

PROJECT MANUAL

Western Slope Food Bank of the Rockies

BID PACKAGE #3 – FOUNDATIONS

100% Construction Documents

Issued: June 15, 2021

Architect's Project Number: 2108

OWNER:

Food Bank of the Rockies

ARCHITECT:

Chamberlin Architects, P.C.
437 Main Street
Grand Junction, CO 81501
(970) 242-6804

MECHANICAL ENGINEER:

Ralston Mechanical Consulting
356 Echo Canyon Court
Grand Junction, CO 81507
(970) 434-9819

STRUCTURAL ENGINEER:

Lindauer-Dunn, Inc.
802 Rood Avenue
Grand Junction, CO 81501
(970) 241-0900

ELECTRICAL ENGINEER:

Ron Slade, PE
745 Rood Avenue
Grand Junction, CO 81501
(970) 201-4302

Specification divisions or sections not included below are included on the drawings or are not applicable or are included in a separate bid package. For specifications related to civil site work or electrical site work and underground electrical, refer to Bid Package #2 – Site. For pre-engineered metal building components, refer to Bid Package #1 – Metal Building. Other scopes of work will be included in future bid packages.

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007300 SUPPLEMENTARY GENERAL CONDITIONS

General Requirements Subgroup

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SECTION 00 7000 - GENERAL CONDITIONS

PART 1 - GENERAL

- 1.1 The "General Conditions of the Contract for Construction," AIA Document A201, 2007 Edition, Articles 1 through 14 inclusive, is a part of this Contract, and is incorporated as fully as if here set forth.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 00 7000

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SECTION 00 7300 - SUPPLEMENTARY GENERAL CONDITIONS

PART 1 - GENERAL

The following Supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction" AIA Document A201, 2007 Edition. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these Supplements, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

Article 3: CONTRACTOR3.6.1 Sales and Use Taxes (Add)

Contractors shall be responsible for informing themselves of applicable tax laws, requirements, regulations, and interpretations as they apply to this project.

3.7.1 (Delete and replace with the following)

The Owner will pay for tap/connection fees for storm, sanitary sewer, power, gas, phones, TV and both domestic and fire system water. The Owner will also pay for any Community Development plan review fees and impact fees. All other fees, permits, and licenses will be paid for by the Contractor. The Architect will be responsible for the initial submittal of information to the authorities having jurisdiction, answering and responding to questions regarding design issues, and providing design clarifications necessary to obtain permits and approvals. The Contractor will be responsible for coordinating the applications, picking up licenses, approvals and permits and informing the Owner and Architect of any requirements from authorities having jurisdiction.

Article 7: CHANGES IN THE WORK7.3.3.3 After the word "fee", add the following:

"...of the itemized cost breakdown as follows:

Overhead and profit on burdened labor hours, itemized by skill or category: not to exceed 15%.

Overhead and profit on materials required, as verified by quantities and unit cost invoices, including applicable sales taxes, but deducting any trade discounts: not to exceed 10%.

Overhead and profit on fair rental value for power tools or equipment for additional time such are used in connection with the change, regardless of ownership, hours or days and rates: not to exceed 10%

Overhead and profit charged by Subcontractors or Sub-subcontractors on all subcontract work: not to exceed 10%."

7.3.7

First sentence, after "...an amount for overhead and profit as set forth in" add "Article 7.3.3.3." Delete "the Agreement, or if no such amount, a reasonable amount."

7.3.7.5 (delete paragraph, substitute)

Among items to be considered as included in overhead and profit and not as separate costs are: insurance premiums not listed above, superintendents, supervision, small or hand tools, time keepers, clerks, watchmen, subsistence, incidental job expenses and general office expenses.

Article 8: TIME

8.3.4 (Added)

Time extensions will not be granted for rain, wind, snow, or other weather phenomena of normal intensity for the locality where work is performed. Determinations of the extent of delay attributable to unusual weather conditions shall be made by comparing the weather for the contract period involved with the average of the preceding five (5) year climactic range during the same period on the calendar. National Oceanic and Atmospheric Administration National Weather Service statistics for the locality or area where the work is performed shall be used to determine the five (5) year average weather conditions.

Article 9: PAYMENTS AND COMPLETION

9.2 (Add the following sentence)

The schedule of values shall be prepared in such a manner that each major item of Work and each subcontracted item of Work is shown as a single item on AIA Document G702, Application and Certificate for Payment and G703, Continuation Sheet.

9.3.1 (Add the following paragraphs)

The form of Application for Payment shall be AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet.

Until the Work is 50% complete, the Owner will pay 90% of the amount due the Contractor on account of progress payments. At the time the Work is 50% complete and thereafter, if the manner of completion of the Work and its progress are and remain satisfactory to the Architect, and in the absence of other good and sufficient reasons, he shall (on presentation by the Contractor of consent of surety for each Application), authorize any remaining partial payment to be paid in full.

The full contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Architect, (or if the Surety withholds his consent), or for other good and sufficient reasons.

9.10 Final Completion and Final Payments

9.10.1.1 (Add)

If the work is completed, except for delay or correction of minor defects or unavailability of materials, or other causes beyond the control of the Contractor, the Owner, at his discretion, may release to the Contractor the remainder of the Contract Sum except for an amount equal to three times the cost of completing the unfinished work and/or correcting the defective work.

9.10.2.1 (Add)

Upon completion of the above and the requirements set forth in Division 01 "Closeout Procedures", the project shall be advertised in accordance with the Notice of Contractor's Settlement, by two publications of notice, the last publication appearing at least ten (10) days prior to the time of final settlement.

On the date of final settlement thus advertised, and after the Contractor has submitted a written notice to the Owner that no claims have been filed, final payment and settlement shall be made in full.

If any unpaid claim for labor, materials, supplies or equipment is filed before payment in full of all sums due the Contractor, the Owner shall withhold from the Contractor sufficient funds to insure the payment of such claim, until the same shall have been paid or withdrawn, such payment or withdrawal to be evidenced by filing a receipt in full or in order for withdrawal signed by the claimant or his duly authorized agent or assignee. However, as provided by statute, such funds shall not be withheld longer

than 90 days following the date fixed for final settlement with the Contractor, as set forth in the published notice of Contractor's Settlement unless such action at law shall be commenced within that time to enforce such unpaid claim and a notice of such action at law shall have been filed with the Owner. At the expiration of the 90-day period, the Owner shall release to the Contractor all monies as are not the subject of such action at law.

9.10.6 (Add)

Unless otherwise agreed in writing, the Contractor shall carry on the Work and maintain its progress during any dispute, arbitration and/or litigation, and, subject to the provisions of this Article 9, the Owner shall continue to make payments to the Contractor in accordance with the Contract Documents.

Article 11: INSURANCE AND BONDS

11.1.1

In the first sentence, replace the word "jurisdiction" with the word "state."

11.1.1.9 (Added)

Liability insurance shall include all major divisions of coverage and be on a comprehensive basis including:

Premises--Operations (Including X-C-U as applicable)

Independent Contractor's Protective
Products and Completed Operations

Personal Injury Liability with Employment Exclusion deleted.

