

SECTION 22 01 00

PLUMBING OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element.
 - 2. Contractor information.
 - 3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
 - 4. All parts and maintenance manuals for items of equipment.
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates).
 - 9. Control operations/equipment wiring diagrams.
 - 10. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Complete electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.

- B. Minimum ring size: 1 inch; Maximum ring size: 3 inches.
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2 inch x 11 inch.
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project.
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified.
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer.
 - 2) Maintenance contractor as appropriate.
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement.
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
 - 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems.
 - 2) Control and flow diagrams.
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.

4. Written text, as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure.
 - 2) Instances that might affect validity of warranties or bonds.
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts.
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Summer and winter operating instructions.
 - 4) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Alignment, adjusting and checking.
 - 5) Routine service based on operating hours.
 - d. Servicing and lubrication schedule. List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Description of sequence of operation by control manufacturer.
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear.
 - 2) Items recommended to be stocked as spare parts.
 - h. As installed control diagrams by controls manufacturer.
 - i. Complete equipment internal wiring diagrams.
 - j. Each Contractor's coordination drawings.
 - k. As installed color coded piping diagrams.
 - l. Charts of valve tag number, with location and function of each valve.
 - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - n. Other data as required under pertinent sections of the specifications.
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
 4. Provide complete information for products specified in Division 22.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.
 9. Provide backflow preventer certified test reports.
 10. Provide gas piping pressure test reports.

END OF SECTION

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SECTION 22 05 00

PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing.
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories.
 - 2. National Fire Protection Association.
 - 4. Local Municipal Building Inspection Department.
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than three systems of comparable size and type that has served their Owners satisfactorily for not less than three years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.
- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain three sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (two sets are for the Owner's use and one set is for the Architect / Engineer's records). Delivery of these as-built prints and reproducible is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
 - 1. Indicate all addendum changes to documents.
 - 2. Remove Engineer's seal, name, address and logo from drawings.
 - 3. Mark documents RECORD DRAWINGS.
 - 4. Clearly indicate: DOCUMENT PRODUCED BY.
 - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
 - 6. Indicate exact location of all underground plumbing and flow line elevation.
 - 7. Indicate exact location of all underground plumbing piping and elevation.
 - 8. Indicate exact location of all underground electrical raceways and elevations.
 - 9. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 - 10. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
 - 11. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
 - 12. Exact location of all electrical equipment in and outside of the building.
 - 13. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
 - 14. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 - 15. Cloud all changes.

1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

- A. Guarantee work for one year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit three copies of all

certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit three copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each subcontractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 VANDAL RESISTANT DEVICES

- A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
- B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner two suitable tools for use with each type of fastener used.
- C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.3 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.4 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

SECTION 22 05 10

PLUMBING CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 22 05 12

PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings.
 - 2. Coordination Drawings.
 - 3. Product data.
- C. Submittals shall be prepared and produced for:
 - 1. Distribution as specified.
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section.

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: $\frac{1}{4}$ inch = 1 foot - 0 inch.
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished.
 - 2. Service clearance.
 - 3. Relationship to other equipment and components.
 - 4. Roof drains and leader piping.
 - 5. Fire protection piping and equipment.
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
 - 1. Ductwork shop drawings.

- 2. Coordination drawing specified in Division 26.
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply, "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Manufacturer's catalog numbers.
 - 4. Conformance with requirements of Contract Documents.
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect/Engineer's acceptance.

- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect/Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect/engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities.
 - 2. That the item will fit in the available space in a manner that will allow proper service.
 - 3. Construction methods, materials and finishes.
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
 - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
 - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. The number of each Shop Drawing, Project Datum and Sample submitted.
 - 5. Other pertinent data.
- D. Submittals shall include:
 - 1. The date of submission.
 - 2. The project title and number.
 - 3. Contract Identification.
 - 4. The names of:
 - a. Contractor.
 - b. Subcontractor.
 - c. Supplier.
 - d. Manufacturer.
 - 5. Identification of the product.
 - 6. Field dimensions, clearly identified as such.
 - 7. Relation to adjacent or critical features of the work or materials.
 - 8. Applicable standards, such as ASTM or federal specifications numbers.
 - 9. Identification of deviations from contract documents.
 - 10. Suitable blank space for General Contractor and Architect/Engineer stamps.
 - 11. Contractor's signed and dated Stamp of Approval.
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
 - 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
 - 2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
 - 1. The related specification section number.
 - 2. The exact specification section title.
- B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
 - 1. Indicate that the document or sample is a re-submittal.
 - 2. Identify changes made since previous submittals.
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
- C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect/Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule.
 - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal.
 - 3. Return submittals to Contractor for distribution or for resubmission.
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect/Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.

2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 22 05 15

PLUMBING EARTHWORK

PART 1 - GENERAL

- A. Excavate and backfill for pipe trenches for underground piping, and excavate for structures installed as part of plumbing work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavate trenches for underground piping to the required depth to ensure 2 foot minimum coverage over piping.
- B. Cut the bottom of the trench or excavation to uniform grade.
- C. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp well.
- D. Lay out alignment of pipe trenches to avoid obstructions. Assure that proposed route of pipe will not interfere with building foundation before any cutting is begun. Should interference be found, contact the Architect/Engineer before proceeding.

3.2 BACKFILL

- A. Backfill shall not be placed until the work has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades shown on drawings. Except where special materials are requested, use suitable friable soils from other excavation as backfill material. Do not use peat, silt, muck, debris or other organic materials. Deposit backfill in uniform layers and compact each layer as specified in Division 2.
- B. Compacting Backfill. Place material in uniform layers of prescribed maximum thickness and wet or dry the material to optimum moisture content. Compact with power-driven tampers to the prescribed density. Place regular backfill in 8 inch maximum layers, loose measure. Compact to not less than 95 percent of maximum soil density as determined by ASTM D-698 Standard Proctor.
- C. Restoration. Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks, and similar areas, to a condition equal to the adjacent undisturbed earth, and restore surface of the area to the condition existing prior to trenching or excavating operation.
- D. Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe.

3.3 DISPOSAL OF EXCESS MATERIAL

- A. Remove excess excavation material or material unsuitable for backfill. Excess material can be spread on grade, or shall be removed from site as directed by the Owner/Architect.

END OF SECTION

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SECTION 22 05 23

VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Plumbing Valves.

PART 2 - PRODUCTS

2.1 VALVES

- A. Pressure Ratings:
 - 1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450 deg. F.
 - 2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.
- B. Ball Valves
 - 1. Provide ball valves with:
 - a. Blowout proof stem.
 - b. Full size port, 316 stainless steel ball and stem.
 - c. Cast bronze body.
 - d. Threaded ends.
 - 2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
 - 3. Service rating:
 - a. 150 psi saturated steam.
 - b. 600 psi WOG.
 - 4. Provide with memory stop for balancing valves.
 - 5. Where Viega ProPress fittings are used, Viega ProPress ball valves may be used.
 - 6. All valves for domestic use must be lead free.
- C. Valve Connections
 - 1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
 - 2. Thread pipe sizes 2 inches and smaller.
 - 3. Use screw to solder adapters for copper tubing.
 - 4. Use grooved body valves with mechanical grooved jointed piping.
 - 5. Use press valves when using copper press systems.
- D. Provide valves of same manufacturer throughout where possible.
- E. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.
- F. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.
- G. Provide valve, seat and trim materials suitable for the intended service.

2.2 VALVE SCHEDULE

- A. Domestic Service
 - 1. Cold water service (all listed must be Lead Free):
 - a. Nibco Ball Valve full port through 2 inch: T-585-66-LF.
 - b. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used).
 - c. Milwaukee Full Port ¼ inch-2 inch.
 - d. Milwaukee Standard Port 2-1/2 inch & 3 inch.
 - e. Apollo Press Bronze Ball valves – 77 WLF.
 - f. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.
- C. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
 - 1. 3/4 inch valve for pipes smaller than 6 inch.
 - 2. Terminate with pipe plug.
 - 3. Drain valves shall be ball valves.
- D. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.
- E. Provide clearance for installation of insulation and access to valves.
- F. Provide access where valves are not exposed.

