

SECTION 22 0400 - GENERAL CONDITIONS FOR PLUMBING TRADES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This section applies to certain sections of Division 26, "Electrical," and this section applies to all sections of Division 22, "Plumbing" of this project specification unless specified otherwise in the individual sections.
- C. The Drawings of other trades (Architectural, Structural, Landscape, Civil, Mechanical, Fire Protection and Electrical) shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

1.2 DESCRIPTION

- A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.
- B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division. Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

1.3 INTENT

- A. It is the intent of the Specifications and Drawings to call for finished work, tested and ready for operation. Provide all parts necessary for the intended use, fully complete and operational, and installed in professional manner in accordance with the design intent.
- B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

- C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.
- D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section includes the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

1.4 DEFINITIONS

- A. "Approved equal" also known as "alternative" mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.
- B. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.
- C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.
- D. "Finished" refers to all rooms and areas to be specified to receive architectural treatment as indicated on the drawings. All rooms and areas not covered, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.
- E. "Furnish" or "supply" shall mean purchase, deliver to, and off-load at the job site, ready to be installed including where appropriate all necessary interim storage and protection.
- F. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.
- G. "Install" shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.
- H. "Lead Free" shall mean not more than .25% in the wetted surface area.
- I. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.
- J. "Product" shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.
- K. "Provide" shall mean furnish (or supply) and install as necessary.

- L. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- M. Remove: The term "remove" means "to disconnect from its present position, remove from the premises and to dispose of in a legal manner."
- N. Special Warranties: The term "Special Warranties" are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.
- O. Standard Product Warranties: The term "Standard Product Warranties" are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- P. "Subcontractor" means specifically the subcontractor working under this Division. Other Contractors are specifically designated "Plumbing Subcontractor", "General Contractor" and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.
- Q. Substitutions: Requests for changes in products, materials, equipment, and methods of construction proposed by the Contractor are considered requests for "substitutions."
- R. "Wiring" shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

1.5 CONTRACT DOCUMENTS

- A. The two dimensional drawings govern the construction. They show the design intent and are part of the Contract Documents. BIM models are not part of contract documents. They are developed for convenience only.
- B. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)
- C. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.
- D. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

1.6 DISCREPANCIES IN DOCUMENTS

- A. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.
- B. Where Drawings or Specifications conflict or are unclear, submit clarification request in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or un-clarities thus resolved.
- C. Where Drawings or Specifications do not coincide with manufacturers' recommendations or with applicable codes and standards, submit clarification request in form of an RFI before installation. Otherwise, make changes in installed work required for compliance with manufacturer instructions or codes and standards within Contract Price.
- D. Where insufficient information exists in the documents to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements, where notification required by Paragraph (B) above has not been submitted, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in professional manner either concealed or exposed in accordance with the design intent.
- E. Where discrepancies exist between the mechanical, plumbing, fire protection, and electrical drawings in regards to what trade owns disconnects or starters, the discrepancy shall be brought to the Architect's attention in accordance with paragraph (B) above. If the scope is not resolved prior to the Award of Contract, Division 26 shall provide such items.

1.7 SURVEYS AND MEASUREMENTS

- A. Before submitting the Bid, the Contractors shall visit the site and become thoroughly familiar with all existing conditions under which work will be installed. This Contract includes all modifications of existing systems required for the installation of new equipment. This Contract includes all necessary offsets, transitions and modifications required to install all new equipment in existing spaces. All new and existing equipment and systems shall be fully operational under this Contract before the job is considered complete. The Contractors shall be held responsible for any assumptions made, any omissions or errors made as a result of their failure to become fully familiar with the existing conditions at the site and the Contract Documents.
- B. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

- C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.8 CODES AND STANDARDS

A. Reference Standard Compliance

1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.
2. Independent Testing Organization Certificate: In lieu of the label or listing indicated above, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

- B. Wherever Codes and/ or standards are mentioned in these specifications, the latest applicable edition or revision of the local building or life safety code shall be followed.

- C. The following Standards shall be used where referenced by the following abbreviations:

ACGIH	American Conference of Governmental Industrial Hygienists
AGA	American Gas Association
AIA	American Institute of Architects
ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society of Testing and Materials

AWS	American Welding Society
AWWA	American Water Works Association
CGA	Compressed Gas Association
CSA	Canadian Standards Association
CISPI	Cast Iron Soil Pipe Institute
EJMA	Expansion Joint Manufacturing Association
EPA	Environmental Protection Agency
FM	Factory Mutual
FSSC	Federal Specification
HIS	Hydraulic Institute Standards
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
ISO	Insurance Services Office
MCAA	Mechanical Contractors Association of America
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NOFI	National Oil Fuel Institute
NSC	National Safety Council
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PDI	Plumbing and Drainage Institute
SBI	Steel Boiler Industry (Division of Hydronics Institute)
SDWA	Safe Drinking Water Act

SMACNA Sheet Metal and Air Conditioning Contractors National Association

STI Steel Tank Institute

UL Underwriters' Laboratories

- D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.
- E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.9 PERMITS AND FEES

- A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.10 EQUIPMENT EQUIVALENTS AND SUBSTITUTIONS

- A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of quality, finish and design that is required. If the Contractors uses an "approved equal" alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.
- B. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.
- C. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.
- D. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for

substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non-approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer's equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

- E. If an alternative or substitute item results in a difference in quantity and arrangement of structure, piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.
- F. Equipment, material or devices submitted for review as a "substitution" shall meet the following requirements:
 - 1. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.
 - 2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
 - b. Samples, where applicable or requested.
 - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
 - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
 - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

- f. Cost information, including a proposal of the net change, if any in the Contract Sum.
- g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
- h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.
- i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.
 - 1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.
 - 2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 - 3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.11 SUBMITTAL PROCEDURES

- A. Provide Submittals in accordance with the requirements of Division 01 and as indicated in the following.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
1. Allow ten business days for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
 2. If an intermediate submittal is necessary, process the same as the initial submittal.
 3. Allow ten business days for reprocessing each submittal.
 4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.
- D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Submittals shall be arranged in order of specification sections.
1. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Number, title and paragraph of appropriate Specification Section.

- i. Drawing number and detail references, as appropriate.
- E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
- F. Except for submittals for record, information or similar purposes, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.
- G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.

1.12 SHOP DRAWINGS

- A. Submit neatly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
- B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated plumbing layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review all shop drawings to be incorporated in the Plumbing Contract.
- C. Provide shop drawings for all devices specified under equipment specifications for all systems. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures), of all shop drawings, performance cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.
- D. When a submittal could involve more than one trade, e.g., valves, piping, etc., the submitted shall be separated by traded involved, ie. HVAC, plumbing, fire protection, etc.

- E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.
- F. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.
- G. "No Exception Taken" rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings. Review of shop drawings shall not apply to quantity of material.
- H. After shop drawings have been reviewed, with no exceptions taken, no further changes will be allowed without the written consent of the Engineer.
- I. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.
- J. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to bidding to allow for issuance of an Addendum.
- K. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.
- L. All submittals shall be made in electronic PDF format with searchable OCR (Optical Character Recognition) format. This excludes scanned and faxed materials.

1.13 COORDINATION DRAWINGS AND BIM MODEL

- A. Coordination drawings are required for all fire protection, plumbing, mechanical and electrical trades. The content and procedures described in Division 01 shall be followed, with the additional requirements specifically for the plumbing and electrical trades as described in this Section. If a BIM model is not used on this project, the below requirements shall be accomplished in CAD.
- B. Prepare coordination drawings in accordance with Division 01 to a minimum scale of 1/4"=1'-0" detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
 - 1. The Contractor shall indicate the proposed locations of piping, conduit, ductwork, equipment, and materials. Include the following:

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GENERAL CONDITIONS FOR
PLUMBING TRADES
22 0400 - 12 of 25**

- a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - b. Equipment connections and support details.
 - c. Exterior wall and foundation penetrations.
 - d. Fire-rated wall and floor penetrations.
 - e. Sizes and locations of required concrete pads and bases.
- C. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
- D. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
- E. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.
- F. The Contractor and each subcontractor shall sign and date each coordination drawing prior to submission.
- G. Work shall not be performed until coordination drawings have been approved by the architect and engineer.
- H. Electronic copies of the MEP floor plans and/or BIM model are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. If the Contractor elects to obtain the Engineers electronic files an Electronic Drawing File Release Form must be submitted. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic Drawing File Release Form, the Engineer will provide copies of the electronic files for the Contractor's use. A copy of the Electronic Drawing File Release Form is appended to the end of this specification section
- I. Review by Engineer of coordination drawings is limited to confirming that requirements for coordination and preparation of plans have been complied with by the Contractor and shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other related work.

1.14 COORDINATION WITH OTHER DIVISIONS

- A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information

as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

- B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, HVAC piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.
- C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.
- D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.
- E. The two dimensional drawings are diagrammatic. They indicate general arrangements of mechanical systems and other work, and are intended to convey sufficient information for skilled contractors and tradespeople to furnish and install complete systems. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, provide all other components and materials to make the systems fully complete, coordinated with other systems and the structure and space available, and operational. Similarly, the drawings do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades in order to avoid interferences and to meet ceiling heights and other Architectural requirements. Establish and provide offsets, changes in direction, and exact routings to coordinate all systems. Where conflicts or potential conflicts exist and engineering guidance is desired, submit a "Request for Information" (RFI).
- F. Controls contractor shall coordinate and sequences of operation with all other trades as necessary to provide a complete and functioning system.

1.15 QUALITY CONTROL

- A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

- C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled tradespeople, fitters, metal workers, welders, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.
- D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.
- E. All labor for installation of plumbing systems shall be performed by experienced, skilled tradespeople under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, professional manner. The Engineer reserves the right to reject any work which, in their opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.16 SHUTDOWNS

- A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.
- B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.
- C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.17 TEMPORARY UTILITIES

- A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
- C. First Aid Supplies: Comply with governing regulations.
- D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

- E. Utilities: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
 - 1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.
- F. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
- G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.
- H. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.18 EQUIPMENT ACCESS

- A. Appliances, controls devices, valves and accessories that utilize energy shall be accessible for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping not connected to the appliance being inspected, serviced, repaired or replaced. A level working space not less than 30 inches deep and 30 inches wide shall be provided in front of the control side to service an appliance.

1.19 PROJECT PHASING

- A. Work under each Section shall include all necessary temporary connections, equipment, piping, heating, temperature control work, fire stopping, water heaters, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required to maintain existing systems operational or to accommodate the construction phasing of the project.

1.20 PROTECTION OF MATERIALS AND EQUIPMENT

- A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or tradespeople and shall include making good all damage thus caused.
- B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.
- C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.
- D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by tradespeople or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.21 ADJUSTING AND TESTING

- A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.
- B. Where requested by the Engineer, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer's recommendations and is operating as intended by the manufacturer.

1.22 CLEANING

- A. The Contractor shall thoroughly clean and flush all piping and equipment of all foreign substances, oils, burrs, solder, flux, etc., inside and out before being placed in operation.
- B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

- C. During the course of construction, all pipes shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.
- D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.
- E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - 1. Remove labels that are not permanent labels.
 - 2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - 3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - 4. Wipe surfaces of plumbing equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition.
- F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.
- G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.23 OPERATING AND MAINTENANCE

- A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or the Owner's representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) days' notice to the Owner and the Engineer in advance of this period.
- B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

- C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.
- D. An authorized manufacturer's representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. The following equipment will require this inspection: pumps; controls, water heaters, compressors, boilers etc. These letters shall be bound into the operating and maintenance books.
- E. Refer to individual trade Sections for any other particular requirements related to operating instructions.
- F. Demonstration shall be recorded on USB Flash drive and turned over to the Owner. Video recording shall be done in a professional manner with quality video (1080p resolution) and clear audible sound.

1.24 OPERATING AND MAINTENANCE MANUALS

- A. Prepare operating and maintenance manuals in accordance with the requirements of Division 01 and as follows. The Contractor shall prepare up to six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information and designation partitions with identification tabs. Mark appropriate identification on front and spine of each binder.
- B. Manual shall include the following:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing and operating instructions including lubrication charts and schedules.
 - 5. Emergency and safety instructions.
 - 6. Spare parts list.
 - 7. Copies of warranties.
 - 8. Wiring diagrams.