Contractual--including specified provision for the Contractor's obligations under Paragraph 4.18

Owned, non-owned and hired motor vehicles

Broad Form Property Damage including Completed Operations

Umbrella Excess Liability

11.1.2.1 (Add the following Clause 11.1.2.1 to 11.1.2)

The insurance required by Subparagraph 11.1.1 shall be written for not less than the following, or greater if required by law:

1. Worker's compensation—Statutory
Employer's Liability: \$100,000
2. Comprehensive general liability, (including Premises-Operations; Independent Contractor's Protective; Product and Completed Operations; Broad Form Property Damage):
Combined single limits for bodily injury and property damage:
\$1,000,000 each occurrence and annual aggregate
Products and Completed Operations to be maintained for two years after final payment.
Property Damage Liability insurance shall provide X, C or U coverages.
3. Contractual Liability:
Bodily Injury: \$1,000,000 each occurrence and annual aggregate
Property Damage: \$1,000,000 each occurrence and annual aggregate
4. Personal Injury, with Employment Exclusion deleted: \$1,000,000 each person and annual aggregate
5. Comprehensive Automobile Liability: Combined single limits for bodily injury and property damage: \$1,000,000 each occurrence and annual aggregate

11.1.5 (Add)

Furnish one copy of Certificates herein required for each copy of the Agreement; specifically set forth evidence of all coverage required by Subparagraph 11.1.1, 11.1.2 and 11.1.3. The form of the Certificate shall be AIA Document G705. Furnish to the Owner, copies of any endorsements that are subsequently issued amending coverage or limits.

11.3 Property Insurance11.3.1.6 (Added)

The form of policy for this coverage shall be "Completed Value." Provide policy in the broadest form available as of the Contract Document's date.

11.3.1.7 (Added)

If by the terms of this insurance any mandatory deductibles are required, the Contractor shall be responsible for payment of such mandatory deductibles in the event of a paid claim. Should the Owner elect to increase any mandatory deductibles or purchase deductible not otherwise required, he shall be responsible for payment of such additional deductible amounts. The amount of the mandatory deductible provision is \$1,000 per occurrence.

11.3.6 (Delete the first sentence and substitute following)

The Owner shall file a certificate of insurance for all policies including insurance coverages required by Paragraph 11.3.1. with the Contractor before an exposure to loss may occur.

Article 13: MISCELLANEOUS PROVISIONS13.5.2 (Add the following)

Should such special testing, inspection or approval be caused by the Contractor's failure to follow requirements of the Contract Documents or by required tests per 4.2.6 indicating conditions not in conformance with Contract Documents, the costs of such additional testing, inspection or approval shall be borne by the Contractor regardless of the results.

Article 15: CLAIMS AND DISPUTES15.1.5.2 (Add the following sentences)

Claims for time delays due to unusual weather conditions will be evaluated on a tentative basis until the project is substantially complete. At Substantial Completion actual weather conditions prevailing throughout the entire contract period will be considered in approving time extension due to weather delays. Time extensions for weather delays do not entitle the Contractor to "extended overhead" recovery.

15.3 (Delete 15.3 - Mediation and substitute the following)

Any claim, dispute or other matter in questions may be resolved in any manner permitted by law.

15.4 (Delete 15.4 – Arbitration)

END OF SECTION 00 7300

SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Project information.
 - 2. Work covered by the Contract Documents.
 - 3. Access to site.
 - 4. Work restrictions.

1.2 PROJECT INFORMATION

- A. Project Identification: Western Slope Food Bank of the Rockies
 - 1. Project Location: Grand Junction, Colorado.
- B. Owner: Food Bank of the Rockies
- C. Architect: Chamberlin Architects, 437 Main Street, Grand Junction, CO 81501
- D. Construction Manager / General Contractor: Ford Construction, 560 25 Rd, Grand Junction, CO 81505.

1.3 WORK COVERED BY THE CONTRACT DOCUMENTS

- A. The Work consists of the following:
 - 1. The Work includes: Building foundations, underslab utilities, monument sign foundations.

1.4 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period.

1.5 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate #1, Clean Room
 - 1. Not Applicable to Bid Package #3.

B. Alternate #2, Agency Cooler Insulated Slab

1. Base Bid: Provide typical flush concrete floor slab per structural drawings. Agency Freezer has an insulated concrete slab in base bid.
2. Alternate: Provide insulated floor slab with structural slab recessed 10” to receive 4” of XPS insulation over vapor barrier with 6” topping slab. Provide thermal break between Freezer and Cooler as detailed on drawings.

C. Alternate #3, Kitchen Cooler/Freezer Insulated Slab

1. Base Bid: Provide typical flush concrete floor slab per structural drawings with recessed area at Freezer to receive insulated panel by refrigeration supplier.
2. Alternate: Provide insulated floor slab at both Freezer and Cooler with structural slab recessed 9” to receive 4” of XPS insulation over vapor barrier with 5” topping slab. Provide thermal break between Freezer and Cooler as detailed on drawings.

END OF SECTION 01 2300

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use **CSI Form 13.1A**.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.

- g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

1.5 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
 - 4. Requests for Interpretation (RFIs).
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.2 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
 9. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate required installation sequences.
 - c. 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. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
 2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
 3. Number of Copies: Submit electronic copies through project management website established by Owner.
 4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
- B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at

Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1.6 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.

- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than fifteen (15) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Critical work sequencing and long-lead items.
 - c. Designation of key personnel and their duties.
 - d. Procedures for processing field decisions and Change Orders.
 - e. Procedures for RFIs.
 - f. Procedures for testing and inspecting.
 - g. Procedures for processing Applications for Payment.
 - h. Distribution of the Contract Documents.
 - i. Submittal procedures.
 - j. Use of the premises (and existing building if applicable).
 - k. Responsibility for temporary facilities and controls.

- l. Construction waste management and recycling.
 - m. Parking availability.
 - n. First aid.
 - o. Progress cleaning.
 3. Minutes: Record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. The Contract Documents.
 - b. Related RFIs.
 - c. Related Change Orders.
 - d. Submittals.
 - e. Review of mockups.
 - f. Possible conflicts.
 - g. Compatibility problems.
 - h. Time schedules.
 - i. Weather limitations.
 - j. Manufacturer's written recommendations.
 - k. Warranty requirements.
 - l. Compatibility of materials.
 - m. Acceptability of substrates.
 - n. Regulations of authorities having jurisdiction.
 - o. Testing and inspecting requirements.
 - p. Installation procedures.
 - q. Coordination with other work.
 - r. Protection of adjacent work.
 - s. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at weekly intervals, or longer intervals when agreed upon by Owner and Architect. Coordinate dates of meetings with preparation of payment requests.
 1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in

- planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Sequence of operations.
 - 2) Status of submittals.
 - 3) Progress cleaning.
 - 4) RFIs.
 - 5) Status of proposal requests.
 - 6) Pending changes.
 - 7) Status of Change Orders.
 3. Minutes: Record the meeting minutes.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.7 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
 1. Project name.
 2. Date.

3. Name of Contractor.
 4. Name of Architect.
 5. RFI number, numbered sequentially.
 6. Specification Section number and title and related paragraphs, as appropriate.
 7. Drawing number and detail references, as appropriate.
 8. Field dimensions and conditions, as appropriate.
 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. Contractor's signature.
 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs: CSI Form 13.2A or Contractor's form with information listed above.
1. Identify each page of attachments with the RFI number and sequential page number.
- D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven (7) working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within ten (10) days of receipt of the RFI response.

- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.

- G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B or Contractor's form Including the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were dropped and not submitted.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

- A. Provide Product Data for all products indicated in Construction Documents and as indicated in individual product sections of the Specifications.
 - 1. Provide Shop Drawings of all fabricated products and as indicated in individual product sections of the Specifications.
- B. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided upon request by Architect for Contractor's use in preparing submittals. The Architect's electronic file waiver must be signed and returned prior to delivery of electronic files.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - b. No extension of time will be allowed because of failure to properly coordinate and sequence submittals.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow fifteen (15) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow fifteen (15) days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow twenty-one (21) days for initial review of each submittal including:
 - a. Structural, Mechanical, Plumbing and Electrical submittals.
- E. Color Review and Approval: The Color Schedule in the Drawings indicate the initial color selections for the project. Because of the potential for product substitutions and discontinuation of colors, final color selections will be made by the Architect only after all color submittals have been received from the Contractor.**
1. Within seven (7) days after receipt of the final color submittal, the Architect will issue a Final Color Schedule to the Contractor in the form of an ASI to modify the color schedules in the Construction Documents.
- F. Identification: Place a permanent label or title block on each submittal for identification.**
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - f. Number and title of appropriate Specification Section.
- G. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.**
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.**
1. Transmittal Form: Use AIA Document G810, CSI Form 12.1A or Contractor's standard transmittal form.