3.2 VALVE TAGS

- A. Furnish valves with 1-1/2 inch diameter brass valve tags with stamped, black or red-filled numbers. Service designations shall be 1/4 inch letters, and valve numbers shall be 2 inch letters. Engineer shall approve Service designations. Secure tags to valves by use of brass "S" hooks or brass chain. Secure chain to valve by use of copper or Monel meter seals. Valve tags are not required if the valve is located within 3 feet of the equipment being served and the service is obvious.
- B. Mount charts and drawings listing functions of each valve and its location in a metal and glass frame. Place charts and drawings as directed; in addition, on the record drawings mark the symbols and furnish a valve schedule properly identifying the valve number, service, exact location, the material being piped, and the room number of area that the valve services. This schedule shall be furnished on reproducible drafting paper or film suitable for reproduction on an Ozalid machine. The Owner shall approve the size of drafting paper. Provide a copy of the valve chart in the Operating and Maintenance Manuals.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Tags.
- B. Pipe Markers.

1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.3 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- E. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Piping: Tags or Pipe markers.
- B. Valves: Tags.

2.2 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Kolbi Pipe Marker Company: www.kolbipipemarkers.com.
- C. Seton Identification Products: www.seton.com.
- D. Substitutions: to Section 01 6000 - Product Requirements.

2.3 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter. 1/2 inch numbers with 1/4 inch system identification abbreviation.

- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges. 1/2 inch numbers with 1/4 inch system identification abbreviation.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Install tags with corrosion resistant chain.
- B. Install plastic pipe markers in accordance with manufacturer's instructions.
- C. Identify valves in main and branch piping with tags.
- D. Identify piping, concealed or exposed with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service and flow direction.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- E. Natural gas pipe: pipe identification shall be the words "NATURAL GAS" in black letters at five feet intervals using plastic pipe markers or stenciled painted letters per IFGC.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including domestic hot and cold water, roof and overflow drain sump bodies and rain leaders, horizontal sanitary drain piping which receives condensate.

1.2 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.
- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe insulation:
 - 1. Johns-Manville Micro-Lok AP-T.
 - 2. Owens-Corning ASJ/SSL.
 - 3. Knauf ASJ/SSL.
- B. Cellular Glass Insulation (Foamglass):
 - 1. Pittsburg Corning.
 - 2. Cell-U-Foam.
- C. Fiberglass reinforcing cloth mesh:
 - 1. Perma Glass Mesh.
 - 2. Alpha Glass Mesh.
 - 3. Childers Chil-Glas.
 - 4. Vimasco.
- D. Mastics and Adhesives
 - 1. Childers.
 - 2. Foster.
 - 3. Vimasco.
 - 4. Armstrong 520 Adhesive.
- E. Elastomeric Insulation
 - 1. Armacell.
- F. Glass fiber blanket insulation
 - 1. Manville R-series Microlite FSKL.
 - 2. Owens-Corning eD75 or ED100 RKF.
 - 3. Knauf 0.75 PCF FSK.

2.2 FIBERGLASS PIPE INSULATION

- A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
 - 1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.3 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than $\frac{3}{4}$ " shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test. Minimum $\frac{3}{4}$ " thick.
 - 1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518).

2.4 CELLULAR GLASS INSULATION

- A. ASTM C552:

1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
2. 8.0 lb./cu.ft. (128 kg/cu.m.) density.

2.5 INSULATION/SHIELD AT HANGERS

- A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.
 1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
 2. Minimum thickness of foam glass insulation shall not be less than 1" thick.
- B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.6 SEALANT, ADHESIVE AND FINISH

- A. Lap Adhesive. Provide Childers CP-82 adhesive.
- B. Vapor Barrier Finish:
 1. Indoors: Provide as insulation coating Childers CP-35, white.
 2. Outdoors: Provide as insulation coating Childers Encacel X.
 3. Underground: Provide Childers CP-22/24 for fittings and areas. Pittwrap cannot be used.
- C. Sealant. Provide Childers CP-76 vapor barrier sealant.
- D. Lagging Adhesive. Provide Childers CP-50.
- E. Other products of equal quality will be acceptable only upon approval.

