawings as "duct" or "ducts", underground conduits shall be PVC type, with concrete encasement.
B. Duct Materials and Joints:

1. PVC conduit: This shall be Carlon Type EB or as approved, UL listed.
2. Fittings: These shall include couplings, elbows (except the riser elbows specified below), adapters, and other necessary types, all of the same material and make as those of the PVC conduit.
3. Joints between PVC materials shall be solvent welded type, made with cement furnished by the PVC conduit manufacturer.
4. Riser elbows: Provide a galvanized rigid steel conduit elbow at the base of each duct riser from below-ground and below-floor to above-ground and above-floor, coupled to the horizontal end of the PVC conduit with a suitable adapter.
5. Supports and spacers: Provide these as required to securely hold conduits in proper position prior to and during concrete placing, with required spacing between adjacent conduits.

C. Concrete Encasement: This shall be as detailed; if not detailed, concrete shall be at least 3" thick below, above, and on each side of the duct assembly. (Concrete by Concrete Section, with 5/8" maximum size aggregate).
D. Grounding Conductor: For each run of one or more PVC conduits in an underground duct assembly, provide a single stranded copper grounding conductor, buried directly in the ground above the concrete encasement, and connected to the above-ground metallic conduit system at each end of the duct run.

2.04 PULL BOXES, JUNCTION BOXES, AND WIRING GUTTERS

A. General: Pull boxes, junction boxes, and wiring gutters shall be of the types and minimum sizes indicated, or as required for the conditions involved where types and sizes are not indicated.

Before installation, check proposed locations of boxes and gutters with the architectural, structural, and mechanical drawings, and locate each box and gutter so that it will be accessible in the finished project.

B. Underground Boxes: These shall be Hope HD6000 galvanized cast iron strictly watertight submersible type, with wide flanges on box top, neoprene cover gasket, cover bolted on with stainless steel bolts, and threaded hubs for all conduit connections.

C. Above Ground Boxes and Gutters: These shall be galvanized steel of at least Code gauge for each size involved, and of weatherproof construction where exposed to weather.

1. Where indicated, boxes for under ground conduits shall be above ground and encased in concrete pedestals, as detailed.

2.05 OUTLET BOXES

A. General: Outlet boxes and covers therefor shall be steel or cast ferrous metal with zinc or other suitable metallic rustproof coating, or cast aluminum, all of the proper sizes and types to accommodate the conduits, conductors, connections, devices, fixtures, architectural conditions, and structural conditions involved.

B. Special Box Requirements:

1. Exposed-to-weather outlet boxes shall be cast metal, with threaded hubs and gasketed covers, all strictly weatherproof.
2. Floor boxes for floor outlet devices shall be per the basis of design on the drawings.

C. Installation:

1. Before installation, check proposed location of each outlet box with the architectural, structural, and mechanical drawings, and locate each outlet box so that it will be accessible and interference free in the finished project.
2. Set each concealed box flush with finished surfaces, and so that exposed finished surfaces will not be marred.
3. Install each wall switch on the knob side of the door involved. Before placing each wall switch box, verify the applicable door swing with the architectural drawings, and locate the wall switch box accordingly.
4. Where equipment is served by exposed flexible cords, locate the outlet box as near as practicable to the equipment connection point, to minimize flexible cord length.

2.06 WIRE, JOINTS, AND SPLICES, 600 VOLTS AND LESS

A. Lighting and power wire shall be copper only: Types shall be as follows:
Feeders shall be copper as indicated on single line diagram.

1. High temperature and other special conditions: types NEC approved for the conditions involved.
2. Exposed flexible cords: Type S, with grounding conductor.
3. Direct earth burial: Type USE, with neoprene jacket.
4. All other lighting and power wire: No. 8 and larger, Type THWN stranded; No. 10 and smaller, Type THWN/THHN solid.

B. Control wire shall be Type MTW copper, stranded.

C. Signaling, sound, communications, alarm, indicating, and other special system wire shall be copper, of the types specified hereinafter with the equipment, or as indicated, or as recommended by the equipment manufacturers if neither indicated nor specified.

D. Wire Sizes: Where sizes are neither indicated nor otherwise specified wire sizes shall be:

1. Branch circuit wire: No. 12.
2. Control wire: No. 14, or as recommended by the control manufacturer.
3. Special system wire: as recommended by the manufacturer of the equipment involved.