2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked "No Exceptions Taken" or "Make Corrections Noted".
 - J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
 - K. Use for Construction: Use only final submittals with mark indicating "No Exceptions Taken" or "Make Corrections Noted" by Architect.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
 1. Submit electronic submittals directly to extranet specifically established for Project.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Compliance with specified referenced standards.
 - h. Testing by recognized testing agency.
 4. Submit Product Data before or concurrent with Samples.
 5. Number of Copies: Submit three (3) copies of Product Data, unless otherwise indicated. Architect will return two (2) copies. Mark up and retain one returned copy as a Project

Record Document. Electronic submittals are preferred in lieu of hard copies unless specifically noted otherwise.

- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Design calculations.
 - e. Compliance with specified standards.
 - f. Seal and signature of professional engineer if specified.
 - g. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
 3. Number of Copies: Submit three (3) opaque copies of each submittal, unless copies are required for Structural, Mechanical, Electrical or Plumbing Engineers, in which case submit four (4) copies. Two (2) copies will be returned. Electronic submittals are preferred in lieu of hard copies unless specifically noted otherwise.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate Specification Section.
 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 4. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing

color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit two (2) sets of Samples. Architect will retain one (1) Sample set and return one (1).
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least two (2) sets of paired units that show approximate limits of variations.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 1. Number of Copies: Submit two (2) copies of each submittal, unless otherwise indicated. Architect will not return copies.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- C. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- D. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- E. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- F. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

- G. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- H. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
 2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.
- I. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- J. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- K. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.
1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.3 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit two (2) copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S/ ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - 1. No Exceptions Taken.
 - 2. Make Corrections Noted.
 - 3. Rejected.
 - 4. Revise and Resubmit
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 3300

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SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- J. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.

5. Description of the Work and test and inspection method.
6. Complete test or inspection data.
7. Test and inspection results and an interpretation of test results.
8. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
9. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
10. Name and signature of laboratory inspector.
11. Recommendations on retesting and reinspecting.

1.5 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed, unless otherwise indicated.

1.6 TESTING SCHEDULE

A. Testing paid by Owner:

1. Fill and Backfill compaction density tests.
2. Concrete Testing.
3. Steel Testing.

B. Testing paid by Contractor:

1. Mechanical systems balancing and testing.
2. Electrical system testing.

1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
 - 2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 4000

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SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

- A. General: Unless otherwise indicated, cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Sewer, Water, and Electric Power Service: Sewer, Water and Electrical Power Services will continue to be paid for by the Owner.

1.3 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pavement: Comply with pavement Sections.
- B. Portable Chain-Link Fencing: Minimum 2-inch, 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide concrete or galvanized steel bases for supporting posts.
- C. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry" or "Miscellaneous Rough Carpentry."
- D. Paint: Comply with requirements in Division 09 painting Sections.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.
 - a. Owner does authorize use of permanent HVAC system for use during construction.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION (Other than authorized use of Owner's utility services)

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- C. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- D. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service either overhead or underground.
 - 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- E. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- F. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install at least one (1) telephone line(s) for each field office.
 - 1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Architect's office.
 - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- G. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in common-use facilities.
 - 1. Provide DSL in primary field office if available.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:

1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
 2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earth Moving."
 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Asphalt Paving."
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary parking areas for construction personnel if there are no designated areas of Owner's existing parking.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- F. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
1. Provide temporary, directional signs for construction personnel and visitors.
 2. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 01 Section "Summary."
- B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
 1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- C. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01 5000

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3 SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

- a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - g. Cost information, including a proposal of change, if any, in the Contract Sum.
 - h. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Change Order.
 - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- B. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
- a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.
- C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 3. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Store cementitious products and materials on elevated platforms.
 - 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 7. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. **Manufacturer's Warranty:** Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. **Special Warranty:** Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. **Specified Form:** When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 - 2. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
 2. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 3. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 4. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
 5. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
 6. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
 7. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions,

- and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
8. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
 9. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within sixty (60) days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. Substitution request is fully documented and properly submitted.
 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified warranty.

2.3 COMPARABLE PRODUCTS

- A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
1. Construction layout.
 2. Field engineering and surveying.
 3. General installation of products.
 4. Coordination of Owner-installed products.
 5. Progress cleaning.
 6. Starting and adjusting.
 7. Protection of installed construction.
 8. Correction of the Work.

1.2 QUALITY ASSURANCE

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 3. Inform installers of lines and levels to which they must comply.
 4. Check the location, level and plumb, of every major element as the Work progresses.
 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

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

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

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

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 7300

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Disposing of non-hazardous demolition and construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

1.3 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 Site Access and Temporary Controls:

- A. Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycling is encouraged as much as possible. Recycle construction waste and packaging materials that are accepted by local facilities. Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste and transport to recycling receiver or processor.
- D. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- E. Site-Clearing Wastes: Chip brush, branches, and trees at landfill facility.

3.3 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01 7419

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one (1) set(s) of marked-up Record Prints.
 - 2. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal: Submit one (1) set(s) of marked-up Record Prints. Architect will initial and date each print and mark whether general scope of changes, additional information recorded, and quality of markups are acceptable and legible. Architect will return prints for organizing into sets, printing, binding, and final submittal. Documents may be submitted electronically in lieu of hard copies.
 - b. Final Submittal: Submit one (1) set(s) of original marked-up Record Prints, and two (2) copies printed from Record Transparencies. Print each Drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one (1) copy of Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Revisions to electrical circuitry.
 - d. Changes made by Change Order or Construction Change Directive.
 - e. Changes made following Architect's written orders.
 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
 3. Identification: As follows:

- a. Project name.
- b. Date.
- c. Designation "PROJECT RECORD DRAWINGS."
- d. Name of Architect.
- e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders and Record Drawings where applicable.

2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01 7839

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SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation Walls and Grade Beams.
 - 3. Slabs-on-grade.
 - 4. Building walls.
- B. Related Sections include the following:
 - 1. Section 017419 “Construction Waste Management” for recycling and disposal requirements.
 - 2. Section 033543 “Polished Concrete Finishing” for treatment of slabs to receive polished finish.
 - 3. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
 - 4. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

2. Submit substantiating data for each concrete mix design contemplated for use to the Architect/Engineer not less than four weeks prior to first concrete placement. Data for each mix shall, as a minimum, include the following”:
 - a. Mix identification designation (unique for each mix submitted).
 - b. Statement of intended use for each mix.
 - c. Wet and dry unit weight.
 - d. Water/cementitious materials ratio.
 - e. Total air content.
 - f. Design slump.
 - g. Intended method of placement in field.
 3. Shrinkage testing per ASTM C157.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
1. Show all reinforcing, top and bottom profile of concrete element, supports below, and concrete walls, grade beams, joists, etc. framing into the element.
 2. Provide one continuous elevation at 1/4” scale for all beams, joists, or walls in a common line. Show pockets and openings in shear walls, structural slabs, beams, elevation at top of beams, walls, columns, sections through all beams, pilasters and columns, and placing sequence of reinforcing items with more than one reinforcing layer.
 3. Show locations of approved construction joints, splices of reinforcing, type of splice used and splice location, grade of all reinforcement used and specifically identify all ASTM A706 and epoxy coated reinforcing.
- D. Welding certificates if weldable reinforcement is specified on the Contract Documents.
- E. Samples:
1. For vapor retarder.
 2. For aggregate mix at polished concrete floors.
- F. Qualification Data: For Installer testing agency.
- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Alkali-Aggregate Reactivity of Aggregates. Submit test reports indicating that fine and coarse aggregates are not “potentially reactive” based on the ASTM C295 or ASTM C1260 (or ASTM C1293) testing limits set forth in Section 5.1 of “Guide Specification for Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association). Alternately, submit ASTM C1567 test reports indicating that the combination of mix ingredients reduces the expansion due to alkali-aggregate reactivity such that the mix complies with Section 5.2 of “Guide Specification for Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association). All tests for submitted reports shall have been performed within one year of the submittal date.
- H. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.