2.7 GLASS FIBER BLANKET INSULATION

- A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

- A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.
- B. Install hanger with protective shield, on the outside of all insulation.

- C. Where domestic water pipes (1/2" & 3/4" pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.
- D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.
- E. Piping to be insulated as specified above:
 1. Storm drainage system including roof and overflow drain bodies, vertical piping from drain body and all rain leaders including pipe in chase to exterior wall penetration.
 2. Domestic cold water piping.

3.2 FLANGE, VALVE AND FITTING INSULATION

- A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
 1. Apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.
 2. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
 3. Overlap mastic and fiberglass cloth by 2" on adjoining sections of pipe insulation.
 4. Apply a second coat of mastic over the fiberglass cloth to present a smooth surface.
 5. Apply mastic to a wet film thickness of 3/64".
 6. Fabric shall not be visible after completion.
 7. Vapor seal flanges, valves and fittings with Childers CP-35.
- B. PVC fitting covers are acceptable.

3.3 CONCEALED STORM DRAIN PIPING

- A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing. Install insulation of clean, dry piping.
- B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2" with facing to the outside to obtain specified R-value using a maximum of 25% compression.
- C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3" wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3" (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6" (152mm) on center.
- D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.

3.4 MISCELLANEOUS

- A. Install materials after piping has been tested and approved.
- B. Apply insulation on clean, dry surfaces only.
- C. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.5 INSULATION THICKNESS

<u>INSULATED UNIT</u>	<u>THICKNESS</u> <u>(Inches)</u>
Exposed Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Exposed Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Storm Drain Piping	1
Domestic Cold Water Piping. 1 ½" Pipe and smaller	1

END OF SECTION

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SECTION 22 11 16

DOMESTIC WATER PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install domestic hot and cold water piping.

1.2 RELATED WORK

- A. Division 22 Plumbing
 1. Valves, Strainers and Vents.
 2. Pipe and Pipe Fittings – General.
 3. Plumbing Piping Insulation.
 4. Plumbing Fixtures and Fixture Carriers.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.
- B. Above Slab Piping: PEX tubing. Refer to section 22 11 21.
- C. Unions. Provide 150 lb. standard unions with ground joint and bronze seat. Flange joints larger than 2 inches. Provide dielectric isolating unions at junctions or connection between metallic piping of dissimilar metal. Provide pipe threads with standard taper pipe threads ANSI B2.1.
- D. Alternate Method of Joining Copper Pipe and Tubing: Press Fittings: Copper press fitting shall conform to the material and sizing requirements of ASME B16.51. O-rings for copper press fittings shall be EPDM. VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

PART 3 - EXECUTION

3.1 DRAINAGE

- A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

3.2 STERILIZATION

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Disinfect water distribution system as required per state and local codes.

- C. 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, AWWA C652 or local authority having jurisdiction
 - 1. Obtain a minimum of one water sample flushing from at least 10% of the outlets and from the water entry.
 - 2. Take samples from faucets located at highest point in the building, and farthest point from the main water supply.
- D. After final flushing, remove aerators, clean and replace.

3.3 TESTING

- A. Test under a cold water hydrostatic pressure not less than operating pressure of system and carefully check for leaks. Test shall conform to requirements of IPC and local codes.
 - a. Repair leaks and retest system until proven watertight.
- B. Test the domestic water piping system at pressure, maintained for minimum of 15 minutes.
- C. Use only potable water for the test.
- D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.
- E. If the system is tested in sections, the entire domestic water piping system shall be submitted to a final test, employing the specified procedure.
- F. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- G. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- H. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

END OF SECTION

SECTION 22 11 21

PEX PIPE AND FITTINGS

Uponor (Pipe Sizes ½" Through 3" Copper Tube Sizes)

PART 1 – GENERAL

1.1 PIPE

- A. All hot and cold water PEX piping shall be manufactured by Uponor North America as AquaPEX and manufactured in a Standard Dimensional Ratio of 9 (SDR 9) and satisfy ASTM F876. As recognized in IAPMO Research and Testing File No. 3558, the tubing is produced from a cross-linked polyethylene compound complying with ASTM F877, has a 100 PSI pressure rating at 180 degrees.