4. Home runs shall be 12 gauge if the distance from the panelboard to first outlet is less than 100 feet; 10 gauge if distance is over 100 feet.

E. Identification:

1. General: All wires shall be identified as required by NEC.
2. Control and special systems wire: these shall be color coded throughout, or identified at each terminal and junction point with a suitable permanently attached tag or label.

F. Joints and Splices: Make these with suitable solderless connectors, in the various boxes, gutters, and similar locations, but not in any conduit. Leave enough wire slack to permit at least one splice or joint to be remade in case of fault.

1. Branch circuit, control, and special system wire joints: use Ideal, Buchanan, 3M, or similar tool-applied to twist-on type connectors.
2. All other wire joints: use Ilsco tin plated aluminum type pressure connectors, or suitable brass, bronze, or copper pressure type connectors.
3. Insulate all joints and splices with suitable insulating sleeves or caps integral with the connectors or separate therefrom, or with vinyl plastic insulating tape.

2.07 ELECTRICAL IDENTIFICATION AND NAMEPLATES

A. Conductors identified by wire markers shall be branch circuits in the panel or panelboard and at the point of termination. The text shall be of black, non-smear ink. Text shall be pre-printed letters and numbers. Combinations of text and numbers shall be used to indicate the branch circuit or other use of the conductor or cable.
B. Disconnects, panelboards shall be identified with name plates with 1.5” black lettering with white background. Provide 1.5” white lettering with red background on all equipment served by generator.
C. Each panelboard shall be included with a label listing the following:

1. Source info (fed from _____)
2. Voltage/Phase
3. Current/Phase

D. Junction boxes and pull boxes shall be identified with the circuit numbers and panel designation in permanent marker or label.
E. All conduits shall be labeled with circuit numbers labeled with permanent marker at conduit entry into panelboard.

2.08 FUSES

A. General: Provide fuses of the indicated types and sizes, in place, for each device requiring fuses. Unless otherwise indicated, fuses shall be dual element non-renewable delay type. Fuses shall be Bussman, and Littlefuse.

1. Spare Fuses: Furnish three spare fuses of each size and type required for the electrical system, deliver these to the Owner's representative in a suitable clearly labeled box, and obtain signed receipt for delivery. Include this receipt in the Close-Out documents.

2.09 DISCONNECT SWITCHES, MOTOR STARTERS, AND SEPARATE CIRCUIT BREAKERS

A. General: Except as otherwise specified below, Electrical Section shall provide disconnect switches, circuit breakers, and motor starters for all motors and other electrically operated equipment, regardless of who furnishes and/or installs that equipment. Types and locations of

these devices shall be as indicated, or as required where types and/or locations are not indicated.

1. These devices which are located on other equipment shall be as specified under the corresponding headings; these devices NOT located on other equipment shall be as specified below, and shall be separately mounted.
2. Separately mounted disconnect switches, circuit breakers, and motor starters shall be Square D, Allen-Bradley, ITE, or as approved. Enclosure types shall be: NEMA 3R for devices exposed to weather; NEC required type for devices in other special locations; and NEMA 1 type for devices in other locations. Each circuit breaker and each disconnect switch, including those integral with motor starters, shall have padlocking means.
3. All terminals for disconnect switches, circuit breakers and motor starters shall be rated and marked for 75 degrees C terminations.

B. Disconnect Switches: These shall be: non-fused heavy duty type safety switches where overcurrent protection is not required; and fused heavy duty type safety switches or circuit breakers (as indicated) where overcurrent protection is required; except that other suitable properly rated switches may be used for fractional hp motors and other small loads.

C. Circuit Breakers: These shall be molded case type. Breakers shall be quick make, quick break type with trip indications shown and with common trip handle on all multipole breaker.

D. Manual Motor Starters: These shall have neon motor running pilot lights and proper sized overload protective devices for the motors involved; and shall be surface mounted in equipment rooms and unfinished areas, and flush mounted in finished area. Where manual motor starters are not indicated, small manually controlled motors shall be controlled directly by the panelboard circuit breakers.