2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Fiber reinforcement.
 6. Curing compounds.
 7. Floor and slab treatments.
 8. Bonding agents.
 9. Adhesives.
 10. Vapor retarders.
 11. Semirigid joint filler.
 12. Joint-filler strips.
 13. Repair materials.
- I. Minutes of pre-installation conference.
- J. Placement notification: Advanced notification of concrete placement, submit notification at least 24 hours in advance.
- K. Proposed locations of saw cut joints not indicated on the Contract Documents.
- L. Evaporative retarder product data and application data.

1.5 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, as documented according to ASTM E 548.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
 3. Concrete reinforcing steel shall be inspected by personnel experienced in concrete construction and acceptable to the Architect/Engineer. Personnel currently certified as an ACI Concrete Construction Inspector will be accepted.

- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- F. Formwork: Design and engineering of formwork shall be the responsibility of the Contractor. Design of formwork and preparation of formwork drawings shall be under the supervision of a professional engineer registered in the state of the Colorado.
- G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- H. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".
 - 1. Before submitting design mixtures, review concrete 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. Polished concrete 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, joint filler strips, vapor retarder installation, floor and slab flatness and levelness measurement and concrete protection.
 - 3. Minutes of the meeting shall be recorded, typed, and printed by the Contractor and distributed by the Contractor to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner's Representative, Consultant Engineer. The minutes shall include a statement by the concrete subcontractor indicating that the proposed mix design, and placing, finishing, and curing procedures can produce the concrete quality required by these specifications.
- I. Record of Work: Maintain a record listing the time and date of placement of all concrete for the structure. Retain batch tickets for all concrete. Such record shall be kept until the completion of the project and shall be available to the Architect for examination at any time.
- J. Pre-placement Inspection: Formwork installation, reinforcing steel placement, and installation of all items to be embedded or cast into concrete shall be verified by the Contractor prior to placement.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior grade plywood panels, suitable for concrete forms, complying with DOC PS-1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form)), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. 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 will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1-1/2 inch (38 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: Where welding of reinforcement is noted on the drawings ASTM A 706/A 706M, deformed.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars 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.
- C. Mechanical Splices: Full mechanical splices shall develop at least 125% of the bar yield strength in tension or compression, as required. Splices shall comply with ICC-ES Evaluation Criteria and shall comply with ACI 318 21.2.6.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project. Alternate cementitious materials, when proposed to control alkali-silica reactions and tested as part of a representative complete concrete mix in accordance with ASTM C1567, may be used subject to approval.
 1. Portland Cement: ASTM C 150, Type I/II sulfate resistant, gray white. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

- B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. All coarse and fine aggregates shall be tested per ASTM C295 or ASTM C1260 (or ASTM C1293) in accordance with Section 5.1 of “Guide Specification for Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association). 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: As noted on the drawings.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
 7. Non-Chloride, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C494, Type C or E, and shall not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least one year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.
 8. Mid-Range water reducing admixture: Shall be EUCON X-15 or EUCON MR by The Euclid Chemical Company, DARACEM or Mira series by W.R. Grace, or POZZOLITH 997 or Rheobuild 3000 by Master Builders, and shall conform to ASTM C494 Type A.
- C. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Available Products:
 - a. Axim Concrete Technologies; Catexol 1000CI.
 - b. Boral Material Technologies, Inc.; Boral BCN2.
 - c. Cortec Corporation; MCI 2000 .
 - d. Grace Construction Products, W. R. Grace & Co.; DCI-S.
 - e. Master Builders, Inc.; Rheocrete 222+.
 - f. Sika Corporation; FerroGard-901.

2.7 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Basis-of-Design Products:
 - a. Stego Industries, LLC; Stego Wrap, 15 mils.
 - 2. Thickness: 15 mils minimum.
 - 3. Permeance: 0.01 perms per ASTM E1745.
 - 4. Puncture Resistance: 2200 grams
 - 5. Tensile Strength: not less than 45 lb/in.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 FLOOR AND SLAB TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Available Products:
 - a. Burke by Edoco; Titan Hard.
 - b. ChemMasters; Chemisil Plus.
 - c. ChemTec International; ChemTec One.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
 - e. Curecrete Distribution Inc.; Ashford Formula.
 - f. Dayton Superior Corporation; Day-Chem Sure Hard.
 - g. Euclid Chemical Company (The); Euco Diamond Hard.
 - h. Kaufman Products, Inc.; SureHard.
 - i. L&M Construction Chemicals, Inc.; Seal Hard.
 - j. Meadows, W. R., Inc.; Liqui-Hard.
 - k. Metalcrete Industries; Floorsaver.
 - l. Nox-Crete Products Group, Kinsman Corporation; Duranox.
 - m. Symons Corporation, a Dayton Superior Company; Buff Hard.
 - n. US Mix Products Company; US Spec Industraseal.
 - o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Available Products:
 - a. Axim Concrete Technologies; Cimfilm.
 - b. Burke by Edoco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
 - f. Euclid Chemical Company (The); Eucobar.
 - g. Kaufman Products, Inc.; Vapor Aid.
 - h. Lambert Corporation; Lambco Skin.
 - i. L&M Construction Chemicals, Inc.; E-Con.
 - j. MBT Protection and Repair, Div. of ChemRex; Confilm.
 - k. Meadows, W. R., Inc.; Sealtight Evapre.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
 - n. Sika Corporation, Inc.; SikaFilm.
 - o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
 - p. Unitex; Pro-Film.
 - q. US Mix Products Company; US Spec Monofilm ER.
 - r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- D. Water: Potable.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

- A. Repair Overlay: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland Cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4,100 psi at 28 days when tested according to ASTM C 109/C 109M.
 5. Provide products compatible with specified flooring materials and adhesives.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland Cement in concrete as follows:

1. Fly Ash: 25 percent.
 2. Combined Fly Ash and Pozzolan: 25 percent.
 3. Combined Fly Ash, Slag, Pozzolan and other Portland Cement replacements at slabs-on-grade to receive polished finish: not to exceed 10 percent of Portland Cement volume.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Minimize use of admixtures at floors slabs to receive polished concrete finish.
 2. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 3. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 4. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 5. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Performance and Design Requirements
1. Shrinkage: Shrinkage strain, determined and reported in accordance with ASTM C157 as amended and modified herein, shall not exceed the values below for each class of concrete listed.
 - a. Amendments and Modifications to ASTM C157:
 - 1) Storage: After the initial 24 hour comparator reading, the specimens are placed back in the lime-saturated water until the age of 7 days. At this time another comparator reading is taken. This reading is used as the base reading, which is used to calculate percent shrinkage. The specimens are then stored in a 50% humidity room at 73 degrees.
 - 2) Test Reports: Report gage length (average of 3) after 4, 7, 14, 28, and 56 days. In addition to the information required by ASTM C157 Section 11, shrinkage test reports shall include the gage lengths (initial measurements) used to determine the reported shrinkage strains.
 - b. 28-day Shrinkage Strain: Shrinkage strains, determined as above after 28 days of storage, shall not exceed the following:
 - 1) Concrete for slabs-on-grade cast directly on a vapor retarder: 0.046%.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Proportion structural normal weight concrete mixture as noted on the drawings, unless aggregates are “potentially reactive” with alkalis based on the ASTM C295 or ASTM C1260 (or ASTM C1293) testing limits of Section 5.1 of “Guide Specification for Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association). When aggregates are “potentially reactive”, compliance with Section 5.2 of “Guide Specification for Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association) must be established through ASTM C1567 testing for proposed alternate concrete mixture. Submit test reports in accordance with Part I of this specification.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, 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.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117. Concrete adjacent to elevators shall be installed within the tolerances required by the elevator manufacturer.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
 - 3. The permissible irregularity is a cumulative value due to all sources of error including, but not limited to, layout, plumbness, member sizes, formwork offsets, joints, and member levelness. The permissible irregularity shall also apply between adjacent concrete surfaces on opposite sides of a construction joint, expansion joint, or shrinkage pour strip.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- M. All formwork surfaces that will provide the finished surface of exposed concrete must be accepted by the Architect before depositing concrete.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges" and with the following additional requirements:
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.3 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, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
 - 2. Place plastic vapor retarder as indicated in the drawings and in the following locations:
 - a. Exterior side of foundation walls (in lieu of dampproofing) and as a barrier below foundation drains
 - b. Directly below all building slabs-on-grade, except as note below.
 - c. Below insulation and above sub-slab at insulated floor slabs.
 - 3.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not place