9. Recommended "turn around" cycles.
 10. Inspection procedures.
 11. Approved Shop Drawings and Product Data.
 12. Equipment Start-up Reports.
 13. Balance reports.
- C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, bearing number, etc. Schedule shall include maintenance to be done and frequency.
- D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.

1.25 ACCEPTANCES

- A. The equipment, materials, quality, design and arrangement of all work installed under the Plumbing Sections shall be subject to the review of the Engineer.
- B. Within 30 days after the awarding of a Contract, the Plumbing Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Plumbing Sections. The intent to use the exact manufacturers and models specified does not relieve the Contractor of the responsibility of submitting such a list.
- C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of award of the Contract. In such instances, equipment substitutions may be made pending acceptance by the Engineer or the Owner's representative.
- D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Plumbing Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.
- E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.
- F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings

and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.26 RECORD DRAWINGS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.
- B. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Items to be indicated include but are not limited to:
 - 1. Dimensional change
 - 2. Revision to drawing detail
 - 3. Location and depth of underground utility
 - 4. Revision to pipe routing
 - 5. Revision to electrical circuitry
 - 6. Actual equipment location
 - 7. Pipe size and routing
 - 8. Location of concealed internal utility
 - 9. Changes made by Change Order
 - 10. Details not on original Contract Drawing
 - 11. Information on concealed elements which would be difficult to identify or measure later
- C. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
- D. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
- E. Note related Change Order numbers where applicable.
- F. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

- G. Final record documents shall be prepared in the latest electronic version and on USB Flash drive of all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.27 WARRANTIES AND BONDS

- A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers' standard warranties on products and special warranties are to be included:
 - 1. General close-out requirements included in Division 01.
 - 2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions-02 through -50.
 - 3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.28 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

- E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.
- H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.
- I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.
 - 1. Refer to individual Sections of Divisions-02 through -50 for specific content requirements, and particular requirements for submittal of special warranties.
- J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
 - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
 - 2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.
 - 3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.29 GUARANTEES

- A. The Contractor shall guarantee all material and installation quality under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner. During this guarantee period, all defects developing through faulty equipment, materials or installation quality shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineer's satisfaction.
- B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided.

1.30 PROJECT CLOSE-OUT

- A. Submit specific warranties, quality bonds, maintenance agreements, final certifications and similar documents in accordance with Division 01.
- B. Deliver tools, spare parts, extra stock, and similar items.
- C. Complete start-up testing of systems, including measuring and documenting all required startup checklist requirements documented in installation and maintenance instructions by the equipment manufacturer, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
- D. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- E. Field Observation Procedures: On receipt of a request for an Engineers Field Observation, the Engineer will advise the Contractor of unfulfilled requirements. The Engineer will advise the Contractor of construction that must be completed or corrected before the certificate will be issued. Contractor shall submit written response to each corrective item including specific photos prior to final Engineering inspection.
 - 1. The Engineer will repeat the Field Observation when requested and assured that the Work has been substantially completed.
 - 2. Results of the completed list of unfulfilled items will form the basis of requirements for final acceptance.

END OF SECTION 22 0400

Electronic Drawing File Release Form

DELIVERY OF ELECTRONIC FILES FOR: _____
Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys' fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____ Client's Signature	_____ Date
_____ Company - Title	
_____ Architects' Signature	_____ Date
_____ Firm - Title	
_____ Owner's Signature	_____ Date
_____ Company - Title	

**NEW YORK PRESBYTERIAN
 IONA SCHOOL OF HEALTH SCIENCES
 IONA COLLEGE
 BRONXVILLE, NY**

**S/L/A/M – 20287.10
 GENERAL CONDITIONS FOR
 PLUMBING TRADES
 22 0400 - 25 of 25**

SECTION 22 0500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Certification of seismic restraint designs and installation supervision.
2. Certification of seismic attachment of housekeeping pads.
3. Seismic restraint products
 - a. Vibration isolation elements.
 - b. Equipment isolation bases.
 - c. Piping flexible connections.
 - d. Seismic restraints for isolated and non-isolated mechanical and electrical items.
4. Inertia bases.

B. Identification for Piping and Equipment:

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

1.2 INTENT

- A. All plumbing equipment and piping as noted on the equipment schedule or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
- B. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.

- C. It is the intent of the seismic portion of this specification to keep all mechanical and electrical building system components in place during a seismic event.
- D. All such systems must be installed in strict accordance with seismic codes, component manufacturer's recommendations and building construction standards. Whenever a conflict occurs between the manufacturer's recommendations or construction standards, the most stringent shall apply.
- E. This specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements (i.e. California Title 24, California OSHPD, Canadian Building Codes, or other requirements).
- F. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

- A. American Society of Mechanical Engineers:
 - 1. ASME B31.1 - Power Piping.
 - 2. ASME B31.9 - Building Services Piping.
- B. ASTM International:
 - 1. ASTM E84-18b - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction Materials.
 - 3. ASTM E814-13a - Standard Test Method for Fire Tests of Penetration Fire Stop Systems.
 - 4. ASTM F708-92 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
 - 5. ASTM E1966-15 - Standard Test Method for Fire-Resistive Joint Systems.
- C. American Welding Society:
 - 1. AWS D1.1 - Structural Welding Code - Steel.
- D. FM Global:
 - 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- E. Underwriters Laboratories Inc.:

1. UL 263 - Standard for Fire Test of Building Construction and Materials
2. UL 723 – Standard for Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 – Standard for Fire Tests of Penetration Firestops.
4. UL 2079 – Standard Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

1.4 RELATED WORK

A. Housekeeping Pads

1. Housekeeping pad reinforcement and monolithic pad attachment to the structure details and design shall be prepared by the restraint vendor if not already indicated on the drawings.
2. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.

B. Supplementary Support Steel

1. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment, as required or specified.

C. Attachments

1. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

1.5 SEISMIC FORCE LEVELS

- ##### A.
- Installations shall be designed to safely accept external forces determined in accordance with the International Building Code –2003, Section 1621 in any direction for all rigidly supported equipment without failure and permanent displacement of the equipment. Seismic restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise.

1.6 PERFORMANCE REQUIREMENTS

- ##### A.
- Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping.
- ##### B.
- Provide minimum static deflection of isolators for equipment as follows:
1. Basement, Under 20 hp

- a. Under 400 rpm: 1 inch
 - b. 400 - 600 rpm: 1 inch
 - c. 600 - 800 rpm: 0.5 inch
 - d. 800 - 900 rpm: 0.2 inch
 - e. 1100 - 1500 rpm: 0.14 inch
 - f. Over 1500 rpm: 0.1 inch
2. Basement, Over 20 hp
- a. Under 400 rpm: 2 inch
 - b. 400 - 600 rpm: 2 inch
 - c. 600 - 800 rpm: 1 inch
 - d. 800 - 900 rpm: 0.5 inch
 - e. 1100 - 1500 rpm: 0.2 inch
 - f. Over 1500 rpm: 0.15 inch
- C. Use concrete inertia bases for motors in excess of 40 hp and on base mounted pumps over 10 hp.

1.7 DEFINITIONS

A. Life Safety Systems:

- 1. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flow paths to fire protection and/or emergency lighting systems.
- 2. All medical and life support systems.
- 3. Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.

B. Positive Attachment:

- 1. A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, or any other equipment are not acceptable on this project as seismic anchor points.

- C. Transverse Bracing:
 - 1. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.
- D. Longitudinal Bracing:
 - 1. Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.
- E. Failure
 - 1. For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8" (3mm) and/or horizontal permanent deformation greater than 1/4" (6mm).

1.8 SUBMITTALS

- A. See Division 01 – Requirements for Submittals.
- B. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Shop Drawings (Identification): Submit list of wording, symbols, letter size, and color coding for identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Manufacturer's Installation Instructions: Submit special procedures.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Welders' Certificate: Include welders' certification of compliance with ASME Section IX or AWS D1.1.
- G. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.
- H. Product Data:
 - 1. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.
- I. Shop Drawings:
 - 1. Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
 - 2. Provide Drawings showing methods of suspension and support guides for conduit, piping and ceiling hung equipment.

3. Record actual locations and installation of vibration isolators and seismic restraints including attachment points.
 4. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.
 5. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
 6. Drawings showing methods for isolation of conduits and pipes penetrating walls and floor slabs.
 7. Specific details of restraints including anchor bolts for mounting and maximum loading at each location, for each piece of equipment and/or pipe locations.
- J. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.
- K. Seismic Certification and Analysis:
1. Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.
 2. All restraining devices shall have a preapproval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Preapprovals based on independent testing are preferred to preapprovals based on calculations. Where preapproved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 45 degrees to the weakest mode.
 3. Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in section 1.06 acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.
- L. Design Data: Submit calculations indicating maximum room sound levels are not exceeded. Use sound power levels of actual equipment to be installed on project. Analysis shall include breakout noise calculations. In the absence of specified background sound level criteria, the guidelines as express in Table 34 of Chapter 47,

“Sound and Vibration Control” of the 2003 ASHRAE Handbook – HVAC Applications, shall be used.

- M. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.
- N. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.
- O. Manufacturer's Field Reports: Indicate sound isolation installation is complete and in accordance with instructions.
- P. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.9 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.
- B. Perform vibration and seismic control Work in accordance with ARI 575, ANSI S12.36.

1.10 QUALIFICATIONS

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

1.11 PRE-INSTALLATION MEETINGS

- A. See Division 01 - General Requirements.
- B. Convene minimum one week prior to commencing work of this section.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. See Division 01 - General Requirements.
- B. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.
- C. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

1.13 WARRANTY

- A. See Division 01 - General Requirements.

1.14 VIBRATION AND SEISMIC CONTROL - CONTRACTORS RESPONSIBILITIES

- A. Verify field measurements prior to fabrication.
- B. Contractor shall have the following responsibilities:
 - 1. Determine vibration isolation and seismic restraint sizes and locations per specifications.
 - 2. Provide and install isolation systems and seismic restraints as scheduled or specified.
 - 3. Guarantee specified isolation system deflection.
 - 4. Provide installation instructions, drawings and field supervision to assure proper installation and performance.
 - 5. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.
 - 6. Substitution of "Internally Isolated" plumbing equipment in lieu of the specified isolation of this section is acceptable

1.15 CLOSEOUT SUBMITTALS

- A. See Division 01 - General Requirements.
- B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, guides, tagged valves; include valve tag numbers.
- C. Operation and Maintenance Data (Expansion): Submit adjustment instructions.

PART 2 PRODUCTS

2.1 CONCRETE HOUSEKEEPING PAD

- A. Refer to Division 03 - Concrete

2.2 INERTIA BASES

- A. Manufacturers:
 - 1. Mason
 - 2. Vibration Eliminator
 - 3. Vibro-Acoustics Ltd.
 - 4. Substitutions: Division 01 – General Requirements
- B. Structural Bases:
 - 1. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.

2. Construction: Welded structural steel with gusset brackets, supporting equipment and motor with motor slide rails.
- C. Concrete Inertia Bases:
 1. Mass: Minimum of 1.5 times weight of isolated equipment.
 2. Construction: Structured steel channel perimeter frame, with gusset brackets and anchor bolts, adequately reinforced, concrete filled.
 3. Connecting Point: Reinforced to connect isolators and snubbers to base.
 4. Concrete: Reinforced 3,000 psi concrete.