1.2 TECHNICAL DATA

A. APPLICABLE STANDARDS

- 1. AquaPEX is available in nominal sizes of ¼" through 3" diameter.
- 2. Uncoated (natural) AquaPEX has a material designation of PEX 5106.
- 3. Coated (blue and Red) AquaPEX has a material designation of PEX 5206.
- 4. AquaPEX is recognized as conforming to ASTM F 877 by IAPMO R&T #3558, as well as conforming to NSF 61, NSF (J-00103652).

B. APPLICABLE CODES

- 1. 2018 International Plumbing Code (IPC).

1.3 FITTINGS

A. Uponor ProPEX®

- 1. Third-party certified to NSF 14 and ASTM F1960 cold expansion with PEX reinforcing ring and shall comply with ASTM F876 and ASTM F877, ½ inch through 3 inch nominal pipe size fittings manufactured from the following material types:
 - a. Reinforcing cold expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked "F1960".
- 2. Uponor multiport tees and elbows: Multiple-outlet fitting complying with ASTM F877 (CAN/CSA B137.5); with ASTM F1960 inlets and outlets.
- 3. Uponor manifolds Multiple outlet assembly with ASTM F1960 outlets.
 - a. Type L copper branch manifold with lead-free brass valve outlets.
 - b. Type L copper branch manifold without valves, with lead-free brass outlets.

B. PEX-to-metal transition fittings:

- 1. Manufacturers: Provide fittings from the same manufacturer of the piping.
- 2. Third-party certified to NSF 14 and ASTM F1960 cold expansion with PEX reinforcing ring and shall comply with ASTM F876 and ASTM F877, 1/2 inch through 3 inch nominal pipe size fittings manufactured from the following material types:
 - a. PEX-a to thread transition: One-piece lead free (LF) brass fitting with male or female threaded adapter and ASTM F1960 cold expansion end, with PEX-a reinforcing cold-expansion ring.
 - b. PEX-a to copper sweat transition: One-piece lead free (LF) brass fitting with sweat adapter and ASTM F1960 cold expansion end, with PEX-a reinforcing cold expansion ring.

- c. PEX-a to copper press transition: One-piece lead free (LF) brass fitting with one ASME B16.51 copper press end and one ASTM F1960 cold expansion end, with PEX-a reinforcing cold expansion ring.
- d. PEX-a to flange transition: Two-piece fitting with one steel flange conforming to ASME B16.5 and one lead free (LF) brass adapter conforming to ASTM F1960.
- e. PEX-a to groove transition: One-piece lead free (LF) brass fitting with one CSA B242-05 groove end in either iron pipe size (IPS) or copper tube size (CTS) and one ASTM F1960 cold expansion end with PEX-a reinforcing cold expansion ring.
- f. PEX-a to water meter transition: Two-piece fitting with one NPSM union thread and one ASTM F1960 cold expansion end, with PEX-a reinforcing cold expansion ring.

1.4 COMPRESSION FITTINGS

- A. Uponor's compression type fittings consist of a nut, compression ring and insert. Compression type fittings are available in nominal sizes from 3/8" through 1" diameter. The compression fittings comply with ASTM F877 when used with Uponor AquaPEX tubing.

1.5 BASIC USE

- A. Uponor's AquaPEX cross-linked polyethylene (PEX) tubing and fittings for use in potable hot and cold water distribution, water service in buildings of any type of construction allowed under the applicable code.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. The piping systems shall be constructed from a cross-linked polyethylene (PEX) tubing and fittings compounds.