reinforcement on grade or deck and subsequently raise into position while placing concrete. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Size, length, number, and placing of supports shall be sufficient to hold reinforcing in the proper position within specified tolerances during construction traffic and concrete placement.
- G. On vertical formwork, use approved bar chairs or spacers as required to maintain proper concrete cover and bar position. Do not staple or use any other metallic fastener to secure bolsters, chairs, etc. to formwork for concrete surfaces exposed the exterior.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete

when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

3. All other Interior Slabs-on-Grade: Unless noted otherwise on the drawings, locate construction joints on column centerlines. **Locate control joints where shown on the drawings. If not shown, provide control joints at column centerlines and at intervals not more than 10 feet each way.**

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

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

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

3.8 CONCRETE PLACEMENT

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

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

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

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

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

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

- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 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, to be covered with a coating or covering material applied directly to concrete as indicated.

- 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 FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.
 - 1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. 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 indicated and surfaces to receive trowel finish and to be covered with fluid applied or sheet waterproofing, built-up or membrane roofing.
- D. 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 indicated or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system .
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 - b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Polished Concrete Finish:
 - 1. Refer to drawings for locations of polished concrete floors. Finish according to Section 033543 Polished Concrete Finishing.
 - 2. At lobby and office polished floor areas (PCONC1) aggregate shall not be pushed down from the surface of the concrete but allowed to stay at the top of the concrete mix so aggregate may be exposed during grinding and polishing.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 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 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 the remainder of the 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. Moisture-retaining cover shall be inspected each day by Contractor. Any areas which do not show condensation on the underside of the cover or any slab areas which are not wet shall be immediately rewetted and the cover reapplied to prevent moisture loss.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..
 - 3. Curing Compound: Not allowed.
 - 4. Curing and Sealing Compound: Not allowed.

3.13 LIQUID FLOOR TREATMENTS

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

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland Cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning and that are unacceptable to the Architects. Allow Architect/Engineer to observe formed concrete surfaces immediately upon removal of forms and prior to repair of surface defects. Defects in structural concrete shall be brought to the attention of the Architect/Engineer. Repair tie holes and surface defects immediately after such observation. Where the concrete surface will be textured by sandblasting or bush-hammering, repair surfaces before texturing.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template. Submit proposed repair for acceptance prior to beginning this work.

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

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.

5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength

and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

END OF SECTION 033000

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Flashing.
4. Sleeves.
5. Formed steel channel.

B. Related Sections:

1. Section 099000 - Painting and Coating: Product and execution requirements for painting specified by this section.
2. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Product and execution requirements for vibration isolators.
3. Section 221100 - Facility Water Distribution: Execution requirements for placement of hangers and supports specified by this section.
4. Section 221300 - Facility Sanitary Sewerage: Execution requirements for placement of hangers and supports specified by this section.
5. Section 221400 - Facility Storm Drainage: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
2. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

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

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

- E. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 - 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
 - 3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
- D. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with applicable authority.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.
- B. Provide ventilation in areas to receive solvent cured materials.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - DWV:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
6. Vertical Support: Steel riser clamp.
7. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

B. Plumbing Piping - Water:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Vertical Support: Steel riser clamp.

2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Flexible Flashing: compatible with roofing.
- D. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sealant: Acrylic.

2.6 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.

3.2 PREPARATION

- A. Obtain permission from Architect/Engineer before using powder-actuated anchors.

- B. Do not drill or cut structural members.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, MSS SP 89.
- B. Support horizontal piping as scheduled.
- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.
- F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- I. Support riser piping independently of connected horizontal piping.
- J. Provide copper plated hangers and supports for copper piping.
- K. Design hangers for pipe movement without disengagement of supported pipe.
- L. Prime coat exposed steel hangers and supports. Refer to Section 099000. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 220700.

3.4 INSTALLATION - FLASHING

- A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Seal floor, shower, and mop sink drains watertight to adjacent materials.
- D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.5 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel escutcheons at finished surfaces.

3.6 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting, testing.

3.7 CLEANING

- A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

3.8 PROTECTION OF FINISHED WORK

- A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.9 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Pipe Material: Cast iron.
 - a. Maximum Hanger Spacing: 5 feet.
 - b. Hanger Rod Diameter: 5/8 inch.
 - 2. Pipe Material: Cast Iron, with 10-foot length of pipe.
 - a. Maximum Hanger Spacing: 10 feet.
 - b. Hanger Rod Diameter: 5/8 inch.
 - 3. Pipe Material: Copper tube.

- a. Size: 1-1/4 inches and smaller.
 - b. Maximum Hanger Spacing: 6 feet.
 - c. Hanger Rod Diameter: 1/2 inch.
4. Pipe Material: Copper tube.
- a. Size: 1-1/2 inches and larger.
 - b. Maximum Hanger Spacing: 10 feet.
 - c. Hanger Rod Diameter: 1/2 inch.
5. Pipe Material: PVC.
- a. Maximum Hanger Spacing: 4 feet.
 - b. Hanger Rod Diameter: 3/8 inch.
6. Pipe Material: Steel.
- a. Size: 3 inches and smaller.
 - b. Maximum Hanger Spacing: 12 feet.
 - c. Hanger Rod Diameter: 1/2 inch.

END OF SECTION 220529

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SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.

B. Related Sections:

1. Section 099000 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

- A. Plastic Tags:
 - 1. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.
- B. Metal Tags:
 - 1. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.
- C. Information Tags:
 - 1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.
- D. Tag Chart: Typewritten letter size list of applied tags and location, plastic laminated.

2.3 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
 - 2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
 - 3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
 - 4. Ductwork and Equipment: 1-3/4 inches high letters.
- B. Stencil Paint: As specified in Section 099000, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers
 - 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Pipe Markers
 - 1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Plastic Underground Pipe Markers
 - 1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color-coded head.
- B. Color code as follows:
 - 1. Plumbing valves: Green.

2.6 LABELS

- A. Description: Aluminum, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

- B. Prepare surfaces in accordance with Section 099000 for stencil painting.

3.2 INSTALLATION

- A. Apply stencil painting in accordance with Section 099000.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates or stencil painting. Identify in-line pumps and other small devices with tags.
- H. Identify control panels and major control components outside panels with plastic nameplates.
- I. Identify valves in main and branch piping with tags.
- J. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- K. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plumbing piping insulation, jackets and accessories.
2. Plumbing equipment insulation, jackets and accessories.