2.3 VIBRATION ISOLATORS

- A. Manufacturers:
 1. Mason
 2. Vibration Eliminator
 3. Amber Booth
 4. Substitutions: Division 01 – General Requirements
- B. Open Spring Isolators:
 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
- C. Restrained Spring Isolators:
 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

- b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
 - 5. Restraint: Furnish mounting frame and limit stops.
- D. Closed Spring Isolators:
- 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 - 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.
- E. Restrained Closed Spring Isolators:
- 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 - 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.
- F. Spring Hanger:

1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
 4. Misalignment: Capable of 20 degree hanger rod misalignment.
- G. Neoprene Pad Isolators:
1. Rubber or neoprene-waffle pads.
 - a. 30 durometer.
 - b. Minimum 1/2 inch thick.
 - c. Maximum loading 40 psi.
 - d. Height of ribs: not to exceed 0.7 times width.
 2. Configuration: Single layer.
- H. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.
- I. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.
- J. Seismic Snubbers:
1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
 2. Neoprene Elements: Replaceable, minimum of 0.75 inch thick.
 3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
 4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

2.4 IDENTIFICATION FOR PIPING AND EQUIPMENT

A. Manufacturers:

1. Craftmark Identification Systems

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**S/L/A/M – 20287.10
COMMON WORK RESULTS FOR PLUMBING
22 0500 - 11 of 20**

2. Safety Sign Co.
 3. Seton Identification Products
 4. Substitutions: Division 01 – General Requirements and 22 04 00 – General Requirements.
- B. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light background color.
- C. Plastic Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches diameter.
- D. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Color and Lettering: Conform to ASME A13.1.
- E. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Color and Lettering: Conform to ASME A13.1.
- F. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 NAMEPLATES

- A. Manufacturers:
1. Craftmark Identification Systems
 2. Safety Sign Co.
 3. Seton Identification Products
 4. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.
- B. Product Description: Laminated three-layer plastic with engraved letters.
1. Letter Color: White.
 2. Letter Height: 1/4 inch
 3. Background Color: Black.
 4. Plastic: Conform to ASTM D709.

2.6 TAGS

- A. Plastic Tags:
1. Manufacturers:

- a. Craftmark Identification Systems
 - b. Safety Sign Co.
 - c. Seton Identification Products
 - d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.
 - 2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.
- B. Metal Tags:
- 1. Manufacturers:
 - a. Craftmark Identification Systems
 - b. Safety Sign Co.
 - c. Seton Identification Products
 - d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.
 - 2. Aluminum with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.
- C. Information Tags:
- 1. Manufacturers:
 - a. Craftmark Identification Systems
 - b. Safety Sign Co.
 - c. Seton Identification Products
 - d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.
 - 2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.
- D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.7 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers:

- a. Craftmark Identification Systems
- b. Safety Sign Co.
- c. Seton Identification Products
- d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers:

1. Manufacturers:

- a. Craftmark Identification Systems
- b. Safety Sign Co.
- c. Seton Identification Products
- d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Underground Pipe Markers:

1. Manufacturers:

- a. Seton
- b. Northtown
- c. Kolbi
- d. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

2. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with color code as follows:

- a. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
- b. Fire Quenching Fluids: Red with white letters.
- c. Toxic and Corrosive Fluids: Orange with black letters.
- d. Flammable Fluids: Yellow with black letters.
- e. Combustible Fluids: Brown with white letters.
- f. Compressed Air: Blue with white letters.

2.8 CEILING TACKS

A. Manufacturers:

- 1. Seton
- 2. Northtown
- 3. Kolbi
- 4. Substitutions: Division 01 - Product Requirements and 22 04 00 – General Requirements.

B. Description: Steel with 3/4 inch diameter color-coded head.

C. Color code as follows:

- 1. Plumbing valves: Green.

2.9 LABELS

A. Manufacturers:

- 1. Seton
- 2. Northtown
- 3. Kolbi
- 4. Substitutions: Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Description: Polyester for above grade and Laminated Mylar for below grade, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 EXECUTION

3.1 INSTALLATION – VIBRATION AND SEISMIC CONTROL

- A. Install isolation for motor driven equipment.
- B. Bases:
 - 1. Set steel bases for 1 inch clearance between housekeeping pad and base.
 - 2. Set concrete inertia bases for 2 inch clearance between housekeeping pad and base.
- C. Adjust equipment level.
- D. Install spring hangers without binding.
- E. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- F. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- G. Provide pairs of horizontal limit springs on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans.
- H. Provide resiliently mounted equipment and piping with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05 inch maximum clearance. Provide other snubbers with clearance between 0.15 inch and 0.25 inch.
- I. Support piping connections to isolated equipment resiliently as follows:
 - 1. Up to 4 inch Diameter: First three points of support.
 - 2. 5 to 8 inch Diameter: First four points of support.
 - 3. 10 inch Diameter and Over: First six points of support.
 - 4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.2 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

- A. Install plastic nameplates with adhesive.
- B. Install plastic tags with corrosion resistant metal chain.

3.3 INSTALLATION - IDENTIFICATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- D. Install tags using corrosion resistant chain. Number tags consecutively by location.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 10 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- J. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.4 SCHEDULES

Pipe Size Inch	Isolated Distance from Equipment
1	120 diameters
2	90 diameters
3	80 diameters
4	75 diameters
6	60 diameters
8	60 diameters

3.5 VIBRATION ISOLATION AND SEIMIC RESTRAINT INSTALLATION

- A. Horizontal pipe isolation: The first three pipe hangers in the main lines near the mechanical equipment shall be as described in specification 11. Specification 11 hangers must also be used in all transverse braced isolated locations. Brace hanger rods with SRC clamps specification 14. Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in specification 10. Floor supported piping shall

rest on isolators as described in specification 6. Heat exchanger's and expansion tanks are considered part of the piping run. The first three isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" deflection for pipe sizes up to and including 3", 1 1/2" deflection for pipe sizes up to and including 6", and 2 1/2" deflection thereafter. Hangers shall be located as close to the overhead structure as practical. Where piping connects to mechanical equipment install specification 23 expansion joints or specification 24 stainless hoses if 23 is not suitable for the service.

- B. Riser isolation: Risers shall be suspended from specification 10 hangers or supported by specification 5 mountings, anchored with specification 25 anchors, and guided with specification 26 sliding guides. Steel springs shall be a minimum of 0.75" except in those expansion locations where additional deflection is required to limit load changes to \pm 25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.
- C. Seismic Restraint of Piping
 - 1. Seismically restrain all piping listed as a, b or c below. Use specification 12 cables if isolated. Specification 12 or 13 restraints may be used on unisolated piping.
 - a. Fuel oil piping, gas piping, medical gas piping, and compressed air piping that is 1" I.D. or larger.
 - b. Piping located in boiler rooms, mechanical equipment rooms, and refrigeration equipment rooms that is 1 1/4" I.D. and larger.
 - c. All other piping 2 1/2" diameter and larger.
 - 2. Transverse piping restraints shall be at 40' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
 - 3. Longitudinal restraints shall be at 80' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
 - 4. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
 - 5. For fuel oil and all gas piping transverse restraints must be at 20' maximum and longitudinal restraints at 40' maximum spacing.
 - 6. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" of the elbow or TEE or combined stresses are within allowable limits at longer distances.
 - 7. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.

8. Branch lines may not be used to restrain main lines.
9. Cast iron pipe of all types, glass pipe and any other pipes joined with a four band shield and clamp assembly in Zones 2B, 3 and 4 shall be braced as in sections 3.2.D.2 and 3. For Zones 0, 1 and 2A, 2 band clamps may be used with reduced spacings of 1/2 of those listed in sections 3.2.D.2 and 3.

D. Vibration Isolation and Seismic Restraint of Plumbing Equipment

1. All equipment shall be vibration isolated and seismically restrained as per the schedules in part 3.5 of this specification.
2. Equipment mounted on housekeeping pads: Pads shall be properly doweled or expansion shielded to deck to meet acceleration criteria.
3. Requirements for installation on concrete inertia bases shall be as follows:
 - a. Minimum operating clearance between concrete inertia and base and housekeeping pad or floor shall be 2".
 - b. The equipment structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine or isolators.
 - c. The isolators shall be installed without raising the machine and frame assembly.
 - d. After the entire installation is complete and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
 - e. Install equipment with flexibility in wiring connection.
 - f. Verify that all installed isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4".
 - g. Prior to start-up, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base, isolators, or seismic restraints.

3.6 SEISMIC RESTRAINT EXCLUSIONS

- A. General: All mechanical and electrical components and systems that are considered exempt from the requirement for seismic restraint, in accordance with The International Building Code – 2003, Section.1621 and all related State of Connecticut Supplements, shall not require seismic restraint.
- B. Piping
 1. Piping in boiler and mechanical rooms less than 1 1/4" inside diameter.
 2. All other piping less than 2 1/2" inside diameter.
 3. All piping suspended by individual hangers 12" or less as measured from the top of the pipe to the bottom of the support where the hanger is attached. However, if

the 12" limit is exceeded by any hanger in the run, seismic bracing is required for the run.

4. The 12" exemption applies for trapeze supported systems if the top of each item supported by the trapeze qualifies.

3.7 FIELD QUALITY CONTROL

- A. Division 01 - General Requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.15.

3.8 PROTECTION OF FINISHED WORK

- A. Division 01 - General Requirements.
- B. Protect adjacent surfaces from damage by material installation.

3.9 INSPECTION

- A. Examine systems under provisions of Division 01.
- B. On completion of installation of all vibration isolation devices herein specified, the local representative shall inspect the completed system and report in writing any installation error, improperly elected isolation devices, or other faults in the system that could affect the performance of the system. Contractor shall submit a report to the Owner, including the manufacturers representatives' final report, indicating all isolation reported as properly installed or requiring correction, and include a report by the Contractor on steps taken to properly complete the isolation work.

END OF SECTION 22 0500

SECTION 22 0516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Design of expansion system and anchors
 - 2. Flexible pipe connectors.
 - 3. Expansion joints.
 - 4. Expansion compensators.
 - 5. Pipe alignment guides.
 - 6. Swivel joints.
 - 7. Pipe anchors.
- B. Related Sections:
 - 1. Division 22 – Plumbing.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B31.9 - Building Services Piping.
 - 2. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- B. American Welding Society:
 - 1. AWS D1.1 - Structural Welding Code - Steel.

1.3 DESIGN REQUIREMENTS

- A. Provide design, details, work and equipment required for expansion and contraction of hot water and hot water return piping systems. Verify anchors, guides, and expansion joints provide and adequately protect system.
- B. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.
- C. Expansion Compensation Design Criteria:
 - 1. Installation Temperature: 50 degrees F.
 - 2. Domestic Hot Water: 140 degrees F.
 - 3. Domestic Hot Water Recirculation: 110 degrees F.
 - 4. Safety Factor: 30 percent.

1.4 SUBMITTALS

- A. See Division 01 – General Requirements: Requirements for submittals.
- B. Pipe Expansion Analysis, Design and Certification:

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**S/L/A/M – 20287.10
EXPANSION FITTINGS AND
LOOPS FOR PLUMBING PIPING
22 0516 - 1 of 8**

1. Provide pipe expansion and anchoring calculations for all domestic hot water and domestic hot water recirculation piping systems including connections to equipment, fixtures, appliances, and to the structure. Piping layouts and associated calculations must be stamped by a registered professional engineer with at least five years of pipe expansion experience, licensed in the state of the job location.
 2. Analysis must indicate calculated dead loads, active expansion loads and capacity of materials utilized for connections to equipment, fixtures, appliances, and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All expansion and anchoring devices shall be designed to accept the forces as calculated.
- C. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints.
- D. Product Data:
1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- E. Manufacturer's Installation Instructions: Submit special procedures.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- G. Welders' Certificate: Include welders' certification of compliance with ASME Section IX or AWS D1.1 as applicable
- H. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.
- 1.5 CLOSEOUT SUBMITTALS
- A. See Division 01 – General Requirements: Closeout procedures.
 - B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.
 - C. Operation and Maintenance Data: Submit adjustment instructions.
- 1.6 QUALITY ASSURANCE
- A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
 - B. All pre-manufactured expansion fittings and loops installed on the domestic water system shall meet the requirements of SDWA 1417.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.
- B. Installer: Company specializing in performing work of this section with minimum three years of experience.
- C. Design expansion compensating system under direct supervision of professional engineer experienced in design of this work and licensed at project location.

1.8 PRE-INSTALLATION MEETINGS

- A. See Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. See Division 01 – General Requirements: Product storage and handling requirements.
- B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.
- C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

- A. See Division 01 – General Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

- A. See Division 01 – General Requirements: Spare parts and maintenance products.
- B. Supply two 12 ounce containers of packing lubricant and cartridge style grease gun.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL

- A. Manufacturers:
 - 1. Metraflex Company – SLPC
 - 2. Mason Industries Inc. / Mercer Rubber Company; - FFLSS Series
 - 3. Flexicraft FF Series
 - 4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

- B. Inner Hose: 304 Stainless Steel
- C. Exterior Sleeve: Single braided, type 304 stainless steel
- D. Pressure Rating: 125 psi minimum working pressure at 70 degrees F.
- E. Fittings Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings shall not be attached to stainless steel hose.
- F. Size: Use pipe sized units.
- G. Maximum offset: 3/4 inch on each side of installed center line.

