

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.
 - 3. State Health Department.
 - 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, 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 prints and electronic drawings on AutoCad 2012 / Revit CAD files.
- 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 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. 4 inch high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to existing slab
- D. Install concrete curbs around multiple pipe penetrations.

3.3 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.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
 - 1. Provide the training during the Owner's regular working day.

2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.
- B. Time to be allocated for instructions.
 1. Minimum of 8 hours dedicated instructor time.
 2. 4 hours on each of 2 days.
 - C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
 1. One copy to the Owner.
 2. One copy to the Architect / Engineer.
 - D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
 - E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
 - F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
 - G. Demonstrate equipment functions (both individually and as part of the total integrated system).
 - H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
 - I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.
 - J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
 - K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
 1. Designation approved by Architect / Engineer.
 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with ½ inch high letters and fastened with epoxy or screws.

3.6 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.

3.7 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. Shop drawing submittals required:
 - 1. Shop drawing submittals shall be individually submitted by specification section number in PDF format. Combined submittals will be returned for contractor to divide.
 - 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, 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 17

PLUMBING ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water arresters and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

- A. 16-Gauge frames.
- B. 14-gauge steel panels.
- C. Continuous fully concealed hinges.
- D. Cylinder lock with key.
- E. Prime coat finish.
- F. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation.
- G. Material suitable for wall and/or ceiling mounting.

2.2 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors.
- B. 16-Gauge stainless steel.
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation.
- E. Continuous fully concealed hinge.
- F. Automatic closing and latching mechanism.
- G. Knurled knob and recessed key operation for Owner selection.
- H. Interior latch release slide for opening from inside.
- I. Prime coat finish.
- J. Material suitable for wall and/or ceiling mounting.

2.3 ACCEPTABLE MANUFACTURERS

- A. Milcor.
- B. MIFAB.

- C. Acudor.
- D. Elmdor.
- E. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Access doors specified in Division 22 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
- B. Installation shall be in accordance with the manufacturer's printed instructions.
- C. Minimum size required:
 - 1. 24 inch x 24 inch for plumbing multiple isolation valves and electrical related items in ceilings.
 - 2. 12 inch x 12 inch for plumbing for single isolation valve, hub drain or shock arrestor.

END OF SECTION

SECTION 22 05 19

PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

- A. Division 22, Plumbing
 1. Plumbing General Provisions.
 2. Pipe and Pipe Fittings, General.
 3. Valves, Strainers and Vents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

- A. Trerice.
- B. Taylor.
- C. Marsh.
- D. Weksler.
- E. Weiss.
- F. or approved equal.

2.2 PRESSURE GAUGES

- A. Case and Ring: 4 inch type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
- B. Dial: White aluminum with black markings.
- C. Window: Clear acrylic.
- D. Tube: Phosphor bronze and forged brass socket.
- E. Gauge accuracy: +/- 1 percent over operating range.
- F. For pulsating service, provide impulse dampers.
- G. Without flange for pipe mounting.
- H. With flange for wall mounting.
- I. Weiss Model: Domestic Water 4CTS LF (Lead Free) 0-100 PSI.

2.3 THERMOMETER WELLS

- A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction (Lead Free).
- B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.

- C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
- D. Wells shall be sized to extend a minimum of 50 percent into pipe.

2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

- A. Die cast aluminum case with baked epoxy finish.
- B. Adjustable angle 9 inch scale length.
- C. Clear acrylic window.
- D. Brass stem, length to match well.
- E. Red or blue reading organic spirit filled-in magnifying glass column.
- F. White background with black figures and markings.
- G. Brass stems and union connections (Lead Free).
- H. Accuracy: +/- 1 percent of scale range.
- I. Range:
 - 1. Hot water lines: 30 deg. F to 240 deg. F.

2.5 PRESSURE AND TEMPERATURE TEST STATIONS

- A. "Test Station" fitting to receive either a temperature or pressure probe. Fitting shall be solid brass with two valve cores of Nordel (Lead Free).
 - 1. Fitted with a color coded cap strap with gasket.
 - 2. Acceptable Manufacturer: Peterson Equipment Company.
 - 3. Provide with extension neck to match insulation thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with drawing details and manufacturer's recommendations.
- B. Provide a ball valve at each gauge (Lead Free).
- C. Locate gauges and thermometers to be easily readable from the floor at a 5 foot-6 inch eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.
- D. Install pressure gauges in the following locations: across pumps, domestic water service entrance. Pressure scale range 0 to 160 PSI.
- E. Install thermometer in the following locations: At hot water supply at water heater, and hot water return line at circulation pump.
 - 1. Hot water lines: 30 deg. F to 240 deg. F.

END OF SECTION

SECTION 22 05 23

VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Plumbing Valves
- B. Pipe strainer and suction diffusers.

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. Balancing Valves (Manual)
 - 1. Provide balancing valves with:
 - a. Corrosion resistant plug with resilient seal when required.
 - b. O-ring stem seal.
 - c. Permanently lubricated, corrosion resistant bearings.
 - 2. Connections
 - a. Through 2-inch pipe size use threaded connections.
 - b. For valves 2-1/2-inch pipe size and larger shall be provided with 150 psig flange connections.
 - 3. Provide each valve with:
 - a. Memory stop.
 - b. Plastic drip cap.
 - c. 1/8-inch gauge tap.
 - 4. All valves for domestic use must be lead free.
- C. Thermal Balancing Valves (adjustable Temperature)
 - 1. Adjustable thermal balancing valve used for automatic balancing of circulation circuits in domestic hot water systems. Modulates flow rate in each circuit so hot water temperature at fixtures remains constant.
 - 2. Standards:
 - a. NSF/ANSI/CAN 372 low-lead laws, as certified by ICC-ES.
 - b. NSF/ANSI/CAN 61, commercial hot water 180 deg. F. as certified by ICC-ES.
 - c. Meets codes IPC and UPC.
 - 3. Maximum Working Pressure: 230 psig.
 - 4. Body Material: DZR low-lead brass.
 - 5. Connections: NPT female threaded.
 - 6. Hydraulic Seals: Peroxide-cured EPDM.
 - 7. Adjustable Balancing Cartridge: Stainless steel and copper.
 - 8. ABS Adjustable Knob: Temperature adjustment scale for manual setting and tamper-proof adjustment locking screw.
 - 9. Factory Setting: 130 deg. F.
 - 10. Outlet Temperature gauge: 2-inch diameter with optional dual-scale outlet, 30 to 180 deg. F.

11. Check Valve.
12. Isolation Ball Valves: Inlet and outlet low-lead brass.
13. Manufacturers:
 - a. Caleffi.
 - b. Acorn.
 - c. Cimberio Valve.
 - d. Or approved equal.