E. Magnetic Motor Starter: Each motor of 1/8 hp or larger shall be provided with thermal overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, unless otherwise specified, the protective device shall be of the manually reset type. Magnetic starters shall be NEMA size and type including the NEMA withstand ratings, with the automatic-control device actuating the pilot-control circuit. Each magnetic starter shall have a built in control circuit transformer to supply 120 volts to the control circuit. Each magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Two auxiliary contacts shall be a part of the starters. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with approved wiring diagram. All controls shall be 120 volts or less unless otherwise indicated. All motors with a rating of 50 hp and above shall have autotransformer reduced voltage starters; motors less than 50 hp shall be line voltage starters.

F. Identification of Separately Enclosed Devices: Identify each separately enclosed circuit breaker, disconnect switch, magnetic motor starter, and manual motor starter, by attaching to the device cover a metal or plastic nameplate clearly and permanently lettered with the description and location of the equipment controlled by the device.

G. Devices Furnished by Other Sections or Others:

1. 3/4 hp and small single phase roof mounted fans: If the disconnect switches for these are furnished with and factory mounted on the equipment; Electrical Section shall connect to fan motors and/or switches, as required. Verify that disconnects are furnished by others.

2.10 DEVICES

A. General:

1. Wiring devices shall be Hubbell, Leviton, or other makes as approved or as specified below or on drawings. Type of wiring devices required for this project shall be as indicated on the drawings, or suitable for the application involved if type is not indicated; qualities, ratings, and other requirements of wiring devices shall be as specified below. All wiring device types specified below may not necessarily be required for this project.
2. Receptacle configurations shall conform to NEMA standards unless otherwise noted.
3. Exposed finish shall be: for each device with a plastic plate, same color as that of plate; for devices with stainless steel plates, brown; and for all other devices, brown or black. Hospital grade, isolated ground receptacles and emergency devices shall be marked by symbol on the face. Coordinate device and plate color requirements with architect.

B. Devices: Qualities, ratings, and other requirements shall be: (All models are based on Hubbell – other manufacturers are Leviton or as approved)

1. Wall switches: 20A 120-277VAC, single or double pole, 3 or 4 way, as applicable; Hubbell 1221 series. Where indicated as WEATHERPROOF, the above specified switch, Hubbell 7420. Wall switches with occupancy sensors as shown on drawings.
2. Momentary contact switches: 20A 120-277 volt, SPDT, three position with center off; Hubbell 1557 series.
3. Door switches: Hubbell RDS50.
4. Duplex receptacles: (Commercial) 20A 125 volt, 2 pole, 3 wire grounding: Hubbell 5362. Where indicated as WEATHERPROOF the above specified duplex receptacle Hubbell 5206WO, double lift spring door cover.
5. Ground fault circuit interrupter receptacles: (Commercial) 20A 125 volt feed through duplex 5ma sensitivity type with test and reset buttons; Hubbell GF5362. Where indicated as WEATHERPROOF, the above specified receptacle with Hubbell CWP26H spring door cover.
6. Single Receptacle: (Commercial) 20A 125 volt, 2 pole, 3 wire grounding Hubbell 5361. Single receptacles: 30A, 125 volt, 2 pole, 3 wire grounding; Hubbell No. 9308.
7. Single receptacles: 20A, 250 volt, 2 pole 3 wire grounding; Hubbell 5461.
8. Flush floor receptacles: 20A 125 volt, 2 pole, 3 wire grounding; above specified single receptacle with Steel City 889 and P-90-2 receptacle and floor plates.
9. Standing floor receptacles: 20A 125 volt, 2 pole, 3 wire grounding; above specified duplex receptacle in Steel City SFH-40 or equal outlet fitting.
10. Other devices not specified above; as indicated on the drawings.

C. Device Plates: Unless otherwise specified or inapplicable to the devices involved, plates shall be: emergency circuit devices as selected by Architect, plastic; isolated ground receptacles, as selected by Architect. In finished areas device plate colors shall be as selected by Architect, and unfinished areas, brown plastic for flush devices, and zinc coated steel for surface devices.

1. Identification of Emergency System Receptacles: Emergency system receptacles shall be red in color.
2. Identification of Data Processing Equipment Receptacles: These shall be engraved or hot stamped "Data Processing Equipment Only".

PART 3 EXECUTION

3.01 INSTALLATION

A. Run exposed conduit, trays, and other wireways parallel to the principal parts of the building. Wireways shall be run concealed when provisions are made in floors, walls, ceilings, and chases through all finished areas. Fire stop all openings around conduit which penetrates floors and walls with approved non-combustible materials, slabs on grade are accepted.