2.2 FLEXIBLE PIPE CONNECTORS - COPPER

- A. Manufacturers:
 - 1. Metraflex Company Series BBSC
 - 2. Mason Industries Inc. Series CPSB
 - 3. Flexicraft Series SS
 - 4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.
- B. Inner Hose: Bronze.
- C. Exterior Sleeve: Braided bronze.
- D. Pressure Rating: 125 psi minimum working pressure at 70 degrees F.
- E. Fittings Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings shall not be attached to stainless steel hose.
- F. Maximum offset: 1/2 inch on each side of installed center line.
- G. NSF 61 and NSF 372 certified for use with potable water

2.3 EXPANSION JOINTS - STEEL WITH PACKED SLIDING SLEEVE (AXIAL MOVEMENT)

- A. Manufacturers:
 - 1. Hyspan Precision Products – Series 8500
 - 2. Mason Industries / Mercer Rubber Company Type ECGWN
 - 3. ATS (Advanced Thermal Systems, Inc.) - Thermal Pak Series
 - 4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.
- B. Working Pressure and Temperature: Class 150.
- C. Joint: Sweat or equivalent connection as specified for pipe joints.

- D. Size: Use pipe sized units.
- E. Application: Steel piping 2 inches and over.

2.4 EXPANSION JOINTS - COPPER WITH PACKED SLIDING SLEEVE (AXIAL MOVEMENT)

- A. Manufacturers:
 - 1. Hyspan Precision Products – Series 8500
 - 2. Mason Industries / Mercer Rubber Company Type ECGWN
 - 3. Flexicraft Compensator Series
 - 4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.
- B. Working Pressure: 125 psi.
- C. Maximum Temperature: 250 degrees F.
- D. Joint: Flanged.
- E. Size: Use pipe sized units.
- F. Application: Copper or steel piping 2 inches and over.

2.5 EXPANSION LOOPS - HOSE AND BRAID

- A. Manufacturers:
 - 1. Metraflex Company: Metraloop
 - 2. Mason Industries / Mercer Rubber Company: FFL Series or CPSB Series
 - 3. Flexicraft: SS Connector Series
 - 4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.
- B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.
- C. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.
- D. Flexible Connectors: Flanged or as specified in 22 0503 Pipe and Tubes for Plumbing and Equipment, braided type with wetted components of stainless steel, sized to match piping.
 - 1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
 - 2. Accommodate the Following:
 - a. Axial Deflection in Compression and Expansion: To be determined by the Professional Engineer providing calculations.
 - b. Lateral Movement: To be determined by the Professional Engineer providing calculations.
 - c. Angular Rotation: 15 degrees.

- d. Force developed by 1.5 times specified maximum allowable operating pressure.
- 3. End Connections: Same as specified for pipe jointing.
- 4. Provide necessary accessories including, but not limited to, swivel joints.

2.6 EXPANSION JOINTS - EXTERNALLY PRESSURIZED EXPANSION JOINTS

- A. Manufacturers:
 - 1. Metraflex Company: Metragator
 - 2. Mason Industries / Mercer Rubber Company: HEJFFL Series
 - 3. Flexicraft: EP Series
 - 4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.
- B. Construction: Stainless steel with anti-torque device, limit stops, internal guides.
- C. Maximum Allowable Working Pressure: 150 psig at 700 degrees F.
- D. Maximum Axial Compression: 4 inches.
- E. End Connections: Flanged or weld end.
- F. Size: Use pipe sized units.
- G. Application: Steel piping 2 inches and over.

2.7 EXPANSION ACCESSORIES

- A. Manufacturers:
 - 1. Metraflex
 - 2. Mason Industries / Mercer Rubber Company
 - 3. Vibration Eliminator
 - 4. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.
- B. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for insulation, minimum 3 inch travel.
- C. Swivel Joints: Bronze, double ball bearing race, field lubricated, with Buna-N o-ring seals.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

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**S/L/A/M – 20287.10
EXPANSION FITTINGS AND
LOOPS FOR PLUMBING PIPING
22 0516 - 6 of 8**

- B. Install Work in accordance with ASME B31.9
- C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Refer to Section 22 05 00. Provide line size flexible connectors.
- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.
- F. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 22 05 00 for pipe hanger installation requirements.
- G. Provide grooved piping systems with minimum three flexible couplings per flexible connector supported by vibration isolation.
- H. Provide expansion loops as indicated on Drawings.

3.2 MANUFACTURER'S FIELD SERVICES

- A. See Division 01 – General Requirements: Manufacturers' field services.
- B. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

PIPING SYSTEM	PIPING MATERIAL	PIPE SIZE	CONDITION REQUIRING EXPANSION JOINT OR EXPANSION LOOP (ALL CONDITIONS ASSUME "OFFSET LEG" AT END OF RUNS ARE MINIMUM 12'0" LONG)
Domestic hot water supply and recirculation piping (all temperatures)	Copper	Up to 3 inches	All straight sections of piping over 90' long. All straight sections of piping where "offset leg" is less than 12'0"
Domestic hot water supply and recirculation piping (all temperatures)	Steel	Up to 2 inches	All straight sections of piping over 140' long.

Domestic hot water supply and recirculation piping (all temperatures)	Steel	2" to 4"	All straight sections of piping over 90' long
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END OF SECTION 22 0516

SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gate valves.
 - 2. Ball valves.
 - 3. Butterfly valves.
 - 4. Check valves.
 - 5. Pressure relief.
 - 6. Strainers.
 - 7. Balancing valves.
 - 8. Reduced pressure backflow preventers.
 - 9. Thermostatic mixing valves.
 - 10. Plug valves.
 - 11. Gas pressure regulators.
- B. Related Sections:
 - 1. Division 01 – General Requirements.
 - 2. Division 22 – Plumbing.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 2. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.
- B. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP 67 - Butterfly Valves.
 - 2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
 - 3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - 4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
 - 5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
 - 6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- C. Safe Drinking Water Act:
 - 1. SDWA 1417 - Reduction of Lead in Drinking Water.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.

- B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.
- C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - General Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of valves
- C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

- A. For drinking water service, provide valves complying with NSF 61.
- B. All valves installed on the domestic water distribution system shall comply with SDWA 1417. Exception shall be main shut-off valve at domestic water service entrance that is 2-inches or larger.
- C. All valve manufacturers shall demonstrate that valve products have been certified per NSF/ANSI Standard 372.
- D. All valves installed on the domestic water system shall have labeling of lead content engraved on the valve body.
- E. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by Victaulic or an Engineer Approved Equal

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing work of this section with minimum 3 years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

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**S/L/A/M – 20287.10
GENERAL-DUTY VALVES FOR
PLUMBING PIPING
22 0523 - 2 of 8**

- C. Provide temporary protective coating on cast iron and steel valves.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Environmental conditions affecting products on site.
- B. Do not install valves underground when bedding is wet or frozen.

1.9 WARRANTY

- A. Division 01 – General Requirements: Requirements for warranties.
- B. Furnish five year manufacturer warranty for valves excluding packing.

1.10 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.
- B. Furnish two packing kits for each size valve.

PART 2 PRODUCTS

2.1 GATE VALVES

- A. Manufacturers:
 - 1. Apollo
 - 2. Milwaukee Valve Co.
 - 3. NIBCO, Inc.
 - 4. American Valve Co.
 - 5. Watts
 - 6. Division 01 – General Requirements
- B. 2 inches and Smaller: MSS SP 80, Class 300, bronze body, bronze trim, lead free, threaded bonnet, non-rising stem, hand-wheel, inside screw, solid wedge disc, solder ends, Milwaukee Valve Company Model # UP115.
- C. 2 1/2 inches and Larger: MSS SP 70, Class 175, cast iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends, Milwaukee Valve Company F-2885-FP. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.2 BALL VALVES

- A. Manufacturers:
 - 1. Apollo
 - 2. Milwaukee Valve Co.

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S/L/A/M – 20287.10
GENERAL-DUTY VALVES FOR
PLUMBING PIPING
22 0523 - 3 of 8

3. NIBCO, Inc.
 4. American Valve Co.
 5. Watts
 6. Division 01 – General Requirements
- B. 2 inches and Smaller: MSS SP 110, 600 psi WOG, two piece bronze body, lead free, type 316 stainless steel ball, full port, teflon seats, stainless steel blow-out proof stem, solder ends with lever handle, Milwaukee Valve Company Model #UPBA450S.
- C. 2 inches and Smaller: MSS SP 110, Class 600, bronze, three piece body, lead free, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder ends, lever handle, Milwaukee Valve Company Model #UPBA350S.
- D. 2 inches and Smaller: MSS SP 110, Class 250, bronze, two piece body, lead free, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, press ends, lever handle, Nibco Model # PC585-66-LF.

2.3 BUTTERFLY VALVES

- A. Manufacturers:
1. Victaulic
 2. Milwaukee Valve Company
 3. NIBCO, Inc.
 4. American Valve Co.
 5. Watts
 6. Division 01 – General Requirements
- B. 2-inches and Larger: MSS SP 67, Class 200.
1. Body: Cast bronze, lug ends, stainless steel stem, extended neck.
 2. Disc: Aluminum bronze.
 3. Seat: Resilient replaceable EPDM or Fluoroelastomer.
 4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.
 5. Milwaukee Valve Company Model # ML 233E.
- C. 2-inches and Larger: MSS SP 67, Class 200.
1. Body: Ductile iron, lug ends, stainless steel stem, extended neck.
 2. Disc: Aluminum bronze.
 3. Seat: Resilient replaceable EPDM .
 4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.
 5. Lead free.
 6. Milwaukee Valve Company Model # ML 233E.
- D. D. 2-1/2 inches and Larger: MSS SP 67, 300 CWP.

1. Body: Cast bronze, grooved ends
2. Disc: Offset ductile iron
3. Seat: Resilient replaceable Flouroelastomer
4. Handle and Operator: 10 position lever handle. Furnish chain-wheel operators for valves mounted over 8 feet above floor
5. Victaulic Model #608N.

2.4 CHECK VALVES

A. Horizontal Swing Check Valves:

1. Manufacturers:
 - a. Apollo
 - b. Milwaukee Valve Co.
 - c. NIBCO, Inc.
 - d. American Valve Co.
 - e. Watts
 - f. Division 01 – General Requirements
2. 2 inches and Smaller: MSS SP 80, Class 300, bronze body and cap, bronze seat, brass disc, solder ends, Milwaukee Valve Co. Model # 1509.
3. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, [renewable disc seal and seat,] flanged ends.

B. Spring Loaded Check Valves:

1. Manufacturers:
 - a. Apollo
 - b. Milwaukee Valve Company
 - c. NIBCO, Inc.
 - d. American Valve Co.
 - e. Watts
 - f. Division 01 – General Requirements
2. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.
3. 2-1/2 inches and Larger: MSS SP 125, Class 125, lead free, wafer style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends, Nibco Model # F-910-LF.

2.5 TEMPERATURE AND PRESSURE RELIEF VALVES

A. Watts Model 40, 140, N240, 340:

1. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

2.6 STRAINERS

A. Watts series 77:

1. Size 2 inch and Under: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
2. Size 2-1/2 inch to 4 inch: Flanged cast iron body, Class 125 for 200 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.7 BALANCING VALVES

- A. Bell & Gossett CB Series:
1. Construction: Brass or bronze body with union on inlet, temperature and pressure test plug on inlet and outlet.
 2. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control.

2.8 BACKFLOW PREVENTERS

- A. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013, AWWA C506; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; test cocks, Watts 909 or equal.

2.9 THERMOSTATIC MIXING VALVES

- A. Manufacturers: Symmons model as scheduled on the drawings.
- B. Other acceptable manufacturers offer equivalent products:
1. Lawler
 2. Leonard
 3. Powers
 4. Watts
- C. Accessories:
1. Check valves on inlets.
 2. Volume control shut-off valve on outlet.
 3. Stem thermometer on outlet.
 4. Strainer stop checks on inlets.
- D. Temp control thermostatic controller with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid filled motor with bellows mounted out of water, rough brass finish
- E. Valve body: lead free bronze or brass.