D. 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.

E. Thermostatic Mixing Valves

1. Manufacturers:
 - a. Watts.
 - b. Caleffi.
 - c. Lawler.
 - d. Or approved equal.
2. Valve: Lead free brass body, stainless steel or copper alloy, integral temperature adjustment, check valves. At fixture ASSE 1070.

F. 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. Flange pipe sizes 2-1/2 inches and larger.
4. Use screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.
6. Use press valves when using copper press systems.

G. Check Valves

1. Bronze body, 2 inches and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection (Lead Free).
2. Iron body, 2-1/2 inches and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug (Lead Free).
3. Acceptable Manufacturers (All listed must be lead free):
 - a. Apollo.
 - b. Milwaukee.
 - c. Nibco.
 - d. Or approved equal.

H. Backflow Preventer (All valves for domestic use must be lead free):

1. Intermediate Atmospheric Vented Backflow Preventers: Lead-free, ASSE 1012,

same size as pipe, with intermediate atmospheric vent between independent check valves, bronze body with union ends, stainless steel springs, rated for 175 psig and 210°F. Watts LF9D or equal.

2. Acceptable Manufacturers (All listed must be lead free):
 - a. Watts.
 - b. Wilkins.
 - c. Or approved equal.
- I. Provide valves of same manufacturer throughout where possible.
- J. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.
- K. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.
- L. Provide valve, seat and trim materials suitable for the intended service.
- M. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, globe or ball type.

2.2 PIPE SYSTEMS STRAINERS

- A. Body:
 1. Bronze "Y" pattern or basket as shown on the drawings.
 2. Line size.
 3. Threaded strainer blow down port.
 4. ASTM A #126 Class B Cast Iron Body.
- B. Construction:
 1. 2 inch size and smaller with screw connections rated 400 psi WOG.
 2. Over 2 inch size with flanged connections, rated 125 psi WOG.
- C. Fabricate screens of Monel or type 304 stainless steel:
 1. With 20 mesh woven wire in piping systems through 2 inches.
 2. With 0.045 perforations in piping systems 2-1/2 inches and 3 inches.
 3. With 0.125 perforations in piping systems 4 inches and larger.
- D. Start-up:
 1. Provide an additional fine mesh disposable screen for use during start-up operations.
 2. Remove after 30 days.
 3. Attach to piping for Owner's review.
- E. Acceptable Manufacturers (All listed must be lead free):
 1. Apollo.
 2. Crane.
 3. Mueller.
 4. Nibco.
 5. Zurn.
 6. Or approved equal.

2.4 VALVE SCHEDULE

- A. Domestic Service
 - 1. Gas shut-off service: UL approved for natural gas service.
 - a. Nibco Ball Valve, full port through 1 inch: T-585-70-UL.
 - b. Nibco Ball Valve conventional port 1-1/4 inch through 3 inch: T-580-70-UL.
Mueller 1-1/4 inch through 4 inch: Lub-O-seal.
 - c. Milwaukee Full Port ¼ inch-2 inch.
 - d. Or approved equal.
 - 2. Cold and Hot water service (all listed must be Lead Free):
 - a. Nibco Ball Valve full port through 2 inch: T-585-66-LF.
 - b. Nibco Ball Valve 2-1/2 inch and 3 inch conventional port: T-580-66-LF.
 - c. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used).
 - d. Milwaukee Full Port ¼ inch-2 inch.
 - e. Milwaukee Standard Port 2-1/2 inch & 3 inch.
 - f. Apollo Press Bronze Ball valves – 77 WLF.
 - g. Or approved equal.
 - 3. Check Valve (All listed must be Lead Free):
 - a. Nibco Check Valve: T - 413 - Y -LF (Teflon Seats).
 - b. Milwaukee Valve – 509T.
 - c. Apollo Check Valve: 163TLF.
 - d. Apollo Press Check Valve: 163TPR-LF.
 - e. Apollo Check Valve 2 inch and larger 910WE-LF (Wafer).
 - 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. Use ball valves in domestic hot water and domestic cold water systems.
- D. Use ball valves in circulating water systems, for balancing duty.
- E. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
 - 1. 1 inch valve for pipes 6 inch and larger.
 - 2. 3/4 inch valve for pipes smaller than 6 inch.
 - 3. Terminate with pipe plug.
 - 4. Drain valves shall be ball valves.
- F. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on the drawings.
- G. 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.
- H. Provide clearance for installation of insulation and access to valves.

- I. Provide access where valves are not exposed.
- J. Install backflow preventers in accordance with Oklahoma requirements maintaining minimum clearance distances for servicing and testing. Provide indirect waste piping with air gap installation from relief opening to above hub drain or floor drain.

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.

3.3 PIPE SYSTEMS STRAINERS

- A. Provide strainers in supply piping to circulating pumps, thermostatic mixing valves, before solenoid valves and trap primer valves.

END OF SECTION

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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 and 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.

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. Aluminum Jacketing:
1. Childers.
 2. Pabco.
 3. RPR.
- D. Fiberglass reinforcing cloth mesh:
1. Perma Glass Mesh.
 2. Alpha Glass Mesh.
 3. Childers Chil-Glas.
 4. Vimasco.
- E. Mastics and Adhesives
1. Childers.
 2. Foster.
 3. Vimasco.
 4. Armstrong 520 Adhesive.
- F. Elastomeric Insulation
1. Armacell.

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 ¾" 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 ¾" 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 1/2" 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. Seal ends of pipe for drinking chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.
- F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.
- G. Piping to be insulated as specified above:
 - 1. All hot and cold water.
 - 2. Make-up water
 - 3. Horizontal sanitary drain piping that receives condensate
 - 4. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body and all horizontal rain leaders to first elbow turning down

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 not 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 on 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 (Inches)</u>
Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Domestic Cold Water.	1
Horizontal Sanitary Drain Piping Which Receives Condensate	1
Domestic Hot Water Piping, 1-1/2" Pipe and Smaller	1
Domestic Hot Water Piping, 2" Pipe and Larger	1-1/2

END OF SECTION

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SECTION 22 08 00

PLUMBING COMMISSIONING COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section outlines commissioning requirements and activities of Contractor, Owner, CxA and Design Professionals as related to the Division 22 Plumbing.
- B. Related Sections:
 - 1. Division 01 – General Requirements and Specification Section 01 91 13, General Commissioning.
 - 2. Division 22 – Plumbing.
 - 3. Division 23 – Mechanical.
 - 4. Division 26 – Electrical .

1.2 DEFINITIONS

- A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTACT INFORMATION

- A. The Owner will contract directly for commissioning services.
 - 1. Commissioning Agent fee will be paid for directly by the owner.
 - 2. Cost of contractor coordination with the CxA is specified in this section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Contractor shall provide all standard and specialized testing equipment required to perform Start-up and Functional Performance Testing. Test equipment required for Functional Performance Testing is listed below. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 1.0°F and a resolution of + or - 0.2°F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

2.2 OTHER CONTRACTOR PROVIDED EQUIPMENT:

- A. Ladders and/or lifts and appropriate fall protection as required by Contractor site requirements.