B. Conduits and other raceways shall be kept as close as possible to ceilings, walls, columns, etc., and shall be installed in such an orderly manner as to take up a minimum of space and allow a maximum of headroom, per applicable codes.

C. Circuiting: Circuit numbers shown on drawings indicate specific panelboard to which each branch circuit shall be connected, and specific outlets which shall be connected to each branch circuit, and unless otherwise indicated these circuit numbers do not necessarily indicate actual number of circuit breaker in each panel to which each branch circuit shall be connected. Connect each outlet marked with same circuit number to same numbered branch circuit, and connect each branch circuit to indicated panelboard. In each individual panelboard:

1. Balance active circuits on panelboard busses, and leave spare circuit breakers equally divided among panelboard busses, as nearly as practicable.
2. Connect each ungrounded wire of each 3 and 4 wire common neutral circuit to a different panelboard bus.
3. Group conveniently at top of panelboard all breakers used for switching lights not having wall or other switches, and neatly paint handles of all such breakers with white durable quick drying automobile touch up or other similar type lacquer for each identification as light switches. This does not apply to any panelboard in which ALL circuit breakers serve as lighting switches.

D. Provide templates, layouts drawings, and supervision to ensure correct placement of anchors and conduit projecting in concrete.
E. Painting shall be done to repair scratches to surfaces, electrical equipment nameplates shall be protected from paint.
F. Qualifications: Where specific qualifications are specified in individual specification section, provide required data with Subcontractor list.

3.02 TYPE OF SYSTEM, WIRING METHOD

A. Electrical system characteristics: These shall be as indicated. In addition, whether indicated or not, provide low voltage (less than 120 volts) wiring for controls and other purposes, as required for the complete electrical system.
B. Enclosures: Regardless of voltage or use, install wiring in conduits and metal or other enclosures, unless otherwise indicated or otherwise specified.
C. Finished Areas: Conceal conduits below floors, within slabs, within walls, within pipe chases, above suspended ceilings, and within other building construction, in offices, rest rooms, and other finished areas, unless otherwise indicated.
D. Unfinished Areas: Install above-floor conduits exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impractical, in mechanical and electrical equipment rooms, manufacturing areas, warehouse or storage areas, and other unfinished areas.
E. Flexible Cords: Exposed flexible cords approved for the purpose involved shall be used to connect equipment where indicated or specified, and where equipment is factory furnished with or factory arranged for flexible cord connections only. However, in each such case, install the supply outlet as near as practical to the equipment served thereby, and use the shortest practical length of exposed flexible cord between the equipment and the outlet. If a receptacle is used as an outlet, the receptacle and the cord plug shall be 3 or 4 wire (as applicable) grounding twist-lock type.
F. Ground electrical equipment and conductors as required by NEC and other applicable electrical codes.

1. Panelboards served by individual transformers: ground panelboard neutral busses to building grounding system.
2. All metallic cable sheaths, cable shields, metal conduit, transformer cases, cabinets and pedestals shall be made electrically secure to form a continuous system and shall be grounded.
3. The neutral shall only be grounded at the panelboard or service grounding device. Grounding conductors shall be continuous between the service and the driven grounding electrode or other grounding electrode as permitted in Part H of NEC Article 250.
4. All conduits shall have code sized green equipment grounding conductors with diameter based on the largest circuit in each conduit.

3.03 EXCAVATION AND BACKFILL

A. Excavate and backfill as required for the electrical work. Cut bottoms of trenches to the proper lines and grades to provide firm and continuous support for the underground electrical work, and to provide 24 inch MINIMUM depth from finished grade to tops of all exterior underground electrical work. Sheet and brace excavations as required to protect personnel and adjacent structures.

B. After the underground electrical work has been installed and approved, place all backfill in 8 inch maximum thickness loose layers, and compact each layer to at least the density of the adjacent undisturbed site soil, using pneumatic or other suitable power tampers. Mass backfilling (backfilling without tamping) is prohibited.

C. Warning tape for buried electrical work: install detectable warning tape directly over every device by burying tape as close to the surface as possible but no less than six inches beneath finished grade. Tape shall be Reef Industries, Inc., "Terra Tape D", or equal as approved, composition metallized foil-plastic film laminate bearing imprint describing the type of buried electrical work. All materials shall be specifically formulated for prolonged use underground.