2.10 PLUG VALVES

- A. Manufacturers:
1. DeZURIK, Unit of SPX Corp.
 2. Flow Control Equipment, Inc.
 3. Homestead Valve

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S/L/A/M – 20287.10
GENERAL-DUTY VALVES FOR
PLUMBING PIPING
22 0523 - 6 of 8

4. Milliken Valve Co.
 5. Substitutions: Division 01 – General Requirements
- B. 2 inches and Smaller: MSS SP 78, Class 300, semi-steel construction, rectangular port, full pipe area, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.
- C. 2-1/2 inches and Larger: MSS SP 78, Class 300, semi-steel construction, rectangular port, full pipe area, pressure lubricated, teflon packing, flanged ends. Furnish wrench-operated.

2.11 GAS REGULATORS

- A. Manufacturers:
1. Equimeter.
 2. DeZurik.
 3. Maxitrol.
 4. Substitutions: Division 01 – General Requirements
- B. Cast iron body (ASTM A126) spring adjustment, Buna-N soft seat, aluminum orifices, die cast aluminum alloy diaphragm case, vent valve and seal cap.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Verification of existing conditions before starting work.
- B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- D. Install valves with clearance for installation of insulation and allowing access.
- E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08 - Openings.

3.3 VALVE APPLICATIONS

- A. Install ball, butterfly, or gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- B. Install lug or grooved end butterfly valves adjacent to equipment when functioning to isolate equipment.
- C. Install flow control valves at the remote part of the domestic hot water return system. Valve size shall be minimum of 3/4-inch
- D. Provide line sized isolation valves on all domestic water branches greater than 3/4" when more than two fixtures are supplied.

END OF SECTION 22 0523

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Hanger rods.
 - 3. Inserts.
 - 4. Flashing.
 - 5. Formed steel channel.
 - 6. Equipment bases and supports.
- B. Related Sections:
 - 1. Division 03- Concrete Section 23 04 00 – General Conditions for Mechanical Trades
 - 2. Division 07 - Thermal and Moisture Protection
 - 3. Division 09- Finishes
 - 4. Division 22 – Plumbing.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B31.1 - Power Piping.
 - 2. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
 - 3. ASME B31.9 - Building Services Piping.
- B. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 3. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems
 - 4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
 - 5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- C. American Welding Society:
 - 1. AWS D1.1 - Structural Welding Code - Steel.
- D. FM Global:
 - 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Division 01 - General Requirements
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data: Submit manufacturers catalog data including load capacity.
- D. Manufacturer's Installation Instructions: Submit special procedures and assembly of components.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years of experience.
- B. Installer: Company specializing in performing Work of this section with minimum 3 years of experience.

1.6 PRE-INSTALLATION MEETINGS

- A. Division 01 - General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01- General Requirements.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Division 01 - General Requirements.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Globe Pipe Hanger Products Inc.
 - 2. Anvil International
 - 3. Empire Industries
 - 4. Hilti Inc.
 - 5. Substitutions: Division 01- General Requirements
- B. Plumbing Piping - DWV:
 - 1. Conform to ASME B31.9, ASTM F708, or MSS SP 58.
 - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
 - 3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 - 6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 - 7. Vertical Support: Steel riser clamp.
 - 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- C. Plumbing Piping - Water:
 - 1. Conform to ASME B31.9, ASTM F708, or MSS SP 58.
 - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
 - 3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 - 6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 - 7. Vertical Support: Steel riser clamp.

- 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- 9. Copper Pipe Support: Copper-plated, Carbon-steel ring.
- D. Natural Gas / LP Gas Piping:
 - 1. Conform to MSS SP 58.
 - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
 - 3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 5. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.
 - 6. Vertical Support: Steel riser clamp.
 - 7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.2 ACCESSORIES

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

2.3 INSERTS

- A. Manufacturers:
 - 1. HiltiInc.
 - 2. Anvil International
 - 3. Eaton
 - 4. 3M
 - 5. Substitutions: Refer to Division 01 – General Requirements.
- B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

- A. Refer to Division 07 - Thermal and Moisture Protection

2.5 SLEEVES

- A. Manufacturers:
 - 1. Flexicraft Industries; Pipe Wall Sleeve
 - 2. Metraflex; Pipe Wall Sleeve
 - 3. CCI Pipeline; Pipe Wall Sleeve
 - 4. GPT – Centuryline Sleeve Series
 - 5. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.
- B. Vertical Piping:

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S/L/A/M – 20287.10
 HANGERS AND SUPPORTS FOR
 PLUMBING PIPING AND EQUIPMENT
 22 0529- 4 of 9

1. Sleeve Length: 1 inch above finished floor.
 2. Provide sealant for watertight joint.
 3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
 4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
- C. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- D. Pipe Passing Through Below Grade or Exterior Walls:
1. Anchored Sleeve - Zinc coated or cast iron pipe.
 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- E. Clearances:
1. Provide allowance for insulated piping.
 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
 3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814-13A in accordance with Division 07 Thermal and Moisture Protection to prevent the spread of fire, smoke, and gases.
- F. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.
- G. Sleeves for Pipes through Non-fire Rated Walls, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- H. Sealant: refer to Division 07 Thermal and Moisture Protection.

2.6 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
1. Thunderline Link-Seal, Inc.
 2. NMP Corporation
 3. Fernco
 4. BWM
 5. Substitutions: Refer to Division 01 – General Requirements.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
- C. Provide NSF 61 certified assembly when used in potable water storage tank applications.

2.7 FORMED STEEL CHANNEL

- A. Manufacturers:

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**S/L/A/M – 20287.10
HANGERS AND SUPPORTS FOR
PLUMBING PIPING AND EQUIPMENT
22 0529- 5 of 9**

1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division
4. Unistrut Corp.
5. Substitutions: Refer to Division 01 – General Requirements

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

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - General Requirements.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install backing and damming materials to arrest liquid material leakage.
- D. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [above] [flush with top of] [recessed into and grouted flush with] slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, or MSS SP 58.
- B. Support horizontal piping as scheduled.
- C. All pipe hangers and supports shall be sized in accordance with the manufacturer's guidelines to support the piping based on final layout coordinated by the contractor.
- D. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- E. Place hangers within 12 inches of each horizontal elbow.
- F. Use hangers with 1-1/2 inch minimum vertical adjustment.
- G. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- H. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- I. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- J. Support riser piping independently of connected horizontal piping.
- K. Provide copper plated hangers and supports for copper piping.
- L. Design hangers for pipe movement without disengagement of supported pipe.
- M. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- N. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00 Provide supplemental angles, channels and formed steel supports to support piping, ductwork, equipment, etc. from building's structure. Piping, ductwork, equipment, etc. shall not be supported from the roof deck.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment. Refer to Division 01
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

- C. Construct supports of steel members, formed steel channel, or steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 21 05 48.

3.6 INSTALLATION - FLASHING

- A. Refer to Division 08 - Openings
- B. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
- C. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- D. Seal mop sink drains watertight to adjacent materials.

3.7 INSTALLATION - SLEEVES

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

3.8 FIELD QUALITY CONTROL

- A. Refer to Division 01 - Quality Requirements and Execution and Closeout Requirements.

3.9 CLEANING

- A. Refer to Division 01 - Execution and Closeout Requirements:

3.10 PROTECTION OF FINISHED WORK

- A. Refer to Division 01 Execution and Closeout Requirements

3.11 SCHEDULES

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Brass	6	1/2
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
CPVC, 1 inch and smaller	3	1/2
CPVC, 1-1/4 inches and larger	4	1/2
Copper Tube and Pipe, 1-1/4 inches and smaller	6	1/2
Copper Tube and Pipe, 1-1/2 inches and larger	10	1/2
PVC 1 1/2 inch and smaller	3	3/8
PVC 2 inch and larger	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION 22 0529

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Underground pipe warning tape
- E. Ceiling grid markers

1.2 RELATED REQUIREMENTS

- A. Division 09 - Finishes: Identification painting.
- B. Division 22 – Plumbing.

1.3 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems
- B. American Society for Testing Materials
 - 1. ASTM D709 - Standard Specification for Laminated Thermosetting Materials
- C. National Fire Protection Association
 - 1. NFPA 99 - Standard for Health Care Facilities

1.4 SUBMITTALS

- A. See Division 01 – General Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature for each product required.
- C. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- D. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.

1.5 QUALITY ASSURANCE

- A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.
- B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Identification products shall be provided by the following manufacturers:
 - 1. Craftmark Pipe Markers
 - 2. Brimar Industries, Inc.
 - 3. Kolbi Pipe Marker Co.
 - 4. Seton Identification Products
 - 5. Substitutions: See Division 01 - General Requirements.
- B. All identification products shall be by a single manufacturer

2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.
 - 4. Plastic: Conform to ASTM D709.

2.3 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.4 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.5 UNDERGROUND PIPE WARNING TAPE

- A. Detectable Underground Warning Tape: Bright colored continuously printed, 2 mil clear film laminated to ½ mil Aluminum Foil Center Core. Suitable for direct burial. Designed for detectability by non-ferrous locator. Minimum widths as follows:
 - 1. 2" width for burial depths of up to 12"
 - 2. 3" width for burial depth of 12" to 18"
 - 3. 6" width for burial depth of 18" to 24"
- B. Provide with a continuous printed message similar to "Caution Water Line Buried Below".

2.6 CEILING GRID MARKERS

- A. Description: 10 mil self-stick vinyl -7/8" diameter markers. Color coded.
- B. Color code as follows:
 - 1. Plumbing Valves: Green.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 09 – Finishes, for stencil painting.

3.2 INSTALLATION

- A. Install identifying devices after completion of testing and installation of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion.
- C. Install tags using corrosion resistant chain. Number tags consecutively by location.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install detectable underground warning tape 6 to 8 inches below finished grade, directly above buried pipe.
- G. Install piping identification on medical gas systems.

3.3 APPLICATIONS

- A. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- B. Identify control panels and major control components outside panels with plastic nameplates.
- C. Identify valves in main and branch piping with tags.
- D. Identify piping, concealed or exposed, with plastic pipe markers plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service, and flow direction.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops.
 - 4. For concealed piping identification shall be located not to exceed 10 feet.
 - 5. Locate identification adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- E. Provide ceiling grid markers to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 22 0553

SECTION 22 0700 - PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plumbing piping insulation, jackets and accessories.
 - 2. Plumbing equipment insulation, jackets and accessories.
- B. Related Sections:
 - 1. Division 01 General Requirements
 - 2. Division 07 - Firestopping
 - 3. Division 09 – Finishes
 - 4. Division 22 – Plumbing.

1.2 REFERENCES (follow the most currently adopted amended version)

- A. ASTM International:
 - 1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless
 - 2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 4. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
 - 5. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 6. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
 - 7. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - 8. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
 - 9. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 10. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - 11. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 12. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
 - 13. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
 - 14. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
 - 15. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.

16. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
17. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
18. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
19. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
20. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation.
21. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber.
22. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
23. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
24. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
25. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
26. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
27. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Underwriters Laboratories Inc.:

1. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Division 01 – General Requirements
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and installation standards will be achieved.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- B. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

- D. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping. Store all insulation materials in a clean, dry environment.

1.6 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 WARRANTY

- A. Division 01 - Execution and Closeout Requirements.

1.9 SCHEDULING

- A. Schedule insulation application after pressure and leak testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency. Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 MANUFACTURER

- A. Pre-Molded Glass Fiber (PGF):
 - 1. Johns Manville Corporation – Microlok HP Pipe Insulation
 - 2. CertainTeed Corporation - Crimpwrap
 - 3. Knauf Insulation – Earthwool
 - 4. Owens Corning Corporation; SSL II w ASJ:

5. Substitutions: Refer to Division 01 – General Requirements.
- B. Manufacturers for Closed Cell Elastomeric (CCE) Pipe Insulation Products:
 1. Armacell LLC - AP Armaflex 25/50
 2. Aeroflex USA, Inc – Aerocel –SSPT w/SaniGuard
 3. K-Flex USA LLC – Insul-tube
 4. Substitutions: See Division 01 – General Requirements.
- C. Manufacturers for PVC Jacketing (PVC):
 1. Johns Manville - Zeston
 2. P.I.C. Plastics Inc.
 3. Proto Corporation
 4. Substitutions: Division 01.
- D. Manufacturers for Aluminum Jacketing (ALM):
 1. Johns Manville
 2. ITW Insulation Systems
 3. RPR Products – Insul-Mate
 4. Substitutions: Division 01.