PART 3 - EXECUTION

3.1 COORDINATION - GENERAL

- A. Except for the activities to be performed by the CxA called for herein, all component and

system installation work required by the Division 22, 23 and 26 specifications including specific contractor furnished items indicated by this Section shall be provided by the Contractor.

3.2 SUBMITTALS

- A. Plumbing
 - 1. Plumbing Equipment.

3.3 EQUIPMENT START-UP

- A. Notification
 - 1. Contractor shall provide ten Owner business days' notice to CxA, Owner and Design Team of start-up dates.
- B. Prior to start-up, contractor shall:
 - 1. Verify that equipment and systems are complete, accessible, correctly connected to utilities and ready for operation. Perform all pre-start inspections and tests as called for in Division 22.
 - 2. Comply with pre-start requirements of manufacturer and complete applicable documentation.
 - 3. Complete applicable sections of Pre-functional Checklists.
 - 4. Coordinate start-up attendance by manufacturer or authorized representative as required by specifications or manufacturer.
- C. At start-up, contractor shall:
 - 1. Supervise the activities of the authorized start-up technician or manufacturer's representative.
 - 2. Verify proper voltage, phase, drive rotation and any other conditions that may cause damage if not correct.
 - 3. Execute start-up under supervision of qualified contractor and equipment manufacturer personnel and in accordance with the manufacturer's instruction.
 - 4. Complete manufacturer start-up requirements and documentation. Provide a copy of documentation to the CxA for inclusion in the Cx Manual.
 - 5. Complete PFC's and provide documentation to CxA.
 - 6. Provide documentation of any issues noted during start-up to CxA, Owner and Design Team. Outline recommendations for corrective action.

3.4 PRE-FUNCTIONAL CHECKLISTS

- A. Contractor shall forward completed copies of PFC's to the CxA for inclusion into the Cx documentation. PFC's will be provided by the CxA. As an alternate, contractor shall submit their versions of the PFC's to the CxA for review and comment.
- B. Contractor shall complete PFC for each of the following equipment:
 - 1. Plumbing:
 - a. Domestic Hot Water Heater/Converter.
 - b. Recirculation Pump.
 - c. Mixing Valve.

3.5 FUNCTIONAL TESTING

- A. General.
 - 1. Contractor shall organize and schedule Construction Team members to execute the functional testing, which will be directed by CxA.

- B. Recirculation Pump
 - 1. Graphics.
 - 2. Start/Stop/Schedule.
 - 3. Pump Operation (On/Off/Hand/Auto).
 - 4. Temperature Sensor Calibration.

- C. Domestic Water Heater
 - 1. Graphics.
 - 2. Start/Stop Schedule.
 - 3. Discharge Temperature.

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. Below Slab on Grade Piping for Water Entries:
 1. 2-inch and smaller, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube. No joints below slab entries.
 2. 2-1/2-inch and 3-inch, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube, 20 ft. straight lengths. One joint allowed below slab entry using wrought copper, solder-joint pressure fittings: ASME B16.22 with an approved brazing filler metal or pipe can be shop bent for no joint installation by using a "bending" temper tubing.
 3. 4-inch and larger, provide ductile iron pipe with mechanical joints, ANSI A21.6.
 4. 3 inch and larger, provide one-piece stainless steel IBR (in building riser), Watts or Ames.
- B. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.
- C. Below Slab on Grade Piping: PEX tubing. Refer to section 22 11 21.
- D. 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.
- E. Above Slab Piping: PEX tubing. Refer to section 22 11 21.
- F. 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.
- G. 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.

2.2 WATER HAMMER ARRESTORS

- A. Provide piston type hydraulic engineered/manufactured water hammer arrestors in cold and hot water supply lines in chases or walls to each fixture branch or battery of fixtures serving quick closing valves of electrical, pneumatic, spring loaded type, or quick hand closure valves on fixture trim. Provide water hammer arrestors at the end of the branch line between the last two fixtures served. Provide Precision Plumbing Products, Inc., or equal. Size units according to water hammer arrestor's Standard PDI WH-201; refer to schedule on drawings.
- B. Install all water hammer arrestors so as to attain 100% effectiveness according to Plumbing and Drainage Institute PDI-WH201 Table 5, 6 and 6-A for water hammer arrestors.
- C. All water hammer arrestors shall be installed in a vertical position.
- D. All water hammer arrestors shall be accessible and shall have access panels where required. Arrestors located above ceilings in fixture drops will not be acceptable. Refer to sizing and placement data as indicated in PDI Standard PDI-WH-201.

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.

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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.

C. PEX-to-thermoplastic transition fittings:

- 1. PEX-a to CPVC transition: Thermoplastic fitting with one spigot or socket end and one ASTM F1960 cold expansion end, with PEX-a reinforcing cold expansion ring.

1.4 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 11 23

DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. General characteristics for pumps specified in Division 22 - Plumbing.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 22 - Plumbing, including the following:

- A. Division 22 Plumbing - Electrical Provisions of Plumbing Work.

1.3 PUMP SELECTION

- A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.
- B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.
- C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.
- D. The pump curve shall rise continuously from maximum flow to cut-off.
- E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.
- F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.
- G. Select the pump for operation at or near peak efficiency.
- H. Cavitation-free at all points on the curve.
- I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.

1.4 PUMP SIZE AND TYPE

- A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.
- B. Submit copies of manufacturer's performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

- A. Submit factory certified pump curves showing pump performance characteristics with

pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. Show pump curves with system curve plotted.

PART 2 - PRODUCTS

2.1 DOMESTIC HOT WATER CIRCULATING PUMPS (SMALL) FRACTIONAL HORSEPOWER

- A. Pump Construction:
 - 1. Wet-rotor, in-line, single stage.
 - 2. Bronze housings with 1/2" and 3/4" sweat connections.
 - 3. Stainless steel housing with union threaded connections.
 - 4. Variable speed ECM.
 - 5. Integrated check valve inside union fitting on a sweat pump housing.
 - 6. Built-in 5-foot, 115 volt AC line cord with NEMA 3 Prong male plug or line cord.
 - 7. Timer control.
 - 8. Aquastat thermostatic control.

- B. Acceptable manufacturers:
 - 1. Bell & Gossett.
 - 2. Grundfos.
 - 3. Armstrong.
 - 4. Taco.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
 - 1. Provide access space around pumps for service.
 - 2. Lubricate pumps prior to start-up.
 - 3. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60" above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.

- B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge.

- C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.