3.04 FIRE WALL PENETRATIONS

A. Four hour fire walls shall not be penetrated with conduit runs. Conduit runs shall be routed under the floor in these areas. UL listed approved fire stops shall be provided for all two hour wall penetrations.

3.05 FEEDER, STARTER, SWITCH, PROTECTIVE DEVICE, AND OTHER ELECTRICAL DEVICE SIZES

A. Capacities of feeders, motor starters, circuit breakers, switches, protective devices, and other electrical devices indicated to be furnished and installed by Electrical Section for electrically operated equipment, regardless of who furnishes and/or installs that equipment, are based upon the average horsepower and/or electrical ratings. **HORSEPOWER AND/OR ELECTRICAL RATINGS OF ELECTRICALLY OPERATED EQUIPMENT INDICATED ON ELECTRICAL DRAWINGS SHALL NOT LIMIT SIZES OF THE ELECTRICALLY OPERATED EQUIPMENT AND CAPACITY OF THE ELECTRICAL WORK.**

1. Equipment electrical requirements are based on the specified manufacturer and model. Alternate equipment and model revisions result in electrical load variations and is the responsibility of the contractor. Before commencing electrical work for electrically operated equipment, Electrical section shall: check horsepower and/or electrical rating of each individual electrically operated equipment items, regardless of who furnishes and/or installs that equipment; and adjust sizes of all applicable feeders, motor starters, circuit breakers, switches, protective devices, and other electrical devices furnished by Electrical Section, as required to provide proper protection and satisfactory operation of the electrically operated equipment actually installed. This includes increasing to next larger size, or decreasing to next smaller size, all feeders, circuit breakers, starters, switches, protective devices, and other electrical devices involved, as required to match capacities of corresponding electrically operated equipment actually installed, except that no sizes shall be decreased without approval.

B. Switches, circuit breakers, motor starters, protective devices, and other electrical devices furnished by other Sections and by others for installation and/or wiring by Electrical Section, are specified elsewhere to have adequate capacities to serve the electrically operated equipment for which they are furnished. However, BEFORE installing and/or wiring each of these devices, Electrical Section shall check each individual device's electrical rating with the horsepower and/or electrical rating of the corresponding electrically operated equipment actually installed, regardless of who furnishes and/or installs the devices and equipment. Electrical Section shall not install and/or wire any device that is found to be the incorrect size, and shall see to it that

correctly sized devices are furnished by the applicable Section and other applicable persons in all cases.

C. The intent and requirement of the above is to obtain a coordinated electrical system and all of the above shall be done by Electrical Section as part of the contract, at no extra cost to the Owner.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING

PART 1 GENERAL

1.01 SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Submit shop drawings for final approval.
C. Clearly detail shapes, general construction, and installation details.
D. Submit manufacturer's installation instructions.
E. Submit samples of the following for final approval.

PART 2 PRODUCTS

2.01 GROUNDING CABLES

A. Materials:

1. Grounding conductors shall be tinned soft drawn annealed copper, size and type as follows:
    a. Grounding for stress relief cones and splices shall be No. 4 AWG, solid, soft drawn annealed.
    b. All other grounding required minimum No. 4 AWG solid soft drawn annealed unless otherwise specified.
2. Grounding conductors shall be tinned soft drawn annealed copper, size and types as follows:
    a. From primary riser pole to 3-phase transformer No. 2 AWG bare stranded.

B. Joints and splices: Make these with suitable copper compression connectors, in manholes and pull boxes, but not in any conduit. Leave enough wire slack to permit at least one splice or joint to be remade in case of damage.

PART 3 EXECUTION

3.01 INSTALLATION OF GROUNDING SYSTEM

A. Underground Distribution:

1. Ground:
    a. On site, outdoor electrical equipment to driven ground rods.
    b. Interrupted metallic raceways, with ground conductors connected to metallic raceway at each end.
    c. Transformer and secondary neutral; to driven ground rods including:
        (1) Cable shielding.
        (2) Metallic raceways.
        (3) Hardware.
        (4) Grounding conductors.

B. Pull Boxes and Manholes:

1. Ground:
    a. On site pull boxes and manholes to the grounding system including:
        (1) Cable shielding.
        (2) Metallic raceways.
        (3) Hardware.
        (4) Ground conductors.
    b. Interrupted metallic raceways, with ground conductor connected to metallic raceways at each end.