B. Related Sections:

1. Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
2. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
3. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
4. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
5. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
6. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
7. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
8. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
9. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
10. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Perform Work in accordance with codes and standards adopted by authority having jurisdiction.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Glass Fiber and Mineral Fiber Insulation

2.2 PIPE INSULATION

- A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
 - 1. Thermal Conductivity: 0.23 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 850 degrees F.
 - 3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
 - 4. Jacket Temperature Limit: minus 20 to 150 degrees F.
- B. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

2.3 PIPE INSULATION JACKETS

- A. Vapor Retarder Jacket:
 - 1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
 - 2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
- B. PVC Plastic Pipe Jacket:
 - 1. Product Description: ASTM D1785, One piece molded type fitting covers and sheet material, off-white color.
 - 2. Thickness: 10 mil.
 - 3. Connections: Brush on welding adhesive.

2.4 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

- D. Piping 2 inches diameter and larger: High density non-compressible insulation. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.
- E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum or stainless steel jacket single piece construction with self adhesive closure. Thickness to match pipe insulation.
- F. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- G. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- H. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- I. Adhesives: Compatible with insulation.

2.5 EQUIPMENT INSULATION

- A. TYPE E-2: ASTM C612; glass fiber, rigid board, noncombustible with factory applied kraft reinforced aluminum foil jacket.
 - 1. Thermal Conductivity: 0.24 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 450 degrees F.
 - 3. Density: 3.0 pound per cubic foot.
 - 4. Jacket Temperature Limit: minus 20 to 150 degrees F.

2.6 EQUIPMENT INSULATION JACKETS

- A. PVC Plastic Equipment Jacket:
 - 1. Product Description: ASTM D1785, sheet material, off-white color.
 - 2. Minimum Service Temperature: -40 degrees F.
 - 3. Maximum Service Temperature: 150 degrees F.
 - 4. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
 - 5. Thickness: 10 mil.
 - 6. Connections: Brush on welding adhesive.

2.7 EQUIPMENT INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- E. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 013000 - Administrative Requirements: Coordination and project conditions.
- B. Verify piping and equipment has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Finish at supports, protrusions, and interruptions.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Glass Fiber Board Insulation:
 - 1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 - 2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
 - 3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.
- E. Hot Piping Systems less than 140 degrees F:
 - 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
 - 3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- F. Hot Piping Systems greater than 140 degrees F:

1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
3. Insulate flanges and unions at equipment.

G. Inserts and Shields:

1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.

H. Insulation Terminating Points:

1. Condensate Piping: Insulate entire piping system and components to prevent condensation.

I. Closed Cell Elastomeric Insulation:

1. Push insulation on to piping. Do not use pre-slit insulation.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer's recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings with insulation of like material and thickness as adjacent pipe.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

K. Buried Piping:

1. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.
- OR -
2. Install flexible, closed cell elastomeric insulation, and cover with corrugated HDPE sleeve pipe to prevent insulation from being compressed.

3.3 INSTALLATION - EQUIPMENT

- A. Factory Insulated Equipment: Do not insulate.
- B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

- C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- D. Equipment Containing Fluids Below Ambient Temperature:
 - 1. Insulate entire equipment surfaces.
 - 2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 - 3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 4. Finish insulation at supports, protrusions, and interruptions.
- E. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
- F. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 SCHEDULES

- A. Water Supply Services Piping Insulation Schedule:
 - 1. Domestic Hot Water Supply and Recirculation:
 - a. Type: P-1.
 - b. Thickness: 1.0 inch.
 - 2. Domestic Cold Water:
 - a. Type: P-1.
 - b. Thickness: 0.5 inch.
- B. Drainage Services Piping Insulation Schedule:
 - 1. Storm Piping - Horizontal and Vertical Above Ground Within Building:
 - a. Type: P-1.
 - b. Thickness: 1.0 inch.
- C. Equipment Insulation Schedule:
 - 1. Roof Drain Bodies:
 - a. Type: E-2.
 - b. Thickness: 1 inch.

END OF SECTION 220700

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SECTION 221100 - FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Domestic water piping, within 5 feet of building.
2. Domestic water piping, above grade.
3. Unions and flanges.
4. Valves.
5. Pressure gages.
6. Pressure gage taps.
7. Thermometers.
8. Water pressure reducing valves.
9. Strainers.
10. Hose bibs.
11. Hydrants.
12. Recessed valve box.
13. Backflow preventers.
14. Water hammer arrestors.
15. Diaphragm-type compression tanks.
16. System lubricated circulators.
17. Underground pipe markers.
18. Bedding and cover materials.

B. Related Sections:

1. Section 083113 - Access Doors and Frames: Product requirements for access doors for placement by this section.
2. Section 099000 - Painting and Coating: Product and execution requirements for painting specified by this section.
3. Section 220516 - Expansion Fittings and Loops for Plumbing Piping: Execution requirements for pipe expansion devices for placement by this section.
4. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports [**and firestopping**] for placement by this section.
5. Section 220553 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
6. Section 220700 - Plumbing Insulation: Product and execution requirements for pipe insulation.
7. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
8. Section 310513 - Soils for Earthwork: Soils for backfill in trenches.
9. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
10. Section 312316 - Excavation: Product and execution requirements for excavation and backfill required by this section.
11. Section 312316.13 - Trenching: Execution requirements for trenching required by this section.

12. Section 312323 - Fill: Requirements for backfill to be placed by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B31.9 - Building Services Piping.
5. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
6. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Society of Sanitary Engineering:

1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
2. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
4. ASSE 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
5. ASSE 5013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).

C. ASTM International:

1. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
2. ASTM B32 - Standard Specification for Solder Metal.
3. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
4. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
5. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).
6. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
7. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
8. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters.
9. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
10. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
11. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
12. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
13. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.

14. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
15. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
16. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
17. ASTM E1 - Standard Specification for ASTM Thermometers.
18. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
19. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
20. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
21. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
22. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
23. ASTM F442/F442M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
24. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

D. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

E. American Water Works Association:

1. AWWA C651 - Disinfecting Water Mains.
2. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
2. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

G. Plumbing and Drainage Institute:

1. PDI WH201 - Water Hammer Arrester Standard.

H. Underwriters Laboratories Inc.:

1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Submittal procedures.
- B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
4. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of valves and equipment.
- C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 QUALITY ASSURANCE

- A. For drinking water service, provide valves complying with NSF 61.
- B. Perform Work in accordance with codes adopted by the authority having jurisdiction.
- C. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing Work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Product storage and handling requirements.
- B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 016000 - Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Tubing: ASTM B88, Type L, annealed.
 - 1. Fittings: ASME B16.22, wrought copper.
 - 2. Joints: Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88, Type L, drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, solder

2.3 FLUE AND COMBUSTION AIR PIPING

- A. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material.
 - 1. Fittings: ASTM D2466, Schedule 40, PVC.

2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement. Prime joints with a contrasting color.

- B. CPVC Pipe: ASTM F441/F441M, Schedule 40, chlorinated polyvinyl chloride (CPVC) material.

1. Fittings: ASTM F438, CPVC, Schedule 40, socket type.
2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement. Prime joints with a contrasting color.

2.4 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:

1. Copper Piping: Class 150, bronze unions with soldered or brazed joints.
2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

- B. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.5 BALL VALVES

- A. BA-1 2 inches and Smaller: MSS SP 110, 400 psi WOG, two piece bronze body, chrome plated brass ball, full port, teflon seats, blow-out proof stem, solder ends, lever handle.

- B. BA-2 2 inches and Smaller: MSS SP 110, Class 150, bronze, two piece body, chrome plated bronze ball, full port, teflon seats, blow-out proof stem, solder ends, lever handle.

2.6 CHECK VALVES

- A. Horizontal Swing Check Valves:

1. CK-1 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.

- B. Spring Loaded Check Valves:

1. CK-6 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.

2.7 PRESSURE GAGES

- A. Gage: ASME B40.1, UL 393 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

1. Case: Steel, stainless steel or ABS.
2. Bourdon Tube: Brass or Phosphor bronze.
3. Dial Size: 2-1/2 inch or larger diameter.
4. Mid-Scale Accuracy: two percent.