- D. Ensure pumps:
 - 1. Operate at specified system fluid temperatures without vapor binding and cavitation.
 - 2. Are non-overloading in parallel and individual operation.
 - 3. Operate within 25 percent of midpoint of published maximum efficiency curve.

- E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.2 MANUFACTURER START-UP SERVICE ALIGNMENT

- A. After installation, the pumps and motors are to be aligned by the manufacturer or their

representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.

1. Technicians, as required, shall be trained and experienced in the work they perform (Contractor start-up / alignment is unacceptable).
- B. Before starting pumps, but after connecting piping:
1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
 2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
 3. Submit readings for approval.
 4. Include the approved readings in the Owner's Maintenance Manual.

3.3 FINAL PUMP FLOW CALIBRATION

- A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
 2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.
- B. Enter the information on the final configuration of the pump in the Owner's Manual.
1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.4 SPARE PARTS

- A. Provide the following spare parts and material to the Owner for his use after the warranty period.
1. A mechanical seal for each pump.
 2. A set of bearings for each pump.

END OF SECTION

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SECTION 22 13 16

SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping in buildings and underground laterals to 5 foot outside of building.

1.2 RELATED WORK

- A. Site Work:
 - 1. Sanitary Sewers.
 - 2. Excavation, Trenching and Backfilling for Utilities.
- B. Division 22 Plumbing:
 - 1. Pipe and Pipe Fittings.
 - 2. Plumbing Fixtures and Fixture Carriers.
 - 3. Drains, Cleanouts and Hydrants.
 - 4. Earthwork.

1.3 REFERENCES

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

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. All No-Hub clamps must have 4 bands minimum.
 - 1. No-Hub Clamps – Sanitary Waste:
 - a. Husky SD 4000.
 - 2. No-Hub Clamps – Vents
 - a. Husky SD – 2000.
 - b. Mission Rubber Co., LLC Heavy Weight Couplings.
 - 3. Clamp-All Hi-TorQ 80 or approved equal.
- B. Provide Fernco “Pro-flex” shielded couplings Series 3000 with one piece neoprene gasket for all cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 1-1/2” through 8” Series 3000.
- C. Cast Iron Soil Pipe and Fittings:
 - 1. AB&I.
 - 2. Charlotte Pipe and Foundry Co.
 - 3. Tyler Pipe / Soil Division.
- D. PVC Soil Pipe and Fittings
 - 1. Charlotte Pipe.
 - 2. Westlake Pipe and Fittings.
 - 3. JM Eagle.

2.2 DRAIN PIPE AND FITTINGS

- A. Above Slab Piping:
 - 1. Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints.
 - 2. Pipe and fittings shall conform to ASTM D 1784-82.
- B. Above Slab Piping – Commercial Kitchen Fixture Drain Piping.
 - 1. Copper Tube: ASTM B 306, DWV.
 - 2. Fittings: ASME B16.29, wrought copper, or ASME B16.32, solvent.
 - 3. Joints: ASTM B 32, alloy Sn50 solder.
- C. Below Slab on Grade Pipe:
 - 1. Schedule 40 PVC plastic pipe and DWV fittings.
 - 2. Solvent welded DWV joints shall conform to IAPMO Installation Standard IS-9.
 - 3. Pipe and fittings shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2665, ASTM D 3311 and NPS Standard 14 & 61.
- D. Below Slab on Grade Piping for Grease Waste:
 - 1. Schedule 40 CPVC pipe and fittings
 - 2. Solvent welded DWV joints shall conform to ASTM D3311 and be produced to dimensions specified in ASTM F 2618, NSF International, UPC, IAPMO IGS 210 and International Plumbing Code.
 - 3. Solvent Cement, Heavy Body; mustard yellow color, as tested by ASTM F 2618 / ASTM F493.
 - 4. Manufacturer: Spears or equal.
- E. Below Slab on Grade Piping for grease waste:
 - 1. Service weight/cast iron hub and spigot pipe and fittings
 - 2. Compression type, with neoprene gaskets shall conform to ASTM C-564.
 - 3. Pipe shall conform to requirements of ASTM A74.
 - 4. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

2.3 VENT PIPE AND FITTINGS

- A. Above Slab Piping. Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.
- B. Below Slab on Grade Piping:
 - 1. Provide Schedule 40 PVC with DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D1784-82.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All above and below slab soil, waste, sanitary drain and vent piping installation methods shall be in accordance with 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 are 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 vertical piping, not to exceed 15'-0" between clamps..

- C. All above and below slab PVC sanitary waste and vent 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.
- D. Tracer wires shall be installed on all underground PVC sanitary sewer lines installed outside the building slab.
- E. All PVC underground shall be installed in accordance with ASTM D2321.

3.2 GRADE

- A. Give horizontal pipe grade of ¼-inch per foot where possible, but not less than 1/8 inch per foot unless otherwise shown.
- B. Horizontal below grade 2" waste piping sloped at 1/4 inch per foot.
- C. Grease waste piping below grade sloped at 1/4 inch per foot.

3.3 DRAIN PIPE AND FITTINGS

- A. Offsets and Fittings.
 - 1. Use reduction fittings to connect two pipes of different diameter.
 - 2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and sixth-, eighth-, and sixteenth-bends. Sanitary tees can be used on vertical stacks. Use long sweeps at the base of risers.
 - 3. Provide a separate trap at each fixture, unless a trap is built into the fixture. Provide a deep seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
 - 4. Refer to Sanitary Drainage Code section for acceptable fittings to be used for changes in direction of drainage flow. Double combo sanitary fittings or double wye and 1/8th bend fittings are not allowed for horizontal to horizontal piping systems per Code.
- B. Hub Drains. Install hub drains where indicated, with the top of the hub 1/2 above the finished floor, unless otherwise indicated on the drawings.
- C. Cleanouts. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed; however, no cleanout should be larger than 4 inches in diameter. Provide cover with vandal-resistant securing screw.
 - 1. Where cleanouts occur in pipe chases, bring the cleanouts through the walls and install covers. Where cleanouts occur in floor slabs, set flush. Reference drawing schedule.
 - 2. Provide cleanouts where soil lines change direction, every 75 foot on long runs, or as shown on the drawings, at the end of each horizontal waste line, and at the base of each riser (and at each increase in pipe size).
 - 3. Cleanouts shall occur at the end of each battery of water closets, urinals, lavatories, sinks, and single water closets. Cleanouts shall be installed so as to access the main sanitary or soil line. Extend and offset above flood rim of water closet.
 - 4. Double sanitary tees and double quarter bends do not allow for easy access to main lines, therefore these types of fittings are not allowed.

3.4 VENT PIPING

- A. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 12 inches above the roof.

- B. Coordinate with roof contractor for installation of vents thru roof. Flashing at vent penetration shall comply with the roofing manufacturer's requirements. Reference the Architectural Drawings for exact requirements.
- C. Locate vent piping through roof a minimum horizontal distance of not less than 10 feet from any air intake opening or supply fan.