2.2 MANUFACTURERS

- A. PIPE AND/OR FITTINGS
 - 1. Uponor North America.

2.3 SYSTEM DESIGN

- A. System design shall be in accordance with standard industry practice for water distribution systems and the manufacturer's instructions. The design shall take into consideration such factors as pressure and flow requirements, friction loss, operating temperatures, support spacing, joining methods, and thermal expansion and contraction.
- B. A Hazen-Williams C Factor of 150 shall be used in all hydraulic calculations.
- C. AquaPEX:
 - 1. PEX-a (Engel-method crosslinked polyethylene), ASTM F876 and F877 (CAN/CSA-B137.5), SDR 9, CTS, ½ inch through 3 inch nominal pipe size.
 - 2. Tubing is certified to NSF Standards 14 and 61 and listed by the Hydrostatic Stress Board of PPI at 200 degrees F. at 80 PSI, 180 degrees F. at 100PSI and 73.4 degrees F. at 160 PSI.
 - 3. Tubing sizes 2-inch, 2-1/2-inch and 3-inch reach out to manufacturer's representative for proper design flow and velocity sizing of pipe.

PART 3 – EXECUTION

3.1 INSTALLATION PROCEDURES

- A. Installation practices such as pipe support spacing, bracing, allowance for thermal expansion/contraction, handling and storage shall be in accordance with the manufacturer's instructions and this specification.
- B. Special requirements for PEX pressure pipe and fittings:
 - 1. Installing contractor shall have successfully completed the Uponor Commercial Piping Systems Training Course (previously AquaPEX Certification) as given by an Uponor employee or Uponor Manufacturer's Representative.
 - 2. Special installation requirements as indicated above for all PEX pipe systems.
- C. Installers must be factory trained. The manufacturer's published installation instructions must be available on the job site if requested by Code officials.
- D. Reference the use of Table 6-6 by manufacturer for sizing PEX-a F 1960 domestic water systems.
 - 1. Reference the use of Uponor Pressure Loss charts for sizing PEX-a domestic water systems that fall outside of Table 6-6 parameters.
 - 2. Refer to Uponor Plumbing Installation Manual for PEX pipe installation instructions with and without PEX pipe support to ensure proper support and clamping requirements.

3.2 WATER SERVICE AND WATER DISTRIBUTION

- A. When installing pipe horizontally it must be laid or supported in a manner that assures the temperature expansion and contraction joints are securely accommodated for. The installation must comply with applicable codes and the manufacturer's published installation instructions.

3.3 LIMITATIONS

- A. Pipe and fittings are intended for use at a maximum working pressure of 130 psi at 120°F
- B. When installation is in fire resistive assemblies, evidence of compliance with IBC Section 713 (penetrations), UBC Section 709 (walls and partitions), and UBC Section 710 (floor / ceiling or roof / ceiling) and, as applicable, must be provided to the Code official for approval.
- C. The tubing and fittings must be protected from exposure to direct sunlight as noted in the manufacturer's installation instructions.
- D. Clearances from heat producing equipment must be in accordance with Section 802.10-5 of the IAPMO UMC, Section 503.10.5 of the 2009 International Fuel Gas Code®, Section M1306 of the IRC, and Section 304.6 of the 1997 UMC or, as applicable. In areas enforcing the Uniform codes PEX shall not be installed within 18 inches of a water heater.
- E. The tubing must be maintained at the proposed operating pressure during placement of concrete, or prior to backfilling when used in buried applications.
- F. Minimum bending radius is six times the outside tube diameter of the PEX tube. The outside diameter is the nominal diameter plus 1/8 inch (3.2 mm) or copper tube size (CTS).

- G. Installation of tubing must be pressure-tested in the presence of the building official for any possible leaks.
- H. The tubing must not be utilized as a source of electrical ground.
- I. The products are produced under a quality control program in Apple Valley, Minnesota with inspection by IAPMO Uniform ES.