5. Scale: Psi.

2.8 PRESSURE GAGE TAPS

- A. Ball Valve: Brass or stainless Steel, 1/8 inch NPT or 1/4 inch NPT for 250 psi.

2.9 STEM TYPE THERMOMETERS

- A. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
 1. Size: 9 inch scale.
 2. Window: Clear glass or Lexan.
 3. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
 4. Accuracy: ASTM E77 2 percent.
 5. Calibration: Degrees F.

2.10 WATER PRESSURE REDUCING VALVES

- A. 2 inches and Smaller: MSS SP 80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded and single union ends.

2.11 STRAINERS

- A. 2 inch and Smaller: Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

2.12 HOSE BIBS

- A. Interior: Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with hand wheel, vacuum breaker in conformance with ASSE 1011.

2.13 HB-1 HYDRANTS

- A. Wall Hydrant: ASSE 1019; non-freeze, self-draining type with chrome plated lockable recessed box hose thread spout, locks shield and removable key, and integral vacuum breaker, Woodford model RB67 or equivalent.

2.14 WB-1 RECESSED VALVE BOX

- A. Refrigerator: Plastic preformed rough-in box with brass ball valve with handle, slip in finishing cover, and water hammer arrestor.

2.15 BACKFLOW PREVENTERS

A. Reduced Pressure Backflow Preventers:

1. Comply with ASSE 1013.
2. Bronze body, with bronze internal parts and stainless steel springs.
3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two ball valves, strainer, and four test cocks.

2.16 WATER HAMMER ARRESTORS

- A. ASSE 1010; copper construction, piston type sized in accordance with PDI WH-201.
- B. Pre-charged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

2.17 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- B. Accessories: Air-charging fitting, tank drain; pre-charge to 70 psig.
- C. Size: As indicated on drawings.

2.18 SYSTEM LUBRICATED CIRCULATORS

- A. Type: Horizontal shaft, single stage, direct connected with single speed or multiple speed wet rotor motor for in-line mounting, for 140 psig maximum working pressure, 230 degrees F maximum water temperature.
- B. Casing: Bronze or stainless steel with flanged pump connections.
- C. Impeller, Shaft, Rotor: Stainless Steel on non-metallic.
- D. Bearings: Metal Impregnated carbon (graphite) and ceramic.
- E. Motor: Impedance protected, multiple single or three speed.
- F. Performance:
 1. Flow Capacity: 5 gal/min.
 2. Head: 13 feet.
- G. Electrical Characteristics: In accordance with Section 260503 and the following:

1. 1/25 hp, 0.84 rated load amperes.
2. 115 volts, single phase, 60 Hz.

H. Manufacturer and model: Grundfos model 008-BF6 or equivalent.

2.19 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- B. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Domestic Water Service" in large letters.

2.20 BEDDING AND COVER MATERIALS

- A. Bedding: Comply with codes and standards adopted by the authority having jurisdiction.
- B. Cover: Comply with codes and standards adopted by the authority having jurisdiction.
- C. Soil Backfill from Above Pipe to Finish Grade: Comply with codes and standards adopted by the authority having jurisdiction. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 013000 - Administrative Requirements: Coordination and project conditions.
- B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION - THERMOMETERS AND GAGES

- A. Install gage taps in piping.
- B. Install pressure gages with ball valve to isolate each gage.
- C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

- D. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- E. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- F. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.4 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection size, location, and invert are as indicated on Drawings.
- B. Remove scale and dirt on inside of piping before assembly.
- C. Excavate pipe trench in accordance with Section 312316.
- D. Install pipe to elevation as indicated on Drawings.
- E. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
- F. Install pipe on prepared bedding.
- G. Route pipe in straight line.
- H. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- I. Install trace wire continuous over top of pipe. buried 6 inches below finish grade, above pipe line; coordinate with Section 312323. Refer to Section 220553.
- J. Pipe Cover and Backfilling:
 - 1. Backfill trench in accordance with Section 312323 and applicable codes.
 - 2. Maintain optimum moisture content of fill material to attain required compaction density.
 - 3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
 - 4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - 5. Do not use wheeled or tracked vehicles for tamping.

3.5 INSTALLATION - ABOVE GROUND PIPING

- A. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

- C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- D. Group piping whenever practical at common elevations.
- E. Slope piping and arrange systems to drain at low points.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220700.
- H. Provide access where valves and fittings are not accessible.
- I. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 099000.
- J. Install domestic water piping in accordance with ASME B31.9.
- K. Sleeve pipes passing through partitions, walls and floors. Refer to Section 220529.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- N. Install ball valves for throttling, bypass, or manual flow control services.
- O. Provide spring loaded check valves on discharge of water pumps.
- P. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
- Q. Pipe relief from valves, back-flow preventers and drains to nearest floor drain or where indicated on Drawings.
- R. Test backflow preventers in accordance with ASSE 5013.
- S. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to electrically operated valves, lavatories, sinks, warewashing machine outlets, flush valves.

3.6 INSTALLATION - SERVICE CONNECTIONS

- A. Provide new water service complete with approved reduced pressure back-flow preventer and pressure reducing valves, and strainer.
- B. Provide 18 gage galvanized sheet metal sleeve around service main to 6 inch above floor and 3 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements and Section 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test domestic water piping system in accordance with applicable code and local authority having jurisdiction.

3.8 CLEANING

- A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Disinfect water distribution system in accordance with applicable code.
- C. Prior to starting work, verify system is complete, flushed and clean.
- D. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- E. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
- F. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
- G. Maintain disinfectant in system for 24 hours.
- H. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
- I. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
- J. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION 221100

SECTION 221300 - FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewer piping buried within 5 feet of building.
2. Sanitary sewer piping above grade.
3. Floor drains.
4. Floor sinks.
5. Cleanouts.
6. Interceptors.
7. Bedding and cover materials.

B. Related Sections:

1. Section 033000 - Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
2. Section 083113 - Access Doors and Frames: Product requirements for access doors for placement by this section.
3. Section 099000 - Painting and Coating: Product and execution requirements for painting specified by this section.
4. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports [**and firestopping**] for placement by this section.
5. Section 310513 - Soils for Earthwork: Soils for backfill in trenches.
6. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
7. Section 312316 - Excavation: Product and execution requirements for excavation and backfill required by this section.
8. Section 312316.13 - Trenching: Execution requirements for trenching required by this section.
9. Section 312323 - Fill: Requirements for backfill to be placed by this section.
10. Section 334100 - Storm Utility Drainage Piping: Catch basins and manholes.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A112.14.3 - Grease Interceptors.
2. ASME A112.14.4 - Grease Removal Devices.
3. ASME A112.21.1 - Floor Drains.
4. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

3. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
4. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
5. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
6. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
7. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
8. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

C. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. Plumbing and Drainage Institute:

1. PDI G101 - Standard - Testing and Rating Procedure for Grease Interceptors.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with codes adopted by authority having jurisdiction.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Product storage and handling requirements.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 016000 - Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
 - 1. Fittings: PVC, ASTM D2665 or ASTM D3034.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
 - 1. Fittings: Cast iron, ASTM A74.
 - 2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hub-less, service weight.
 - 1. Fittings: Cast iron, CISPI 301.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
 - 1. Fittings: ASTM D2665, PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.3 FLOOR DRAINS

- A. Floor Drain (FD-1): ASME A112.21.1; lacquered or galvanized cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
- B. Floor Drain (FD-2): ASME A112.21.1; lacquered or galvanized cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and square, adjustable nickel-bronze strainer with polished bronze funnel.

2.4 FLOOR SINKS

- A. Floor Sink (FS-1): Square cast iron body with integral seepage pan, white porcelain enamel interior and top, aluminum dome strainer, clamp collar, white porcelain enamel coated cast iron half grate.