3.5 TESTING

- A. Below Slab on Grade and All Floors in Multi-Story Buildings:
 - 1. Test pipe below slab on grade before backfilling and connecting to city 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.
- B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
 - 1. Plugging outlets.
 - 2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
 - 3. Test for 6 hours without any drop in the water level.

3.6 RODDING SEWERS

- A. All sanitary soil and waste 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. All sanitary soil and waste lines below building 3" and larger shall be internally videotaped at time of substantial completion. All videotaping shall include on-screen date and time, and include audio narration. All videotaping shall be provided by experienced individual in videotaping piping systems. An Owner's Representative shall be present during videotaping. Three copies of the videotape shall be delivered to the Owner for future records.
- C. 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 the proper rotary head to clear sewer. Pipe sizes 8 inches and larger shall be hydro-flushed.

3.7 SMOKE TESTING

- A. Interior Plumbing Piping:
1. Contractor shall perform smoke testing on all interior sanitary sewer piping and sanitary vent piping above and below floor prior to cover-up.
 2. Artificially created smoke used must be a persistent white tracer smoke and produced by thermogenic chemical reaction. All smoke candles or smoke pencils to be used must be non-toxic and EPA approved. Provided by Superior Signal Smoke Candles.
 3. All plumbing fixtures must be installed including floor drains with wetted trap seals.
 4. Smoke testing shall be performed after completion of any videotaping, rodding or flushing of the sanitary system. Test must be performed prior to ceiling installation in new construction projects. Smoke is usually injected into the building through the two-way cleanout in the main sewer line leaving the building or a plumbing roof vent or fixture. Smoke will travel through the sanitary sewer and vent system and through the air spaces in the sewer lines and emanate from any leaks in the system. The smoke must reach the last roof vent in the system to indicate the entire system has been completely filled with smoke. The smoke must travel the full length of the piping system. Contractor must provide manpower as necessary to visually trace the flow of smoke through the wall cavities, annular floor/ceiling spaces, inject the smoke, observe the roof vents and to identify the integrity problems.
 5. Contractor shall provide a detailed list of findings and a drawing indicating the location, fixture type, type and size of pipe, and or description of type of problems found.
 6. Typical findings from indoor smoke testing may include:
 - a. Dry traps in floor drains.
 - b. Improperly capped sewer lines or vents.
 - c. Broken sewer lines or vents.
 - d. Cross connected sewer vents and drains.
 - e. The drawing of air emanating from sewer vents into intakes of air exchange systems.
 - f. Poorly glued pipe joints.
 - g. Loose no-hub couplings.
 7. An Owner's Representative shall be present during smoke testing.

3.8 SMOKE TESTING – LIQUID SMOKE SYSTEM

- A. Interior Plumbing Piping:
1. Contractor shall perform smoke testing for finding leaks in all interior of building sanitary sewer piping and sanitary vent piping above and below building slab prior to cover up.
 2. Contractor must use a laboratory tested safe liquid smoke with a patented liquid smoke generating system. The liquid smoke must be contained in a pressure tank with inline filter and quick disconnect.
 3. Smoke generating system must generate up to 3 hours or more of continuous and constant smoke. Generating system must have a metering valve to precisely control smoke flow and density. Smoke generating system must have a 4" x 6" industrial flexible mining duct for connection to vent stack or cleanout.
 4. Smoke generating system must be power full enough to push smoke through the smallest leaks.
 5. The liquid smoke must not leave any stains or odors.
 6. The liquid smoke shall not contain Zinc Chloride, a listed toxic compound in OSHA 1915,1000 – Air contaminants.

7. Smoke generating system must have a means to atomize the liquid smoke and have an enclosed fan system capable of up to 700 cfm with adjustable inlet damper control to adjust cfm as necessary for the size of system.
8. Provide Hurco "Power smoker " with Hurco "LiquiSmoke" system or approved equal.
9. All plumbing fixtures must be installed including floor drains with wetted trap seals.
10. Smoke testing shall be performed after completion of any videotaping, rodding or flushing of the sanitary system. Test must be performed prior to ceiling installation in new construction projects. Smoke is usually injected into the building through the two-way cleanout in the main sewer line leaving the building or a plumbing roof vent or fixture. Smoke will travel through the sanitary sewer and vent system and through the air spaces in the sewer lines and emanate from any leaks in the system. The smoke must reach the last roof vent in the system to indicate the entire system has been completely filled with smoke. The smoke must travel the full length of the piping system. Contractor must provide manpower as necessary to visually trace the flow of smoke through the wall cavities, annular floor/ceiling spaces, inject the smoke, observe the roof vents and to identify the integrity problems.
11. Contractor shall provide a detailed list of findings and a drawing indicating the location, fixture type, type and size of pipe, and or description of type of problems found.
12. Typical findings from indoor smoke testing may include:
 - a. Dry traps in floor drains.
 - b. Improperly capped sewer lines or vents.
 - c. Broken sewer lines or vents.
 - d. Cross connected sewer vents and drains.
 - e. The drawing of air emanating from sewer vents into intakes of air exchange systems.
 - f. Poorly glued pipe joints.
 - g. Loose no-hub couplings.
13. An Owner's Representative shall be present during smoke testing.

END OF SECTION

SECTION 22 20 00

PLUMBING PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install pipe and pipe fittings for piping systems specified in Division 22 - Plumbing.

1.2 RELATED WORK

- A. Division 22 Plumbing
 1. Earthwork.
 2. Valves, Strainers and Vents.
 3. Insulation.
 4. Other Piping Sections.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

- A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.
- C. Solder joints.
 1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
 2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
 3. Use silver brazing alloy or Sil-Fos on underground water entry piping. Use lead free solder on all other copper piping.
- D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.
- E. Flanged.
 1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
 2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment.