2.3 PIPE INSULATION

- A. Pre-Molded Glass Fiber (PGF) Pipe Insulation:
 1. ASTM C547 and ASTM C795, rigid molded, noncombustible with jacket.
 2. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
 3. Maximum Service Temperature: 850 degrees F.
 4. Maximum Moisture Absorption: 0.2 percent by volume.
 5. Vapor Barrier Jacket: Outer film layer, kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96 of 0.02 perm-inches.
 6. Vapor Barrier Lap Adhesive: Compatible with insulation.
- B. Closed Cell Elastomeric (CCE) Pipe Insulation:
 1. Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 3; use molded tubular material wherever possible.
 2. 'K' Value: ASTM C177, between 0.21 and 0.27 at mean rating temperature of 75 degrees F
 3. Minimum Service Temperature: Minus 40 degrees F
 4. Maximum Service Temperature: 220 degrees F
 5. Connection: Waterproof vapor barrier adhesive.
 6. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETS

- A. Polyvinyl-chloride Plastic Pipe Jacket (PVC):
 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.

- c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.
- 2. Covering Adhesive Mastic: Compatible with insulation.
- B. Aluminum Jacket (ALM): ASTM B209 formed aluminum sheet.
 - 1. Thickness: 0.016 inch sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch laps.
 - 4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.5 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- D. Piping 2 inches diameter and larger: hydrous calcium silicate. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.
- E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.
- F. Valve insulation Wraps: White, noncombustible, conforming to ASTM E 84. Match insulation thickness to pipe size. Valve covers shall be easily removable.

2.6 EQUIPMENT INSULATION

- A. Pre-Molded Glass Fiber (PGF) Equipment Insulation:
 - 1. ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.
 - 2. Thermal Conductivity: 0.24 at 75 degrees F
 - 3. Operating Temperature Range: 0 to 450 degrees F
 - 4. Density: 3 pound per cubic foot
- B. Closed Cell Elastomeric (CCE) Equipment Insulation:
 - 1. ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
 - 2. 'K' Value: ASTM C177, between 0.21 and 0.27 at mean rating temperature of 75 degrees F
 - 3. Operating Temperature Range: Range: Minus 70 to 220 degrees F

2.7 EQUIPMENT INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.

- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- E. Adhesives: Compatible with insulation. Refer to manufacturers' installation manual.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Protect insulation from exposure to moisture prior to and after installation. All insulation other than flexible elastomeric that becomes wet shall be replaced at no cost to the project.
- B. Verify that piping and equipment has been tested before applying insulation materials.
- C. Verify that piping and equipment surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Piping and fittings exposed to view: Provide with PVC Plastic pipe jacketing and fittings for additional protection. Locate insulation and cover seams in least visible locations.
- D. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 for penetrations of assemblies with fire resistance rating greater than one hour.
- E. Insulated pipes conveying fluids below ambient temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
- F. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

- G. Pre-molded Glass Fiber (PFG) insulated pipes conveying fluids above or below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.
- H. For hot piping conveying fluids, insulate flanges and unions at equipment.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. . Refer to Section 07 – Thermal and Moisture Protection for penetrations of assemblies with fire resistance rating greater than one hour.
- J. Buried Piping: Provide closed cell elastomeric insulation with all-purpose service jacket with self-sealing lap.
- K. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer and according to the heat trace manufacturer's installation instructions. Verify required thickness with heat trace manufacturer's installation instructions. Cover with aluminum jacket with seams located on bottom of horizontal piping.
- L. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert location: Between support shield and piping and under the finish jacket.
 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- M. Closed Cell Elastomeric (CCE) Insulation:
1. Push insulation on to piping.
 2. Miter joints at elbows.
 3. Seal seams and butt joints with manufacturer's recommended adhesive.
 4. When application requires multiple layers, apply with joints staggered.
 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- N. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - EQUIPMENT

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

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

3.4 PIPE INSULATION SCHEDULE

- A. Provide insulation materials and thicknesses scheduled for each system type and pressure/temperature range. If more than one material is listed for a system, selection from materials listed is Division 22 option.
- B. Insulation for pre-insulated piping shall meet all specified requirements.
- C. Insulation thickness shall be coordinated with heat trace manufacturers' installation instructions. Listed sizes on schedule shall be used as minimum sizes only.

Domestic Hot Water Supply and Recirculation Systems				
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-Molded Glass Fiber (PFG)	1-1/4 inches and smaller	1.0	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.
	1-1/2 inches and larger	1.5		

Closed Cell Elastomeric (CCE)	1-1/4 inches and smaller	1.0	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.
	1-1/2 inches and larger	1.5		

Domestic Cold Water Supply Systems				
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-Molded Glass Fiber (PFG)	1-1/4 inches and smaller	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.
	1-1/2 inches and larger	1.0		
Closed Cell Elastomeric (CCE)	1-1/4 inches and smaller	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.
	1-1/2 inches and larger	1.0		

Storm Systems: Horizontal Above Ground Within Building For The First 30 Feet				
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-Molded Glass Fiber (PFG)	All Sizes	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.
Closed Cell Elastomeric (CCE)	All Sizes	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms.

Sanitary and Storm PVC Systems: Vertical Above Ground Within Building				
Insulation Type	Pipe Size (inch)	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-Molded Glass	All Sizes	0.5	ASJ-SSL	Indoor: PVC for

Fiber (PFG)				exposed piping finished space and mechanical rooms. Outdoor: ALM
Closed Cell Elastomeric (CCE)	All Sizes	0.5	ASJ-SSL	Indoor: PVC for exposed piping finished space and mechanical rooms. Outdoor: ALM

Roof Drain Body			
Insulation Type	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-molded Glass Fiber (PFG)	0.5	N/A	Indoor: N/A Outdoor: N/A
Closed Cell Elastomeric (CCE)	0.5	N/A	Indoor: N/A Outdoor: N/A

Domestic Hot Water Storage Tank			
Insulation Type	Indoor - Minimum Thickness (inch)	Factory Applied Jacket	Field Applied Jacket
Pre-molded Glass Fiber (PFG)	1.5	N/A	Indoor: N/A Outdoor: ALM
Closed Cell Elastomeric (CCE)	1.5	N/A	Indoor: N/A Outdoor: ALM

Domestic Water Storage Tank			
Insulation Type	Indoor -	Factory	Field Applied Jacket

	Minimum Thickness (inch)	Applied Jacket	
Pre-molded Glass Fiber (PFG)	1.0	N/A	Indoor: N/A Outdoor: ALM
Closed Cell Elastomeric (CCE)	1.0	N/A	Indoor: N/A Outdoor: ALM

END OF SECTION 22 0700

SECTION 22 1005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Medical Air.
 - 4. Vacuum.
 - 5. Medical Air Compressor.
 - 6. Medical Vacuum Pump.
 - 7. Storm water.
 - 8. Natural gas.
 - 9. Flanges, unions, and couplings.

1.2 RELATED REQUIREMENTS

- A. Division 01 – General Requirements.
- B. Division 08 – Openings.
- C. Division 07 - Thermal and Moisture Protection
- D. Division 09 - Finishes.
- E. Division 22 – Plumbing.
- F. Division 26 – Electrical: Electrical characteristics and wiring connections.
- G. Division 31 - Earthwork
- H. Division 33 - Utilities.

1.3 REFERENCE STANDARDS – Most Currently adopted versions and amendments for the location of the project.

- A. American National Standards Institute
 - 1. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; and addenda A&B.
 - 2. ANSI Z223.1 - National Fuel Gas Code.
- B. American Society of Mechanical Engineers
 - 1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - 2. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
 - 3. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250.

4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 5. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 6. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
 7. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
 8. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
 9. ASME B31.9 - Building Services Piping.
 10. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers.
 11. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications.
- C. American Society of Sanitary Engineering
1. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.
- D. American Society for Testing and Materials
1. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.
 2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
 4. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 5. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 6. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 7. ASTM B32 - Standard Specification for Solder Metal.
 8. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
 9. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
 10. ASTM B68 - Standard Specification for Seamless Copper Tube, Bright Annealed.
 11. ASTM B75 - Standard Specification for Seamless Copper Tube.
 12. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 13. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
 14. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
 15. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
 16. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 17. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
 18. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

19. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
20. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
21. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
22. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings.
23. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
24. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
25. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
26. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
27. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
28. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
29. ASTM D2846 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
30. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
31. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
32. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
33. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
34. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
35. ASTM F441 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
36. ASTM F442 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
37. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
38. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
39. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
40. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
41. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
42. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.

43. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe;.
 44. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
 45. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.
- E. American Welding Society
1. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
 2. AWS D1.1 - Structural Welding Code - Steel;.
- F. American Water Works Association
1. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
 2. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.
 3. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 4. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
 5. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
 6. AWWA C606 - Grooved and Shouldered Joints.
 7. AWWA C651 - Disinfecting Water Mains.
 8. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Transmission and Distribution; 2016.
 9. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service.
- G. Cast Iron Soil Pipe Institute
1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
 2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
- H. International Code Council
1. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Element.
 2. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.
 3. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements.
 4. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
- I. Manufacturers Standardization Society
1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
 2. MSS SP-67 - Butterfly Valves.
 3. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.

4. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 5. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 20DA.
MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
 6. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
 7. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- J. National Sanitation Foundation
1. NSF 61 - Drinking Water System Components - Health Effects.
 2. NSF 372 - Drinking Water System Components - Lead Content.
- K. National Fire Protection Association
1. NFPA 54 – Natural Gas Code
 2. NFPA 58 – Liquefied Petroleum Gas Code.
- L. Plastic Pipe Institute
1. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe.

1.4 SUBMITTALS

- A. See Division 01- General Requirements
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Welder Certificate: Include welder's certification of compliance with ASME BPVC-IX.
- D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.
- E. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.
- F. Project Record Documents: Record actual locations of valves.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 -General Requirements.
 2. Valve Repacking Kits: One for each type and size of valve.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 10 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joint Seals: ASTM C564 neoprene gaskets.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.4 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88, Type L (A).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.
 - 3. Joints: Grooved mechanical couplings.
 - 4. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non-toxic synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Mueller Streamline Co (Mass approved manufacturer)
 - 2) Oatey Company (Mass approved manufacturer)
 - 3) Cambridge Lee Industries (Mass approved manufacturer)
 - 4) JM Eagle (Mass approved manufacturer)
 - 5) Viega LLC
 - 6) Substitutions: Division 01- General Requirements.

2.5 MEDICAL AIR PIPING, ABOVE GRADE

- A. Piping All Sizes, Below Gage Pressure of 185 psig:
 - 1. Copper Tubing: ASTM B819, Type L. Furnish piping identified with manufacturer's markings.
- B. Piping 2-1/2 inches and Smaller, Above Gage Pressure of 185 psi:
 - 1. Copper Tubing: ASTM B819, Type L. Furnish piping identified with manufacturer's markings.
- C. Fittings: ASME B16.22, wrought copper and bronze or MSS SP 73 wrought and cast copper.
- D. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting temperature range 1190 to 1480 degrees F.

2.6 VACUUM PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B819, Type L.
 - 1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
 - 3. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting temperature range 1190 to 1480 degrees F.

2.7 VACUUM PUMP EXHAUST PIPING

- A. Copper Tubing: ASTM B819, Type L.
 - 1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting temperature range 1190 to 1480 degrees F.

2.8 MEDICAL AIR COMPRESSOR

- A. Manufacturers:
 1. Beacon Medaes
 2. Allied Health Care
 3. Amico Corporation
- B. Oil Free Scroll Compressor: Simplex, tank mounted, enclosed in a steel, sound-insulated canopy. Compressor system shall include:
 1. Inlet Filter:
 - a. Paper cartridge type.
 2. Air Compressor Element:
 - a. Die cast aluminum, fixed scroll housing, orbiting scroll rotor. Cast iron crankshaft and pulley.
 3. Drive Motor:
 - a. Belt driven
 4. Control Panel:
 - a. ON/OFF switch, temp gauge, pressure gauge, hour meter. Pressure switch with automatic on/off.
 5. Starter:
 - a. Direct across the line.
 6. Integrated Dryer:
 - a. Prewired to the compressor power supply, integrated inside the canopy, controlled by primary controller. R134A refrigerant, Air-to-air heat exchanger.
 7. Receiver Tank:
 - a. Size as indicated on drawings, manual drain valve.