2.5 CLEANOUTS

- A. Exterior Surfaced Areas (CO-1): Round cast nickel bronze access frame and non-skid cover.
- B. Exterior Unsurfaced Areas (CO-2): Line type with lacquered cast iron body and round epoxy coated cover with gasket.
- C. Interior Finished Floor Areas (CO-3): Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.
- D. Interior Finished Wall Areas (CO-4): Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.
- E. Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.6 GREASE INTERCEPTORS

- A. Comply with ASME A112.14.6.
- B. Construction:
 - 1. Material: Precast reinforced concrete, 5000 psi minimum strength, monolithic poured floor, H-20 loading, 24 inch diameter concrete manhole extensions, and manhole rings.
- C. Cover: Two cast iron manhole covers.
- D. Unit Rating: 2500 gallons with two compartments divided into 2/3 and 1/3 of capacity.
- E. Accessories: Contractor shall configure and pipe interceptor as indicated in *Grease Interceptor Detail* on drawings.
- F. Manufacturer: Copeland Enterprises Inc., Denver, CO or equivalent.

2.7 BEDDING AND COVER MATERIALS

- A. Bedding: Comply with codes and standards adopted by the authority having jurisdiction.
- B. Cover: Comply with codes and standards adopted by the authority having jurisdiction.
- C. Soil Backfill from Above Pipe to Finish Grade: Comply with codes and standards adopted by the authority having jurisdiction. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 013000 - Administrative Requirements: Coordination and project conditions.
- B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection size, location, and invert are as indicated on Drawings.
- B. Remove scale and dirt on inside of piping before assembly.
- C. Excavate pipe trench in accordance with Section 312316.
- D. Install pipe to elevation as indicated on Drawings.
- E. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
- F. Install pipe on prepared bedding.
- G. Route pipe in straight line.
- H. Install trace wire continuous over top of pipe. buried 6 inches below finish grade, above pipe line; coordinate with Section 312323. Refer to Section 220553.
- I. Pipe Cover and Backfilling:
 - 1. Backfill trench in accordance with Section 312323 and applicable codes and standards.
 - 2. Maintain optimum moisture content of fill material to attain required compaction density.
 - 3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
 - 4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - 5. Do not use wheeled or tracked vehicles for tamping.

3.4 INSTALLATION - ABOVE GROUND PIPING

- A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- F. Install piping to maintain headroom. Do not spread piping, conserve space.
- G. Group piping whenever practical at common elevations.

- H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 220700.
- J. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 083113.
- K. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 099000.
- M. Install bell and spigot pipe with bell end upstream.
- N. Sleeve pipes passing through partitions, walls and floors.
- O. Support cast iron drainage piping at every joint.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements.
- B. Test sanitary waste and vent piping system in accordance with applicable code and local authority having jurisdiction.

END OF SECTION 221300

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SECTION 221400 - FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm water piping buried within 5 feet of building.
2. Storm water piping above grade.
3. Roof drains.
4. Downspout nozzles.
5. Cleanouts.
6. Bedding and cover materials.

B. Related Sections:

1. Section 033000 - Cast-in-Place Concrete: Execution requirements for placement of concrete specified by this section.
2. Section 083113 - Access Doors and Frames: Product requirements for access doors for placement by this section.
3. Section 099000 - Painting and Coating: Execution requirements for painting material specified by this section.
4. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports [**and firestopping**] for placement by this section.
5. Section 220553 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
6. Section 220700 - Plumbing Insulation: Product and execution requirements for pipe insulation.
7. Section 310513 - Soils for Earthwork: Soils for backfill in trenches.
8. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
9. Section 312316 - Excavation: Product and execution requirements for excavation and backfill required by this section.
10. Section 312316.13 - Trenching: Execution requirements for trenching required by this section.
11. Section 312323 - Fill: Requirements for backfill to be placed by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A112.21.2M - Roof Drains.
2. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

2. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
3. ASTM D1785 - Standard Specification for (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
4. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
5. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
6. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
7. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
8. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
9. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
10. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
11. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
12. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
13. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Submittal procedures.
- B. Product Data:
 1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
 2. Storm Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

1.4 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of equipment and cleanouts.

1.5 QUALITY ASSURANCE

- A. Perform Work according to codes and standards adopted by authority having jurisdiction.

- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Product storage and handling requirements.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 016000 - Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
 - 1. Fittings: PVC, ASTM D2665 or ASTM D3034.

2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.2 STORM WATER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 1. Fittings: Cast iron, CISPI 301.
 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
- B. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
 1. Fittings: ASTM D2665 or ASTM D3034, PVC.
 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.3 ROOF DRAINS

- A. Roof Drain (RD-1):
 1. Assembly: ASME A112.21.2M.
 2. Body: 12 inch lacquered or galvanized cast iron with sump.
 3. Strainer: Removable cast metal dome.
 4. Accessories: Coordinate with roofing type:
 - a. Membrane flange and membrane clamp with integral gravel stop.
 - b. Adjustable under deck clamp.
 5. Manufacture and model: Zurn ZC121 series or equivalent.
- B. Roof Drain (RD-2):
 1. Assembly: ASME A112.21.2M.
 2. Body: 12 inch lacquered or galvanized cast iron with sump.
 3. Strainer: Removable cast metal dome.
 4. Pipe extended to 2 inches above flood elevation.
 5. Accessories: Coordinate with roofing type:
 - a. Membrane flange and membrane clamp with integral gravel stop.
 - b. Adjustable under deck clamp.
 6. Manufacture and model: Zurn ZC121 series or equivalent.

2.4 DOWNSPOUT NOZZLES

- A. Product Description: Polished bronze body and wall flange round with straight bottom section, Manufacturer Zurn Z199 series or equivalent.

2.5 CLEANOUTS

- A. Exterior Surfaced Areas (CO-1): Round cast nickel bronze access frame and non-skid cover.

- B. Exterior Unsurfaced Areas (CO-2): Line type with lacquered cast iron body and round epoxy coated cover with gasket.
- C. Interior Finished Wall Areas (CO-4): Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.
- D. Interior Unfinished Accessible Areas (CO-5): Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.6 BEDDING AND COVER MATERIALS

- A. Bedding: Comply with applicable code and standards.
- B. Cover: Comply with applicable code and standards.
- C. Soil Backfill from Above Pipe to Finish Grade: Comply with applicable code and standards. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 013000 - Administrative Requirements: Coordination and project conditions.
- B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection size, location, and invert are as indicated on Drawings.
- B. Establish elevations of buried piping with not less than 3 ft of cover.
- C. Excavate pipe trench according to Section 312316.
- D. Install pipe to elevation as indicated on Drawings.

- E. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
- F. Install pipe on prepared bedding.
- G. Route pipe in straight line.
- H. Install trace wire continuous over top of pipe above pipe line; coordinate with Section 312323. Refer to Section 220553.
- I. Pipe Cover and Backfilling:
 - 1. Backfill trench according to Section 312323.
 - 2. Maintain optimum moisture content of fill material to attain required compaction density.
 - 3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
 - 4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - 5. Do not use wheeled or tracked vehicles for tamping.

3.4 INSTALLATION - ABOVE GROUND PIPING

- A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearance at cleanout for snaking drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- E. Install piping to maintain headroom. Group piping to conserve space.
- F. Group piping whenever practical at common elevations.
- G. Support cast iron drainage piping at every joint.
- H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 220700.
- J. Provide access where valves and fittings are not accessible.
- K. Install piping penetrating roofed areas to maintain integrity of roof assembly.

- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 099000.
- M. Install bell and spigot pipe with bell end upstream.
- N. Sleeve pipes passing through partitions, walls and floors. Refer to Section 220529.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirement.
- B. Test storm drainage piping system according to applicable code and local authority having jurisdiction.

END OF SECTION 221400