- Otherwise, use raised-face flanges.
3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
 4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
 5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.
 6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.
- F. No Hub. Hubless joints shall be made with wide body, neoprene sealing sleeve with stainless steel sleeve, coupling joints conforming to ASTM C 1277.
1. 4" pipe size and smaller coupling housing minimum of 3" width; 24 gauge Series 300 stainless steel with hi-torque clamps; neoprene coupling gasket.
 2. 6" through 10" pipe size coupling housing minimum of 4" width.
 3. Tighten clamps to within manufacturer's tolerances using preset torque wrench.
- G. Mechanical Joints. Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:
1. Duplex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
 2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
 3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
 4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.
- H. Compression Joints for Cast Iron Water Pipe. Use Beltite, Tyton or Grip-Tite compression joints. Install in accordance with the manufacturer's recommendations for compression joints. Provide adequate concrete thrust blocks at changes of direction, as recommended by the manufacturer.
- I. Compression Gasket System. Bell and spigot cast iron pipe 4" and smaller, use flax-base lubricant, Tyler Ty-Seal Lubricant or Charlotte Regular Lubricant. 6" and larger use a neoprene base lubricant, Charlotte Adhesive Lubricant.
- J. Ring-Tite Joints: Ring-Tite gasketed sewer fittings for sanitary and storm. Furnish joints for installation manufactured per ASTM/CSA, Iplex, and J.M Eagle C900. Provide adequate concrete thrust blocks at changes in direction, as recommended by manufacturer. JM Eagle pressure rated PVC water pipe. ASTM D2241 pressure rating, ASTM D3219 joints, gaskets ASTM F477.
- K. Ball Joints. Where shown, provide flexible ball joints, made of carbon steel. Ball joints must have 15° of angular flexibility. Use welded or flanged ends, as required. Furnish with 11N gaskets.
- L. Mechanically Formed Tee Fitting. Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height not less than three (3) times the thickness of the branch wall. The branch tube shall be notched to conform with the inner curve of the run tube and shall have two (2) dimple / depth stops to insure that penetration of the branch tube

into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube. Dimple depth stops shall be in line with the run tube. The second dimple shall be one quarter (1/4) inch above the first and shall serve as a visual point of observation. All joints shall be brazed with silver brazing alloy or Sil-Fos. Soft soldered joints shall not be allowed.

- M. Press fittings for copper pipe 1/2" to 4": Copper press fittings shall conform to the material and sizing requirements of ASTM B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Pro-Press System manufactured by 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.
- N. Press fittings for steel pipe 1/2" to 2": Where accepted by local code for specific applications, Cold Press Mechanical Joint Fittings shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria of ANSI/CSA LC4. Sealing system shall be EPDM or HNBR as appropriate for a defined application. MegaPress system manufactured by VIEGA or approved equal and include "Smart Connect" assurance that unpressed fittings will not hold pressure. 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.

2.3 UNIONS

- A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
 - 1. Where pipe materials of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

- A. Pipe 2" and Smaller. For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.
- B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. Use Weld-o-let when branch is smaller than header. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

- A. High Temperature Piping. Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.
- B. Other Piping. Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America unless specifically named in these specifications.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufacturer, for maintenance.
- B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.
- C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
- D. Install piping without tapping out of the bottom of pipe.
- E. Press Connections: Copper and steel press fittings ½" through 4" shall be applied in accordance with the manufacturer's installation instructions. The tubing/pipe shall be fully inserted into the fitting and the tubing/pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing/pipe to assure the tubing/pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. If soldering (thread adapters, etc.) near press fittings, take precautions to not damage the O-ring fittings. Maintain three pipe diameters or use a cooling agent. Viega-"Pro-Press".

3.2 WELD

- A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.
- B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.
- F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

- A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.
- B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
- B. Provide supports both sides of elbows for pipe 6" and larger. For smaller pipe provide support within 12" of elbows and tees.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On cold water pipe, supports shall be outside the insulation.
- D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
- E. Install trapeze hangers, properly sized, to support the intended load without distortion.
- F. Use electro-galvanized or zinc plated threaded rods, nuts, washers and hangers.
- G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.
- H. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Feet	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

- I. PEX Piping:
 - a. Maximum hanger spacing, 2'-8".
 - b. Hanger rod diameter, 3/8 inch.
 - c. Hanger spacing per piping manufacturer's instructions when using horizontal

rigid metal channel to support piping.

3.5 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.
- C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

- A. Support gas pipe on roof with Miro Industries Model 3-RAH-8 or approved equal with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 ANCHORS

- A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
 - 2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
 - 1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

- E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.11 DRAIN VALVES

- A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.12 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.
- B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.
- C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until "potable water clear" and particles larger than 5 microns are removed.
- D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.
- E. Dispose of water in approved manner.
- F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Flush system and replace with clean water.

- G. Phase Three: Final flushing and rinsing: Flush and rinse until “potable water clear” and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.
- H. Submit status reports upon completion of each phase of work on each system.

3.13 TESTING

- A. Test piping after installation with 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. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- C. 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.
- D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.14 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
 - 1. Both sides of penetrations through walls, floors and ceilings.
 - 2. Close to valves or flanges.
 - 3. Intervals on straight pipe runs not to exceed 50 feet
 - 4. Apply marker where view is obstructed.
- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

END OF SECTION

SECTION 22 33 34

ELECTRIC WATER HEATER (Commercial - Non-ASME)

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electric water heaters for domestic water systems.

1.2 RELATED WORK

- A. Division 22 Plumbing
 1. Domestic Water Piping.
 2. Plumbing Piping Insulation.
 3. Division 26 Electrical.

1.3 WARRANTY

- A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. A. O. Smith.
- B. Bradford White.
- C. Rheem/Ruud.

2.2 PRODUCTS

- A. Provide electric water heaters with kilowatt, recovery ratings, and storage capacities as scheduled on drawings.
- B. Provide a tank designed for 150 psig working pressure. Furnish glass-lined tank. Lining shall be corrosion-resistant.
- C. Furnish factory-assembled, integral units equipped as follows:
 1. Extruded high density anode rod.
 2. Individually mounted thermostat at each element with a high temperature cutoff.
 3. High temperature limit switch (energy cutout).
 4. UL rated.
 5. Temperature and pressure relief valve.
- D. Provide medium watt density elements having zinc-plated copper sheathing and prewired leads.
- E. The outer jacket shall be baked enamel finish and shall be provided with full size control compartment for performance of service and maintenance through hinged front panels and shall enclose the tank with foam insulation.

- F. Electrical junction box with heavy duty terminal block shall be provided.
- G. Heater shall have a three year limited warranty.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installations shall be in accordance with the manufacturer's published recommendations.
- C. Furnish all supports required by the equipment included in this Contract.
- D. Provide a wall support platform beneath heaters with integral drain pan.
- E. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. to facilitate proper functioning and servicing of equipment.
 - 1. Install a line size shutoff valve in cold water inlet and hot water outlet close to each heater.
 - 2. Provide a temperature gauge in the domestic hot water piping within five feet of outlet to each heater, upstream of all shut-off valves. Size and locate gauges to be easily readable from a standing position.
- F. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.
- G. Pipe relief valve discharge and all equipment drains indirectly to appropriate floor drain.
- H. Connect hot water return from circulation pump to cold water supply to heater.
- I. Set thermostats on domestic water heaters to delivery maximum water temperature as indicated on Contract Drawings. Set the operating and safety controls.
- J. Furnish and install an expansion tank on cold water supply to heater. Locate tank as close to water heater as possible between water heater and all check valves or backflow preventers. Expansion tank capacity shall be as scheduled on Contract Drawings. Install expansion tank in accordance with manufacturer's recommendations.

3.2 STARTUP

- A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.