2.9 MEDICAL VACUUM PUMP

- A. Manufacturers:
 1. Beacon Medaes
 2. Allied Health Care
 3. Amico Corporation
- B. Lubricated Rotary Vane Pumps: Oil lubricated, direct driven, air cooled with no water requirements. Integral, fully recirculating oil supply to provide lubrication. An automotive-type, spin-on oil filter. High-discharge temp switch. Oil drain valve assembly with temp gauges. Mount pump on vibration isolators.
 1. Vacuum Pump includes:
 - a. Built -in, anti-suck-back valve mounted at the pump inlet.
 - b. Three non-metallic non-asbestos vanes, 30,000 minimum life hours each.
 - c. 5 micron inlet filter
 - d. Flexible connector and isolation valve.
 2. Vacuum Pump Motor and Lag Alarm:

- a. Motor is continuous duty, NEMA rated, C-face, foot-mounted, TEFC, 1800 RPM.
- 3. Vacuum Receiver:
 - a. ASME code stamped, rated for minimum 200 PSIG.
 - b. Full size three-valve bypass system for draining.
 - c. Manual drain.
- 4. Intake Piping:
 - a. Factory pipe intake with flexible connector
 - b. Isolation valve with 24V electric actuator and check valve.

2.10 STORM WATER PIPING, BURIED WITHIN 10 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 service weight.
 - 1. Fittings: Cast iron.
 - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.11 STORM WATER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
 - 1. Fittings: Cast iron.
 - 2. Joint Seals: ASTM C564 neoprene gaskets

2.12 NATURAL GAS / LPG GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53 Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234, wrought steel welding type.
 - 2. Joints: Threaded or welded to ASME B31.1.

2.13 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
 - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
 - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - 2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
 - 1. Dimensions and Testing: In accordance with AWWA C606.
 - 2. Housing Material: Provide ASTM A47 malleable iron, ductile iron, or galvanized.
 - 3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.

4. Gasket Material: Nitrile rubber suitable for operating temperature range from minus 20 degrees F to 180 degrees F.
 5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
 7. Manufacturers:
 - a. Grinnell Products, a Tyco Business
 - b. Bristol Metals (Mass approved manufacturer)
 - c. Viega LLC (Mass approved Manufacturer).
 - d. Victaulic Company (Mass approved manufacturer)
 - e. Substitutions: Division 01 - General Requirements.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier are required where two dissimilar metal products are connected within a system.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220700.
- G. Provide access where valves and fittings are not exposed.
 1. Coordinate size and location of access doors with Division 08 Openings.

- H. Establish elevations of buried piping outside the building to ensure not less than the local area's frost depth of cover.
- I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly and a minimum of 10 feet from an air intake; refer to Division 08 Openings.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Provide support for utility meters in accordance with requirements of utility companies.
- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
 - 1. Painting of interior plumbing systems and components are specified in Division 09 - Finishes.
 - 2. Painting of exterior plumbing systems and components are specified in Division 09 - Finishes.
- M. Excavate in accordance with Division 31- Earthwork requirements.
- N. Backfill in accordance with Division 31 – Earthwork requirements.
- O. Install bell and spigot pipe with bell end upstream.
- P. Install water piping to ASME B31.9.
- Q. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- R. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- S. Provide 1-1/4" discharge exhaust connection from medical vacuum pump to exterior.

3.4 TOLERANCES

- A. Sanitary Drainage Piping: slope to sanitary drain at minimum of 1/8 inch per foot.
- B. Pressure test natural gas piping in accordance with NFPA 54.

3.5 SYSTEM FLUSHING

- A. The following system flushing criteria shall apply to all domestic water piping systems inclusive of hot water, cold water and hot water recirculation.
- B. Upon completion of installation of piping, and prior to disinfection, flush the piping systems with clean, potable water until dirty water does not appear at the points of outlet.

- C. Remove strainers and flow restrictors from fixtures prior to flushing and reinstall after flushing is complete
- D. Mixing valves located at fixtures shall not be installed until after flushing is complete. Provide temporary bypass connections as required.
- E. Provide isolation and temporary bypass piping for water heaters, expansion tanks, and other equipment.
- F. Run fixtures simultaneously for a minimum of 30 minutes or until no debris is evident.
- G. Flushing shall be considered satisfactory when no debris is evident after running water through a number 80 mesh screen.
- H. Contractor to notify engineer and owner a minimum of 72 hours before performing flushing.
- I. Once system has been successfully flushed, contractor shall provide a report to engineer documenting flushing procedure and results.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

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

END OF SECTION 22 1005

SECTION 22 3300 – WATER HEATERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.01A, entitled “Related Documents.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. This section applies to all sections of Division 22, "Plumbing" of this project specification unless specified otherwise in the individual sections.

1.2 SUMMARY

- A. Section Includes:
 - 1. Commercial gas-fired water heaters.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for concrete housekeeping pads specified by this section.
 - 2. Division 22 – Plumbing.
 - 3. Division 23 – Mechanical.
 - 4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.3 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI Z21.10.1 - Gas Water Heaters Vol. I Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.
 - 2. ANSI Z21.10.3 - Gas Water Heaters - Vol. III Storage, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. American Society of Mechanical Engineers:
 - 1. ASME PTC 25 - Pressure Relief Devices.
 - 2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- D. National Fire Protection Association:
 - 1. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.
 - 2. NFPA 54 - National Fuel Gas Code.
- E. United States Department of Energy:

1. DOE 10 CFR - Uniform Test Method for Measuring the Energy Consumption of Furnaces.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate heat exchanger dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.
- C. Product Data:
 1. Water Heaters: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Indicate pump type, capacity and power requirements. Submit electrical characteristics and connection locations.
 2. Pumps: Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- D. Manufacturer's Installation Instructions: Submit mounting and support requirements.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.6 QUALITY ASSURANCE

- A. Conform to ASME for construction of water heaters. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.
- B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Products storage and handling requirements.
- B. Accept water heaters on site in original labeled cartons. Inspect for damage.
- C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish 10 year manufacturer warranty for domestic water heaters packaged water heating systems.

1.12 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 COMMERCIAL GAS FIRED WATER HEATERS

- A. Manufacturers:
 - 1. A. O. Smith
 - 2. PVI
 - 3. Lochinvar
 - 4. Substitutions: Section 01 60 00 – Product Requirements
- B. Type: Automatic, natural gas-fired, vertical storage.
- C. Tank: Nickel (nickel/phosphorus) coating welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches polyurethane, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
- D. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.
- E. Controls: Automatic water thermostat with adjustable temperature range from 120 to 180 degrees F Automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.

2.2 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics: In accordance with Section 26 05 03
- B. Disconnect Switch: Factory mount disconnect switch on equipment.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Maintain manufacturer's recommended clearances around and over water heaters.
- B. Install water heater on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than water heater base on each side. Refer to Section 03 30 00.
- C. Connect natural gas piping in accordance with NFPA 54.
- D. Connect natural gas piping to water heater, full size of water heater gas train inlet. Arrange piping with clearances for burner removal and service.
- E. Connect domestic hot water, domestic cold water piping to supply and return water heater connections.
- F. Install the following piping accessories. Refer to Section 22 11 00.
 - 1. On supply:
 - a. Thermometer well and thermometer.
 - b. Strainer.
 - c. Pressure gage.
 - d. Shutoff valve.
 - 2. On return:
 - a. Thermometer well and thermometer.
 - b. Pressure gage.
 - c. Shutoff valve.
- G. Install the following piping accessories on natural gas piping connections. Refer to Section 22 11 23.
 - 1. Strainer.
 - 2. Pressure gage.
 - 3. Shutoff valve.
 - 4. Pressure reducing valve.
- H. Install discharge piping from relief valves and drain valves to nearest floor drain.
- I. Install circulator and diaphragm expansion tank on water heater.
- J. Install pressure regulator vent and pipe to outside.
- K. Install condensate neutralization kit and run to nearest floor drain.
- L. Install water heater trim and accessories furnished loose for field mounting.

- M. Install electrical devices furnished loose for field mounting.
- N. Install control wiring between water heater control panel and field mounted control devices.
- O. Connect flue to water heater outlet, full size of outlet. Refer to Division 23.

END OF SECTION

SECTION 22 4000 - PLUMBING FIXTURES AND SPECIALTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the following specifications sections, which are hereby made a part of this Section of the Specifications.
1. Division 01 - General Requirements
 2. Division 07 – Thermal and Moisture Protection: Product requirements for calking between fixtures and building components for placement by this section.
 3. Division 11 – Equipment.
 4. Division 12 – Furnishings: “Plastic Laminate-Clad Countertops”
 5. Division 12 – Furnishings: “Solid Surface Countertops”
 6. Division 22 – Plumbing.
 7. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 SUMMARY

- A. Section includes the following plumbing fixtures:
1. Electric water coolers
 2. Janitors sinks.
 3. Lavatories.
 4. Bathtubs.
 5. Sinks.
 6. Water closets.
- B. Section includes the following plumbing specialties:
1. Reduced Pressure Principal Backflow Preventers.
 2. Double Check Valve Backflow Preventer Assemblies.
 3. Cleanouts.
 4. Expansion tanks.

5. Floor sinks.
6. Fixture supports.
7. Lavatory insulation kit.
8. Plumbing traps.
9. Water hammer arrestors.
10. Water Meters.
11. Stops

1.3 REFERENCES

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. American National Standards Institute:
 1. ANSI 61 - Drinking Water System Components
 2. ANSI A112.21.1 - Floor Drains.
 3. ANSI A112.26.1 - Water Hammer Arrestors.
 4. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 5. ANSI Z124.1 - Plastic Bathtub Units.
 6. ANSI Z124.2 - Plastic Shower Units.
 7. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.
 8. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- C. Air-Conditioning and Refrigeration Institute:
 1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.
- D. American Society of Mechanical Engineers:
 1. ASME A112.6.3 – Floor and Trench Drains
 2. ASME A112.6.4 – Roof, Deck, and Balcony Drains
 3. ASME A112.18.1 - Plumbing Supply Fittings.
 4. ASME A112.18.1M – Plumbing Fixture Fittings.

5. ASME A112.18.2 – Plumbing Waste Fittings.
6. ASME A112.19.1 - Enameled Cast Iron and Enameled Steel Plumbing Fixtures.
7. ASME A112.19.2 - Ceramic Plumbing Fixtures.
8. ASME A112.19.3 - Stainless Steel Plumbing Fixtures
9. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures.
10. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks.
11. ASME A112.19.14 - Six-Liter Water Closets Equipped with Dual Flushing Device.
12. ASME A112.19.15 - Bathtub/Whirlpool Bathtubs with Pressure Sealed Doors.
13. ASME A112.19.19 Vitreous China Non-water Urinals
14. ASME A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
15. ASME A112.36.2M – Cleanouts.

E. American Society of Testing and Materials

1. ASTM A888-20 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
2. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
3. ASTM C1613-17 - Standard Specification for Precast Concrete Grease Interceptor Tanks
4. ASTM F409 – Standard Specifications for Thermoplastic and Replaceable Plastic Tub and Tubular Fittings.
5. ASTM F2649-14 - Standard Specification for Corrugated High Density Polyethylene (HDPE) Grease Interceptor Tanks
6. ASTM D-4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials

F. American Society of Safety Engineers

1. ASSE 1012, Performance Requirements For Backflow Preventers With An Intermediate Atmospheric Vent
2. ASSE 1013, Performance Requirements for Reduced Pressure Principle Backflow Preventers

3. ASSE 1016/ASME A112.1016/CSA B125.16-11, Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations
 4. ASSE 1017, Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems
 5. ASSE 1062, Performance Requirements for Temperature Actuated Flow Reduction (TAFR) Valves for Individual Fixture Fittings
 6. ASSE 1066, Performance Requirements for Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings
 7. ASSE 1069, Performance Requirements for Automatic Temperature Control Mixing Valves
 8. ASSE 1070/ASME A112.1070/CSA B125.70-15, Performance Requirements for Water Temperature Limiting Devices
 9. ASSE 1071, Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment
- G. American Society of Heating, Refrigeration and Air Conditioning Engineers:
1. ASHRAE Std 18 - Methods of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration.
- H. International Association of Plumbing and Mechanical Officials:
1. IAPMO IGC 187 – Roof Drains with Integral Overflow Drain.
 2. IAPMO Z124 - Plastic Plumbing Fixtures.
 3. IAPMO Z403-13 - Terrazzo, Concrete, and Natural Stone Plumbing Fixtures
- I. International Surface Fabricators Association
1. ISFA 2-01 – Classification and Standards for Solid Surfacing Material
- J. National Sanitation Foundation:
1. NSF 61 - Drinking Water System Components - Health Effects.
 2. NSF 372 - Drinking Water System Components - Lead Content.
- K. Plumbing Drainage institute:
1. PDI WH-201 – Water Hammer Arresters.