3.02 FIELD TESTING OF GROUNDING ELECTRODE

A. The ground rod electrode in the transformer pad shall have a resistance to ground test performed. The test shall be made with a self-contained direct reading meter such as "Vibroground" or "Groundohmer".
B. The maximum resistance to ground shall not exceed 25 ohms with all grounding leads disconnected from the electrode at temperatures above 32 degrees Fahrenheit and soil moisture content above 20 percent.
C. If the resistance to ground of the existing electrode exceeds 25 ohms install additional grounding electrodes as necessary to obtain the specified resistance. Additional electrodes shall be minimum 3/4 inch diameter by eight foot in length, copper-clad steel.
D. Where rock is encountered and the electrodes cannot be vertically driven their full length install a grounding trench system consisting of an 18 inch minimum depth trench and place within the trench a single conductor No. 2/0 AWG stranded bare copper wire connected to the electrode. The length of wire shall be such that the specified resistance can be obtained and the minimum length shall be 100 feet.
E. The grounding trench shall be located in an area and position such that surface activities will not disturb the system. Location of the trench shall be approved by the Engineer.

END OF SECTION

SECTION 260926
PANELBOARDS

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the panelboards as specified and as shown on the contract drawings.

1.02 REFERENCES

A. The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and UL as follows:
   1. UL 67 - Panelboards
   2. UL 50 - Cabinets and boxes
   3. NEMA PB1
   4. Fed. Spec. W-P-115C
   5. Circuit breaker - Type I class I
   6. Fusible switch - Type II class I

1.03 SUBMITTAL - FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:
   1. Breaker layout drawing with dimensions indicated and nameplate designation
   2. Component list
   3. Conduit entry/exit locations
   4. Assembly ratings including:
      a. Short-circuit rating
      b. Voltage
      c. Continuous current
   5. Cable terminal sizes
   6. Product data sheets

B. Where applicable, the following additional information shall be submitted to the Engineer:

   1. Key interlock scheme drawing and sequence of operations

1.04 SUBMITTAL FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:
   1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
   2. Installation information
   3. Seismic certification and equipment anchorage details as specified

1.05 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.06 REGULATORY REQUIREMENTS

A. The panelboards shall be UL labeled.

1.07 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Square D.

B. ABB/GE

C. Eaton

D. Siemens

2.02 RATINGS

A. Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 22,000 amperes RMS symmetrical.

B. Panelboards rated 480 Vac shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 14,000 amperes RMS symmetrical.

C. Panelboards shall be labeled with a UL short-circuit rating. When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:
   1. Size and type of upstream device
   2. Branch devices that can be used
   3. UL series short-circuit rating

2.03 CONSTRUCTION

A. Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

B. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided for ease of future access. Both hinged trim and trim door shall utilize three point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owners option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.

C. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

D. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.

E. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door. Provide all information on directory card as indicated in specifications.

F. All locks shall be keyed alike.

G. Provide a pad-lockable handle lock hasp. The pad lockable lock hasp allows the handle to be locked in the ON or OFF position. (Trip-free operation allows the circuit breaker to trip when the handle lock holds the circuit breaker handle in the ON position.) The hasp can be mounted on either side of the handle. The hasp will accommodate up to three padlocks with 1/4 inch (6.4mm) shackles. One per circuit breaker.

2.04 BUS

A. Main bus bars shall be copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum. Aluminum bus bars are acceptable where aluminum conductors are being utilized.

B. A system ground bus shall be included in all panels.

C. Full-size (100%-rated) insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

2.05 BRANCH CIRCUIT PANELBOARDS

A. The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be Eaton Cutler-Hammer type Pow-R-Line 1a, Pow-R-Line 2a, Pow-R-Line 3a, or equivalent.

B. Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

C. Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits.
   1. Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

D. Circuit breakers shall have a minimum interrupting rating of 22,000 amperes symmetrical at 240 volts, and 14,000 amperes symmetrical at 480 volts, unless otherwise noted on the drawings.

2.06 DISTRIBUTION PANELBOARDS - CIRCUIT BREAKER TYPE

A. Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings

as specified herein or indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be Cutler-Hammer type Pow-R-Line 3a or Pow-R-Line 4B. Panelboards shall have molded case circuit breakers as indicated below.

B. Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.

C. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

D. Breakers feeding fire alarm and security systems shall have lock-on breaker, with appropriate warning labels on associated panels.

2.07 ENCLOSURE

A. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

B. Enclosures shall be provided with blank ends.

C. Where indicated on the drawings, branch circuit panelboards shall be column width type.

2.08 NAMEPLATES

A. Provide an engraved nameplate for each panel section, as detailed in specifications.

2.09 FINISH

A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied.

2.10 LABELING (PANEL SCHEDULES)

A. All circuit directories shall include room numbers and descriptions.
B. All circuit directories shall be typewritten. Handwritten directories are not acceptable.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer’s recommendations and the contract drawings.

END OF SECTION

SECTION 26 55 00
LUMINAIRES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDED

A. Provide all labor, materials, equipment and services to achieve a luminaire installation complete with lamps, completely wired, controlled and securely attached to supports, as indicated on the drawings, as specified herein or both.

B. Type of luminaire shall be as indicated and as specified. Where luminaire type has been omitted either on “Lighting Fixture Schedule” or on floor plans or details, Contractor shall request clarification from the Architect prior to submitting bids.

C. Luminaires shall be selected from the fixture schedule not only by catalog number but with consideration to mounting, number, and type of lamps and reference notes all as contained in the “Lighting Fixture Schedule” and in accordance with these Specifications.

1.03 STANDARDS

A. All luminaires shall be listed by and carry the Underwriters Laboratories (U.L.) label.

B. Luminaires shall be labeled with the Underwriters Laboratories (U.L) label appropriate to luminaires’ location (Damp Location, Wet Location, etc.)

C. All luminaires shall meet all required codes and regulations for the application.

D. All luminaires shall be new, clean, and undamaged.

1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 260100.

B. Submit product data for each catalogued luminaire indicating pertinent photometric and physical characteristics.

C. Submit complete detailed shop drawings by the manufacturer for each custom luminaire type.

D. Submittals shall indicate name of project, fixture type, and all necessary data for review.

1.05 SUBSTITUTIONS

A. Equality will be based on upon the following characteristics of the proposed alternate product:

1. Photometric performance
2. Construction quality, including materials and finish
3. Ease of installation and maintenance
4. Appearance
5. Manufacturer’s performance record of support in correcting defects and delivery problems.
6. Delivery schedule.

B. If deemed necessary in the opinion of the Architect, proposed alternate product may be required to be tested by independent authorities or testing laboratories to confirm performance and construction. If independent tests are required, all costs associated with those test will be paid in advance by the business entity requesting alternate product approval.

C. It shall be the Contractor’s responsibility to inform the Architect of any differences between the specified luminaire and the proposed substitution. Failure to do so shall be grounds for rejection of the proposed substitute at any time before or after the bids are received.

D. Final determination of equality shall be the responsibility and judgment of the Architect.

E. Modifications required to any building equipment or system due to the substitution of a luminaire type shall be designed and constructed at the Contractor’s expense.

1.06 INTERFACE

A. Confirm compatibility and interface of luminaire with ceiling system prior to ordering luminaires. Report discrepancies to the Architect and defer ordering until clarified.

B. Coordinate luminaire voltages with all circuitry prior to ordering luminaires. Report discrepancies to the Architect and defer ordering until clarified.

C. Coordinate installation of luminaires with other trades to provide a total system that is neat and orderly in appearance. Confirm absence of conflicts with all walls, structure, ducts, pipes, or other equipment prior to ordering luminaires. Report discrepancies to the Architect and defer ordering until clarified.

PART 2 - PRODUCTS

2.01 LUMINAIRE SCHEDULE

A. Refer to the “Lighting Fixture Schedule” for individual luminaire descriptions and manufacture type.

2.02 GENERAL MATERIALS

A. Recessed luminaires shall have trims which fit neatly and tightly to the surfaces in which they are installed. Where gaskets are required, all gasketing material shall be concealed.

B. Luminaires shall be free of light leaks and shall be designed to provide adequate cooling of electrical components.

C. All painted luminaire components shall be painted after fabrication.

D. Wiring channels and lampholder mountings shall be rigid and accurately made.

E. Lampholders shall hold lamps securely against normal vibrations.

2.03 RECESSED LUMINAIRES

A. Recessed LED luminaires: Prewired type with junction box and flexible conduit forming an integral part of the assembly.