END OF SECTION

SECTION 22 35 16

INSTANTANEOUS GAS-FIRED TANKLESS WATER HEATERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Tankless gas-fired water heaters for domestic water systems.

1.2 RELATED ITEMS

- A. Division 22 Plumbing:
 - 1. Domestic Water Piping.
 - 2. Gas Piping.
 - 3. Flue Piping.
 - 4. Plumbing Piping Insulation.

PART 2 - PRODUCTS

2.0 ACCEPTABLE MANUFACTURERS

- A. Navien
- B. Rinnai Corp.
- C. A. O. Smith.

2.1 PRODUCT SPECIFICATIONS

- A. Commercial tankless, internally mounted, instantaneous, gas fired, direct vent water heater design certified to the ANSI Z21.10.3 / CSA 4.9 wall mounted for indoors.
 - a. Basis of design manufacturer: Navien.
- B. Adjustable hot water temperature range of 90°F to 140°F.
- C. Flow rates of 0.5 GPM up to 9.3 GPM (199 cfh).
- D. Heaters shall be microprocessor controlled (standard digital controller) and utilize a direct electronic ignition system (with no standing pilot) modulating gas valve, flow meter, flow control valve and temperature thermistors to maintain outlet water temperature between +/- 2°F of setpoint temperature.
- E. Safety Devices:
 - 1. Flame failure lockout.
 - 2. Boiling protection lockout.
 - 3. Thermal overheat protection.
 - 4. Lockout protection in the event of a blocked flue.
- F. Accessories:
 - 1. Temperature and Pressure Relief Valve: ASME labeled.
 - 2. Wall mounted support.
 - 3. Ball valves and unions at pipe connection points.
 - 4. Condensate drain neutralizer kit piped to floor sink.
 - 5. Provide a properly sized thermal expansion tank as scheduled on drawing.

2.2 FLUE

- A. This water heater(s) shall be suitable for sealed combustion direct-venting air intake pipe

and exhaust pipe per manufacturer's instructions. Provide roof concentric vent kit.

2.3 ELECTRONIC DESCALER

- A. Electronic descaler to prevent calcium build-up in piping. Install unit on wall next to water heaters, coil wiring installed on cold water supply pipe to water heater per manufacturer's instructions. Coordinate 120 volt outlet for power supply with electrical contractor.
- B. Manufacturer: Clear Water Enviro technologies; model Scaleblaster SB-250 or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install a line size valve in the cold water supply close to each heater and a line size plug cock in the gas supply close to each heater.
- B. Install all flue exhaust and air intake material and manifolds per manufacturer's instructions.
- C. Install according to manufacturer's specifications and pipes as shown. Provide accessories as required for a complete operating system.
- D. Coordinate with plumbing piping and related fuel piping, gas venting, ductwork and electrical work to achieve operating system. Locate equipment and arrange plumbing piping to provide access space for servicing all components.

3.2 WARRANTY

- A. Heat Exchanger: 304 stainless steel burner or copper heat exchanger warranted for 5 years from date of purchase in a commercial application. Three years from date of purchase when used as a circulating water heater with a hot water circulation loop.

END OF SECTION

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.
 3. Soil, Waste and Sanitary Drain Piping and Vent 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. Plumbing Fixtures (Vitreous China):
 1. American Standard.
 2. Kohler.
- B. Plumbing Faucets:
 1. American Standard.
 2. Chicago Faucets.
 3. Moen Commercial.
- C. Supports and Carriers:
 1. Wade.
 2. Zurn.
 3. J.R. Smith.
 4. Watts.
 5. MIFAB.
- D. Flush Valves:
 1. Sloan.
- E. Supplies, Stops and Chrome Plated Tubular Brass:
 1. McGuire.
 2. Brasscraft.
 3. ProFlo.
- F. Water Closet Seats:
 1. American Standard.
 2. Bemis.

- 3. Kohler.
- G. Floor Drains & Floor Sinks:
 - 1. Zurn.
 - 2. J.R. Smith.
 - 3. Sioux Chief.
 - 4. MIFAB.
- H. Cleanouts:
 - 1. J.R. Smith.
 - 2. Zurn.
 - 3. MIFAB.
 - 4. Sioux Chief.
 - 5. Wade.
- I. Shower Valves
 - 1. Bradley.
 - 2. Delta.
 - 3. Symmons.
- J. Stainless Steel Sinks:
 - 1. Elkay.
 - 2. Kohler.
 - 3. Just.
- K. Water Hammer Arrestors:
 - 1. Precision Plumbing Products.
 - 2. Sioux Chief.
 - 3. Watts.
- L. Thermostatic Mixing Valves
 - 1. Watts.
 - 2. Caleffi.
 - 3. Powers.
- O. Grease Interceptors
 - 1. Schier.
 - 2. Endura
- P. Sanitary Sampling Port
 - 1. Schier.
 - 2. Thermaco.
- Q. Water Box & Ice Machine box.
 - 1. Sioux Chief.
 - 2. Oatey.
- R. Trap Primer
 - 1. Precision Plumbing Products.
 - 2. Sioux Chief.
- S. Electric Water Cooler
 - 1. Elkay
 - 2. Oasis.
- T. Trench Drains

1. IMC – Teddy
 2. Advance Tabco.
 3. Eagle Group.
- U. Commercial Kitchen Fixtures
1. Kitchen fixtures furnished by others. Provide rough-in and final connections as required. Coordinate with Kitchen Equipment Contractor. Refer to Architectural drawings and Plumbing Fixture Schedule on plan.

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. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping. Cover exposed water closet bolts with bolt covers.
- B. Make rough-in and final connection of service to each fixture provided under this Section and other Sections, Equipment furnished by others, Architectural and Plumbing Drawings.
- C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a complete installation. Provide chrome plated rigid or stainless steel flexible supplies to fixtures with commercial grade quarter-turn loose key or removable handle stops, reducers, and escutcheons. Install fixture stops in readily accessible location for servicing.
- D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on drawings. Piping stub outs for supply stops shall be type L copper.
- E. Remove piping and services roughed-in incorrectly and install correctly, without cost.
- F. Exposed piping, fittings and appurtenances shall be chrome-plated brass. Cover pipe penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated brass and incased with ADA compliant covers.
- G. Coordinate with the Equipment suppliers for locations and service required for equipment furnished or provided by others.
- H. All floor drains and floor sinks shall have a trap primer connection for trap seal protection.
- I. All floor drains and floor sink locations are to be coordinated with all equipment. Locate drains in mechanical equipment spaces to conform to drain locations of equipment furnished. Coordinate drain location with equipment and Architectural Drawings.
- J. All floor drains and cleanout covers are to be provided with stainless steel vandal resistant screws.
- K. Coordinate installation of exterior below grade grease interceptor and sampling port with site contractor.
- L. Coordinate with Kitchen Equipment Contractor . Provide rough-in piping, traps, tailpieces,

indirect waste lines and make final and necessary connections for foodservice equipment. Install faucets, drains, vacuum breakers, check valves, water inlet fittings, filters, and strainers, furnished by foodservice equipment contractor. Provide condensate drain piping from cooler/ freezer evaporator or ice machines. Make all final and necessary plumbing connections. Provide suitable access panel as required in non-accessible ceilings and walls.