1.4 SUBMITTALS

- A. Division 01 - General Requirements.

**NEW YORK PRESBYTERIAN
IONA SCHOOL OF HEALTH SCIENCES
IONA COLLEGE
BRONXVILLE, NY**

**S/L/A/M – 20287.10
PLUMBING FIXTURES AND SPECIALTIES
22 4000 - 4 of 16**

- B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Samples: Submit two lavatory supply fittings fixtures for color matching.
- E. Manufacturer's Installation Instructions: Submit installation methods and procedures. Indicate assembly and support requirements
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- G. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.
- H. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- I. Waterless Urinals: Submit recommended frequency of maintenance and parts replacement, methods of cleaning, sources of replacement supplies and parts.
- J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - General Requirements.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with State of New York standard.
- B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.
- C. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.
- D. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

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

1.8 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 - General Requirements.
- B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - General Requirements.
- B. Accept products on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures and specialties from damage by securing areas and by leaving factory packaging in place to protect fixtures and specialties, and prevent use.

1.11 WARRANTY

- A. Division 01 - General Requirements.
- B. Furnish five year manufacturer warranty for plumbing fixtures.

1.12 EXTRA MATERIALS

- A. Division 01 - General Requirements.
- B. Furnish two sets of faucet washers flush valve service kits lavatory supply fittings shower heads toilet seats.
- C. Provide two loose keys for hose bibs and wall hydrants.
- D. Furnish supply of chemicals for treatment and testing during warranty period of solar hot water system.

PART 2 PRODUCTS

2.1 GENERAL

- A. See schedule on drawings for additional requirements and accessories.
- B. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 ELECTRIC WATER COOLERS

- A. Electric Water Cooler Manufacturers:
 - 1. Elkay.
 - 2. Haws.

3. Oasis.
 4. Murdock.
 5. Substitutions: Division 01 - General Requirements.
- B. Water Cooler: ARI 1010
- C. All components of the electric water cooler in the wetted surface material shall be lead free in accordance with SDWA 1417
1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F (27 degrees C) and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
 2. Electrical: 115 V, 60-Hertz compressor, 6-foot cord and plug for connection to electric wiring system including grounding connector. Refer to division 26 plans and specifications.
- 2.3 JANITOR SINKS
- A. Manufacturers:
1. American Standard
 2. Acorn
 3. Fiat
 4. Kohler Co.
 5. Just
 6. Substitutions: Division 01 - General Requirements.
- B. IAPMO Z403-13; Molded stone basin and integral drain body.
- C. Supply Faucets
1. Manufacturers
 - a. Speakman
 - b. American Standard, Inc.
 - c. Kohler Company
 - d. Zurn Industries, Inc.
 - e. Symmons
 - f. T&S Brass

- g. Chicago Faucets
 - h. Substitutions: Division 01 - General Requirements.
- D. Faucet and Trim: ASME A112.18.1, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

2.4 LAVATORIES

A. Manufacturers:

- 1. American Standard
 - 2. Willoughby
 - 3. Bradley
 - 4. Kohler Co.
 - 5. Crane
 - 6. Acorn
 - 7. Substitutions: Division 01 - General Requirements.
- B. Basin: ASME A112.19.2; Vitreous China Wall Hung Basin: with 4 inch high back, , rectangular basin with splash lip, front overflow, and soap depression.
- C. Basin: ASME A112.19.2; Vitreous China Under-Mount Basin: ASME A112.19.2; front overflow, mounting kit and template by manufacturer.
- D. Supply Faucets
 - 1. Manufacturers
 - a. American Standard, Inc.
 - b. Kohler Company
 - c. Zurn Industries, Inc.
 - d. Symmons
 - e. T&S Brass
 - f. Chicago Faucets
 - g. Substitutions: Division 01 - General Requirements.
 - 2. Supply Fitting: ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator with maximum

- E. For public hand washing facilities, provide tempered water through regulating device conforming to ASSE 1070.
- F. Waste Fittings: ASME A112.18.2 or ASTM F 409.
- G. Accessories:
 - 1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
 - 2. Perforated open strainer.
 - 3. Screwdriver stops.
 - 4. Rigid supplies.
 - 5. Trap and waste insulated and offset to meet ADA compliance.
- H. Wall Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs. See drawings for additional requirements and accessories.

2.5 BATHTUBS

- A. Bathtub Manufacturers:
 - 1. American Standard.
 - 2. Kohler Co.
 - 3. Sterling.
 - 4. Substitutions: Division 01 - General Requirements.
- B. Bathtub:
 - 1. IAPMO Z124; molded glass fiber reinforced polyester, with slip-resistant bottom surface, contoured shape, color by architect.
- C. Bath and Shower Trim: ASME A112.18.1; concealed shower and over rim supply with diverter spout, indexed handles, bent shower arm with adjustable spray ball joint showerhead and escutcheon, lever operated pop-up waste and overflow.

2.6 WATER CLOSETS – FLUSH VALVE

- A. Manufacturers:
 - 1. American Standard
 - 2. Gerber Plumbing Fixtures LLC
 - 3. Zurn

4. Toto
 5. Kohler Co.
 6. Crane
 7. Substitutions: Division 01 - General Requirements
- B. Bowl: ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.
- C. Flush Valve Manufacturers:
1. Sloan
 2. American Standard
 3. Zurn
 4. Hydrotek
 5. Substitutions: Division 01 - General Requirements.
- D. Sensor Operated Flush Valve: ASME A112.18.1; exposed chrome plated brass, diaphragm type with battery operated solenoid operator, infrared sensor and over-ride button in chrome plated plate, wheel handle stop and vacuum breaker; maximum 1.6 gallon flush volume.
- E. Seat: Solid white plastic, open front, extended back, brass bolts, without cover. See drawings for additional requirements and accessories.
- F. Wall Mounted Carrier: ASME A112.6.1; cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.7 REDUCED PRESSURE BACKFLOW PREVENTERS

- A. Manufacturers:
1. Watts.
 2. Zurn.
 3. Apollo Valves.
 4. Substitutions: See Division 01 - General Requirements.
- B. Reduced Pressure Backflow Preventers:
1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type

differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

- A. In cold water branch lines serving HVAC equipment, provide all-bronze backflow preventers with strainer, air gap drain funnel and quarter-turn full-port ball valves.
- B. For cold water service and hot water 3" and smaller, provide all-bronze flanged backflow preventers with OS&Y gate valves, strainer and air gap drain funnel. For hot water units provide high temperature rated components.
- C. For cold water service 4" and larger, provide epoxy-coated cast iron backflow preventers with OS&Y gate valves, strainer and air gap drain funnel.
- D. All backflow preventers shall be installed so they can be easily accessed for testing and maintenance, install 36" above floor, pipe vent discharge to floor drain.

2.8 CLEANOUTS

A. Manufacturers:

- 1. Josam.
- 2. J.R. Smith.
- 3. Zurn.
- 4. Watts.
- 5. Wade.
- 6. Substitutions: Division 01 - General Requirements.

- B. ASME A112.36.2M; Cleanouts: Cast iron body with adjustable scoriated nickel bronze top and vandal proof screws.
- C. Interior Finished Wall Cleanouts: Line type with cast iron body, round epoxy coated gasketed cover and round stainless steel access cover secured with machine screw.
- D. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide stack cleanouts on vertical rainwater leaders.
- E. Cleanout plugs shall be screwed brass installed either in cast iron-caulked ferrules or directly into threaded drainage fittings. Above floor cleanouts on stacks may be "Dandy" cleanouts.
- F. Refer to other Sections of the Specification for access doors which may be used in lieu of covers specified below.

- G. Cleanouts are to be accessible and locations coordinated with cabinetry, shelving and other architectural details. DO NOT place cleanouts where they will not be readily accessible.

2.9 EXPANSION TANKS

A. Manufacturers:

1. Amtrol.
2. Bell and Gossett.
3. Taco.
4. Watts.

- B. Substitutions: Division 01 - General Requirements Construction: Welded steel, ASME labeled, tested and stamped in accordance with Section 8D of ASME Code; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

2.10 FIXTURE SUPPORTS

A. Manufacturers:

1. J.R. Smith.
2. Josam.
3. Wade.
4. Zurn.
5. MIFAB.

6. Substitutions: Division 01 - General Requirements.

- B. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

- C. For each wall-hung lavatory, urinal, water cooler, drinking fountain and water closet, provide concealed carrier suited for fixture, location, wall thickness and material.

- D. Concealed carriers with exposed arms for sinks and lavatories shall have acid-resisting enamel finish.

2.11 FLOOR SINK

A. Manufacturers:

1. Josam.

2. J.R. Smith.
 3. Watts.
 4. Zurn.
 5. Wade
 6. Substitutions: Division 01 - General Requirements.
- B. ANSI A112.21.1. Square, cast iron, drainage flange with weep holes, and internal cast iron dome strainer. Provide barrier type trap guard conforming to ASSE 1072.
- C. Provide full, half, quarter grates, or less grate as required to suit job conditions.

2.12 LAVATORY INSULATION KIT

- A. Manufacturers:
1. McGuire
 2. Truebro
 3. Plumerex
 4. Substitutions: Division 01 - General Requirements.
- B. ANSI A117.1; Where Lavatories are noted to be insulated for ADA compliance, furnish safety covers consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

2.13 PLUMBING TRAPS

- A. Manufacturers:
1. McGuire Manufacturing Co.
 2. Josam.
 3. Wade.
 4. Zurn.
 5. Substitutions: Division 01 - General Requirements.
- B. ASTM A888-20; Fixture traps shall be 17 gauge or heavier material; other traps shall be of same size and material as pipe on which trap occurs.
- C. Provide cleanout for each trap. Running traps shall have double hubs for two cleanouts.
- D. Provide deep traps with 4" minimum seal, for floor drains.

2.14 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Woodford.
2. Josam.
3. Wade.
4. Zurn.
5. Watts.
6. Substitutions: Division 01 - General Requirements.

B. ANSI A112.26.1; sized in accordance with PDI, precharged, suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250

2.15 WATER METERS

A. Manufacturers:

1. Neptune.
2. Badger.
3. EMCO.
4. Hersey Co.
5. Substitutions: Division 01 - General Requirements.

B. NSF 372;

C. Water meter shall be cast bronze, corrosion resistant, light weight, with glass lens readout and with flanged inlets and outlets. Water meter to meet or exceed all the requirements of the local water authority and AWWA standards. Water meter shall be lead free.

2.16 STOPS

A. Manufacturers:

1. Brass Craft.
2. Watts.
3. Nibco.
4. McGuire.
5. Substitutions: Division 01 - General Requirements.

B. ASME A112.18.1;

C. Chrome plated angle brass supply stop valve with full turn brass stem, lead free, inlet shall be 1/2-inch sweat, outlet shall be 3/8-inch compression.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - General Requirements
- B. Verify walls and floor finishes are prepared and ready for installation of fixtures.
- C. Verify electric power is available and of correct characteristics.
- D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.
- B. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid supplies to fixtures with screwdriver stops, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with wall carriers and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant as specified in Division 07, color to match fixture.
- G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
- H. For ADA accessible water closets, install flush valve with handle to wide side of stall.
- I. Refer to architectural drawing for required mounting heights of fixtures.
- J. Install in accordance with manufacturer's instructions.
- K. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

L. Cleanouts shall be same size as the pipes served, up to 4 inches; 5 and 6 inch pipes shall have 4 inch cleanouts; 8 inch pipes shall have 6 inch cleanouts; 10 inch pipes and larger shall have 8 inch cleanouts.

M. Install components level and plumb.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Division 01 - General Requirements: Product Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Division 01 - General Requirements: Product Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

END OF SECTION 22 4000