B. Supply recessed luminaire complete with trim type required for ceiling system installation. Before ordering, confirm ceiling construction details and architectural finish for each area.

C. Provide integral encapsulate ballasts for recessed high intensity discharge luminaires.

D. Recessed LED luminaires installed in non-accessible ceilings shall be bottom access type, i.e., luminaire component shall be removable from below for access to junction box.

E. Fixtures flush mounted in fire-rated ceiling shall be furnished with the followings nonstandard features:

1. Fixture housing shall not be less than twenty gauge steel.
2. Aluminum radiator shall be provided for ballast mounting.
3. Ballast mounting provisions shall provide for mounting with four bolts; other type mounting are not acceptable.

F. Troffers shall be constructed of not less than 20 gauge steel or 16 gauge rigid construction aluminum and suitable for continuous row mounting where indicated. Hinged doors for support of diffuser shall be gasketed on all sides to prevent light leaks.

G. Reflective surfaces which are painted shall be baked white enamel of minimum average reflectance of 85%. Paint coverage shall be complete without raw or unpainted surfaces or edges.

H. Recessed lay-in luminaries shall conform to NEMA standards including references to luminaire dimensions and temperature ratings.

I. Lenses and diffusers shall be of 100% virgin acrylic of the pattern indicated and shall be of 0.125” minimum thickness for 2’x4’ and smaller panels and of 0.156” minimum thickness for large panels unless otherwise shown. Minimum thickness shall be defined as the measurement from the base side of the panel to the top of the prism. Lens shall be supported within hinged door frame in not less than six points and in such a manner to prevent vibration of the lens.

2.04 PHOTO CONTROL FOR LIGHTING

A. Photo control shall be self-contained turn lock type head with three EEI-NEMA twist type blades and receptacle with weatherproof housing, photocell, relay, and lightning arrester for surge protection. Unless indicated the dual voltage type responding between 105 and 277 volts shall be used. Rating of contacts shall be 1800 volt amps, for operating minimum 1000 watt lamp load Photocell shall be Tork 2100 Series or equal. Receptacle and mounting shall be included.

Cover system in this article is intended for protection of CPVC piping in low-hazard occupancy applications. It also is used to improve the appearance of other piping. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. See Section 016000 "Product Requirements."

2.05 DIGITAL LIGHTING TIMERS

A. Timer shall be a Tork 7-Day Digital Time (Model EW101B) or an approved equal digital, astronomic timer with emergency reserve power supply.

PART 3 - EXECUTION

3.01 GENERAL

A. Install the fixtures where indicated on the architectural ceiling plan. Fixture counts shall not be altered without approval from the engineer.

B. Recessed fixtures mounted in gyp-board ceiling systems shall be provided with the appropriate flange kit as required for proper installation.

C. For lighting fixtures installed in suspended ceiling earthquake clips shall not be used. For seismic design the fixtures shall be bolted to the ceiling grid. Seismic bracing shall be provided for all surface mounted lighting fixtures. See drawings for details.

D. All luminaires weighing more than 20 pounds shall be directly suspended from the building structure.

E. Supply plaster frames, trim rings, and backboxes to other trades as required.

F. Coordinate with other Divisions of these Specifications to avoid conflict between luminaires, supports, fittings, mechanical equipment, piping, structure, etc.

G. Pendant mounted fixtures shall have stem supported by a fixture and stud mounted in the outlet box.

3.02 RECESSED LUMINAIRES

A. Install recessed luminaires to permit removal from below, to gain access to outlet or prewired fixture box.

B. Connect recessed luminaire to boxes with flexible conduit and fixture wire. Maximum fixture whip shall not exceed 8 feet and shall not be used to extend to additional fixtures. Fixture whips shall be no smaller than #14 AWG.

C. Support recessed LED luminaires from the building structure by installing ceiling system suspension wire or fixture chains on two (2) diagonal corners of each luminaire. Ceiling system hold-down clips are not acceptable. Note only applicable in seismic zones.

3.03 ADJUSTING AND CLEANING

A. Align luminaires one week prior to final acceptance. Replace broken lenses or damaged reflectors. Clean all open reflectors with soft cloths. Remove fingerprints and other blemishes. Refer to lighting fixture schedule for lamping requirements.

END OF SECTION