- M. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
- N. Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust valves for intended water flow rate to fixtures without splashing, noise or overflow.
- O. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- P. Clean plumbing fixtures and equipment. Do not permit use of fixtures by construction personnel.
- Q. Protect installed products from damage due to subsequent construction operations.
- R. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 22 63 11

GAS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install steel gas pipe inside buildings and on roof, including the supply line from the meter, service lines to gas equipment and appliances, termination of the service line with a plug valve, drip leg, pressure regulator and final connection to equipment and appliances with unions.
- B. Coordinate with Gas Company for gas meter capacity to handle increase in gas load.
- C. Extend steel gas piping from meter to inside the building and on roof to all fixtures, appliances and equipment requiring gas.

1.2 RELATED WORK

- A. Division 22 Plumbing
 - 1. Plumbing Pipe and Fittings.
 - 2. Valves and Vents.

1.3 UTILITY CONNECTIONS

- A. Make arrangements for and pay all fees and connection charges for obtaining service to the building.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - ABOVE GRADE

- A. Pipe 2 inch and Smaller:
 - 1. Schedule 40 ASTM A 53 black steel pipe.
 - 2. Factory fabricated socket weld fittings or threaded. NFPA 54, ASME B31.1.
 - 3. Where approved for a specific project and where accepted by local code, cold press mechanical joint fittings shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria of ANSI/CSA LC4. Sealing elements shall be HNBR and the fittings shall bear the CSA stamp to confirm acceptability for fuel gas systems. MegaPress system manufactured by VIEGA including "Smart Connect" or approved equal to assure unpressed fittings will not hold pressure. Installers shall carry training credentials from the manufacturer to confirm they have been instructed in the correct installation procedures.
- B. Pipe Larger than 2 inch:
 - 1. Schedule 40 ASTM A 53 black steel pipe.
 - 2. Factory fabricated butt weld fittings for welded steel pipes shall conform to ASTM A-234 WPB (seamless weld fittings).
- C. Unions:
 - 1. Standard 150 lb. (300 lb. water, oil or gas) malleable iron.
 - 2. Ground joint unions, with bronze seat.
 - 3. Flange joints for pipe larger than 2 inch in diameter.
- D. Flanges:
 - 1. Steel flanges. ANSI B16.5 and ASTM A-105.

2.2 VALVES

- A. See Section 22 05 23.

2.3 GAS PRESSURE REGULATOR

- A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as required for all equipment. Coordinate final equipment gas pressure requirements prior to ordering regulators. Provide Maxitrol or American Meter Company regulators or approved equal, suitable for indoor or outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down position.
- B. All line pressure regulators shall be listed in accordance with ANSI (American National Standard) Z21.80 and CSA (Canadian Standards Association Standard) 6.22.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation Standards: Install gas piping in accordance with recommendations of the National Fire Protection Association.
- B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical rise.
- C. Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility company standards.
- D. Sleeves.
 - 1. Encase gas piping running in or through solid partitions with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1 inch larger than encased gas piping.
- E. Do not install gas piping exposed to view inside public area, or occupied spaces, without prior written approval.
- F. Provide test ports and isolation valves to enable proper testing of system in the future.
- G. Provide isolation valve and unions across regulators for proper removal.
- H. Provide anodeless transition risers where below grade polyethylene pipe changes to steel pipe above grade.
- I. Gas Pressure Regulators / Vents:
 - 1. Piping shall be sized in accordance with the regulator manufacturer's instructions. Never use pipe sizes smaller than the vent size; smaller pipe sizes restrict the gas flow. Where there is more than one regulator at a location, each regulator shall have a separate vent to the roof / outdoors or provide vent limiter.
 - 2. Support the vent pipe to eliminate strain on the regulator diaphragm case.
 - 3. Install vent piping from regulators to location to prevent gas smells from entering building. Do not locate the vent line terminus near windows, fans, or other ventilation equipment. See the installation instructions furnished with the regulator.
 - 4. Install double elbows and insect screen at end of piping to prevent moisture and insects from entering. Always point outdoor vent pipes in the downward position

- to reduce the possibility of rain, snow, sleet, and other moisture entering the pipe.
5. When installed inside building provide with vent limiter or route vents horizontally and terminate through building sidewall. The vent must be piped to the outside atmosphere using the shortest length of pipe, the fewest possible pipe elbows, and a pipe diameter as large as the vent size or larger. If a long gas run must be used, increase the pipe one nominal size every ten feet to keep the flow restriction as low as possible. Vents terminating through roof must have prior approval from Architect before installation. Through roof penetrations shall be minimized.
 6. Regulators installed outside or on roof top: Install regulator vent turned downward with insect screen over vent opening. The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.
 7. Ensure the end of the vent line is away from ANY potential ignition sources. It is the installer's responsibility to ensure the vent line is exhausting to a safe environment
 8. Adhere to all applicable codes and regulations.

3.2 TESTING GAS PIPING

- A. Preliminary gas test as required by Code, but minimum test pressure of 3 PSI held for not less than eight hours without noticeable drop.
- B. Test joints with a soap solution while lines are under pressure.
- C. Repair leaks.
- D. Final gas test shall be with a 24 inch column of mercury or a diaphragm gauge with a minimum dial size of 3-1/2 inches with a set hand and a pressure range not to exceed twenty (20) psig with 2/10-pound increments. The minimum test pressure shall not be less than 3 PSI and the maximum test pressure shall be 1.5 times system operating pressure. This test will be observed for no less than (30) thirty minutes with no drop in pressure.
- E. Provide copy of gas pressure test reports in Operations & Maintenance Manual.

3.3 IDENTIFICATION CONDUCTOR

- A. Spiral A #12 AWG insulated copper conductor the full length of the thermoplastic piping system. Fasten to the pipe at 3 foot intervals with plastic tie wraps.
- B. Terminate at each end in a 12 inch x 12 inch x 4 inch FRP junction box.
 1. Bolted gasketed cover with stainless steel screws.
 2. Screw type terminal strip.
 3. Legend on cover "gas pipe identification conductor."
- C. Set in concrete pad.

3.4 PAINT EXPOSED OUTSIDE GAS PIPE

- A. Interior and Exterior Gas piping shall be protected from rust.
- B. Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal Primer White and top coat of Yellow Alkyd Flat Enamel.

END OF SECTION

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