3.4 TESTING

- A. Test under a cold water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Test the domestic water piping system at 150psig hydrostatic pressure, maintained for 6 hours.
- C. Use only potable water for the test. Do not use compressed air.
- D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.
- E. If the system is tested in sections, the entire domestic water piping system shall be submitted to a final test, employing the specified procedure.
- F. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- G. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- H. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.5 WARRANTY

- A. Consult the manufacturer for specific 25 Year System Warranty information.

END OF SECTION

SECTION 22 14 13

ROOF DRAINAGE PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install roof drains, drain pipes and accessories.

1.2 RELATED WORK

- A. Division 22 Plumbing
 1. Pipe and Pipe Fittings - General; for general piping requirements.
 2. Drains and Cleanouts.
 3. Plumbing Piping Insulation.
 4. Earthwork.

1.3 REFERENCES

- A. CISPI – Cast Iron Soil Pipe Institute.
- B. ASTM – American Society for Testing and Materials.

PART 2 - PRODUCTS

2.0 ACCEPTABLE MANUFACTURERS

- A. Cast Iron Soil Pipe and Fittings
 1. AB&I.
 2. Charlotte Pipe and Foundry Co.
 3. Tyler Pipe / Soil Division.
- B. PVC pipe and Fittings
 1. Charlotte Pipe.
 2. JM Eagle.
 3. Cresline.

2.1 STORM PIPE AND FITTINGS

- A. Above Ground Pipe. Provide service weight cast iron Hub and Spigot soil pipe and fittings with compression type neoprene gaskets that conform to ASTM C-564. Pipe and fittings shall meet the requirements of ASTM A 74. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- B. Above Ground Piping. Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.
- C. Below Slab on Grade: Provide hot-dip coated service weight cast iron Hub and Spigot soil pipe and fittings with compression type neoprene gaskets. Pipe and fittings shall meet the requirements of ASTM A 74, and gaskets shall conform to ASTM C-564. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- D. Below Slab on Grade: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All above and below slab storm piping installation methods shall be in accordance with the Cast Iron Soil Pipe Institute Standards.
- B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers to be placed within 12" of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15'-0".
- C. All above and below slab PVC storm piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer's recommendations and applicable standards, and in accordance with ASTM D2321.

3.2 GRADE

- A. Give horizontal lines minimum grade of 1/8 inch per foot.

3.3 TESTING

- A. Above Slab on Grade:
 - 1. Test pipe below slab on grade before backfilling and connecting to existing sewers
 - 2. Maintain not less than 10 foot of hydrostatic head for 1 hour without a leak.
 - 3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
 - 4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
 - 5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
 - 6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
 - 7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
 - 8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.

3.4 RODDING SEWERS

- A. All storm sewer lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.
- B. This work shall be done in the presence of the Owner's Representative, as part of the

Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned for pipe sizes up to 6 inches. Pipe sizes 8 inches and larger shall be hydro-flushed.

END OF SECTION

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SECTION 22 40 00

PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.2 RELATED WORK

- A. Division 22 Plumbing
 1. Drains, Hydrants and Cleanouts.
 2. Domestic Water Piping.

1.3 JOB REQUIREMENTS

- A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Porcelain to steel and enameled cast iron fixtures shall be acid resistant. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cleanouts:
 1. J.R. Smith.
 2. Zurn.
 3. Watts.
 4. Sioux Chief.
- B. Roof Drains:
 1. J.R. Smith.
 2. Zurn.
 3. Watts.
 4. Sioux Chief.
- C. Wall Hydrants
 1. Woodford.
 2. Prier..
 3. Zurn.
 4. J.R. Smith
 5. MIFAB.

2.2 REQUIREMENTS

- A. Refer to the drawings for equipment to be supplied.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the manufacturer's instructions.

- B. Make rough-in and final connection of service to each fixture provided under this Section and Plumbing Drawings.
- C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a complete installation.
- D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on drawings.
- E. Remove piping and services roughed-in incorrectly and install correctly, without cost.
- F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.
- G. All roof drain locations are to be coordinated with all equipment and structural members. Coordinate drain location with Architectural Drawings.

END OF SECTION