SECTION 22 02 00 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departure and the reasons therefore shall be submitted to the Architect/Engineer for approval as soon as reasonably practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is equal to that specified.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent Drawings, including those of other contracts, prior to commencement of Work.

B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings, or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to: materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Plumbing and Fire Protection items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details with regards to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building/job-site, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least seven (7) working days prior to bid; the greater or more

costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified elsewhere, or necessary for complete and functioning plumbing systems shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. The Contractor shall participate in the Commissioning process as required; including, but not necessarily limited to: meeting attendance, completion of checklists, and participation in functional testing.

1.3 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed Shop Drawings.

B. All piping, fixture, or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit Shop Drawings for review.

C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the Contractor at no additional cost to the owner.

D. Additional coordination with Electrical Subcontractor may be required to allow adequate clearances of electrical equipment, fixtures, and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts, or equipment locations.

1.4 SITE VISIT AND FAMILIARIZATION

A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the piping, fixtures and equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.5 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified. Prime and protective painting is included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to plumbing systems.

C. Furnishing and installing all required plumbing equipment, control relays and electrical interlock devices, conduit, wire and junction boxes are included in the Work of this Division.

1.6 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.7 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of Owner occupancy, or the date all punch list items have been completed, or the date final payment has been received. Refer to Division 01 for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such times as the project is ready to receive the equipment, pipe or valves - properly protected from incidental damage and weather damage.

C. Damaged equipment, valves or pipe shall be promptly removed from the site and new, undamaged equipment, valves and pipe shall be provided in its place promptly with no additional charge to the Owner.

1.9 NOISE AND VIBRATION

A. The plumbing systems and the component parts thereof shall be guaranteed to operate without objectionable noise and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C. Carefully fabricate pipe and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect/Engineer, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 APPLICABLE CODES

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection, relocation, and upgrade of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the following nationally accepted codes and standards, including, but not necessarily limited to:

1. American Standards Association, ASA.
2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
3. American Society of Mechanical Engineers, ASME.
4. American Society of Plumbing Engineers, ASPE.
5. American Society of Testing Materials, ASTM.
6. American Water Works Association, AWWA.
7. National Bureau of Standards, NBS.
8. National Fire Protection Association, NFPA.
9. UL, LLC (formerly Underwriters Laboratories).
10. FM Global.
11. International Energy Conservation Code, IECC.
12. International Fire Code.
13. International Gas Code.

D. Where differences exist between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Architect/Engineer in writing of all differences.

E. When directed in writing by the Architect/Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards. Correct the deficiencies and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the

purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver new to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its Subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification

requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 2009 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings. It will not be the province of the Specifications to mention any part of the work which the Drawings are competent to fully explain in every particular and such omission shall not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least seven (7) working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution by made without the written permission of the Architect or Engineer and Owner. **Request for prior approval must be made in writing at least ten (10) days prior to the bid date without fail.**

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equal construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outline herein.

I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical and Plumbing Design Documents and all other trades, including Division 26.

J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected Subcontractors shall be the responsibility of this bidder and not the Owner.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a written acceptance allowing the substitutions.

M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with his trades and all other trades and pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

1.13 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of Shop Drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty (30) day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive Shop Drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all Shop Drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.

3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 00 and Division 01 for additional information on Shop Drawings and submittals.

C. Equipment and materials submittals and Shop Drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of Shop Drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where Shop Drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop Drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The Contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not

approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.

4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous Shop Drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all Shop Drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without Shop Drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Submittals are required for, but not necessarily limited to, the following items:

1. Basic Materials.
2. Plumbing Fixtures and Valves.
3. Supports and Carriers.
4. Floor Drains, Roof Drains, and Cleanouts.
5. Interceptors/Traps (All Types).
6. Water Heaters and Boilers.
7. Expansion Tanks.
8. Water Softeners.
9. Water Treatment Equipment.
10. Water Filters.
11. Domestic Water Booster Pumps.
12. Fire Pumps and Jockey Pumps.
13. Storm, Sanitary, and Wastewater Pumps and Ejectors.
14. Fire Pump and Jockey Pump Controllers.
15. Domestic Water and Fire Protection Break Tanks.
16. Backflow Preventers.
17. Plumbing Piping.
18. Piping, Vessel, and Equipment Insulation.
19. Air Compressors and Air Dryers.
20. Expansion Fittings and Devices.

21. Variable Frequency Drives.
22. Noise and Vibration Controls.
23. Pipe and Equipment Hangers and Supports.
24. Plumbing Specialties.
25. Test, Adjust and Balance Reports.
26. Testing, Adjusting and Balancing Contractor Qualifications.
27. Coordination Drawings.

I. Refer to other Division 22 sections for additional Shop Drawing and submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of plumbing 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. Indicate the proposed locations of pipe, equipment, and other materials. Include the following:
   a. Wall locations and types.
   b. Clearances for installing and maintaining insulation.
   c. Locations of light fixtures and sprinkler heads.
   d. Clearances for servicing and maintaining equipment, including tube removal and space for equipment disassembly required for periodic maintenance.
   e. Equipment connections and support details.
   f. Exterior wall and foundation penetrations.
   g. Routing of storm, sanitary sewer piping and plumbing piping.
   h. Fire-rated wall and floor penetrations.
   i. Sizes and location of required concrete pads and bases.
   j. Valve stem movement.
   k. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting Shop Drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 22.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work; precise locations of all concealed pipe; locations of all valves, controls and operable devices; and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Record Drawings shall indicate, at a minimum, the following installed conditions:

1. Mains and branches of piping systems, with valves and control devices located and numbered, unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion fittings, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
4. Contract Modifications, actual equipment and materials installed.

E. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

F. If the Contractor does not keep an accurate set of Record Documents, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

G. Upon completion of the Work, the Contractor shall submit three (3) full size sets of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY:_____
(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY:_____
(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled dates for each test. This detailed completion and test schedule shall be submittal at least ninety (90) days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit four (4) copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in other Sections of Division 22.

1.17 OPERATIONS AND MAINTENANCE MANUALS

A. Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 22. In addition to the requirements of other Sections, this shall include the following information for fixtures, specialties, and equipment items:

1. Identifying names, name tags designations and locations for all equipment.
2. Valve tag lists with valve number, type, color coding, location and function.
3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. 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.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
8. Servicing instructions and lubrication charts and schedules.
9. Equipment and motor name plate data.
10. Wiring diagrams.
11. Exploded parts views and parts lists for all equipment and devices.
12. Color coding charts for all painted equipment and conduit.
13. Location and listing of all spare parts and special keys and tools furnished to the Owner.
14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

B. Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in “D ring” style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow ¼” of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled

for easy reference. Utilize the individual specification section numbers shown in the Plumbing Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 22 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

C. In addition to the bound “hard-copy” Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.

E. **Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing**. The Contractor will subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.18 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include a minimum of 12 hours of on- site training in three (3) shifts of four (4) hours each.

B. Before proceeding with the instruction of Owner’s Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he or she has a proper understanding of the operation and maintenance of the systems and then resubmit the signed outlines.

C. Refer to other Sections of Division 22 for additional Operator Training requirements.

1.19 FINAL COMPLETION

A. At the completion of the work, all equipment, operable appurtenances, and systems shall be tested. All faulty equipment and material shall be repaired or replaced. Refer to other Sections of Division 22 for additional requirements.

B. Clean and adjust all fixtures, flushometers, valves and operable devices. Replace faulty or otherwise damaged parts immediately prior to final acceptance.

C. Touch up and/or refinish any scratched equipment and devices immediately prior to final acceptance. This shall be acceptable **only for minor superficial scratches**, the determination of which rests solely on the judgment of the Architect or Engineer.

1.20 CONTRACTOR'S GUARANTEE

A. Use of the Plumbing systems to provide temporary service during the construction period shall not be allowed without written permission from the Owner, and, if granted, shall not be cause for the warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one (1) year after its completion and final acceptance, and shall furnish free of additional cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. All air compressors shall have parts and labor guarantees for a period of not less than five (5) years beyond the date of final acceptance.

E. Refer to other Sections of Division 22 for additional guarantee or warranty requirements.

1.21 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for re-use by Architect/Owner or others on extensions of this project or on any other project. Any such re-use or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any re-use or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. At the Architect/Owner's request, Engineer will prepare one "CD" of electronic media to assist the Contractor in the preparation of submittals. The Engineer will prepare and submit the "CD" to the Architect/Owner for distribution to the Contractor.

1. The "CD" will be prepared and all title blocks, names and dates will be removed. The "CD" will be prepared in a ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with "Buy American Act."

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks unless indicated otherwise.

C. All access panels located in wet areas such as toilet rooms, locker rooms, shower rooms, natatoriums, kitchens, and any other wet areas shall be constructed of stainless steel.

D. Access doors shall be as follows:

1. Plastic Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.2 EQUIPMENT PADS

A. Provide four (4) inch high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

B. Provide six (6) inch high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Provide a four (4) foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in other Divisions (10, 11, 12, 13, 21, 22, etc.) for additional rough-in requirements as necessary and provide accordingly.

3.2 PLUMBING INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of plumbing and fire systems, materials, and equipment. Comply with the following requirements:

1. Coordinate plumbing and fire protection systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, leave-outs, and other openings in building components during progress of construction to allow for plumbing installations.
4. Coordinate the installation of required supporting devices, sleeves, and pathways to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of plumbing and fire protection systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access panels or doors where valves, operable devices, and equipment are concealed behind finished surfaces. Refer to Article 2.1 of this Section and to Architectural documents for specifications and locations.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.
14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, valves, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Plumbing Equipment:
    a. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop Drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.
    b. Tags shall be attached to all valves, including control valves, with nonferrous chains. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the Record Drawings.

3.3 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of plumbing equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Article 1.11 DEFINITIONS AND SYMBOLS for definition of "Installer."

C. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including but not limited to removal of plumbing piping, equipment, plumbing fixtures and trim, and other plumbing items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.4 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:

1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and the Architect/Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.

B. Start-up for major plumbing and fire protection equipment shall be performed by a factory authorized technician. Such equipment shall include, but not necessarily be limited to, the following: domestic water boilers and packaged water heating systems, water softeners, ultra-pure water equipment systems, domestic water booster pumps, fire pumps, and break tank level alarm systems. Refer to other Sections of Divisions 21 and 22 for additional requirements.

3.5 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, utilities, equipment and

other apparatus related to this phase of the work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by this Contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe, supports, and hangers. Where pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. Ensure existing piping and equipment to remain that is adjacent to and impacted by the scope of Work is properly supported, fastened, and secure.

E. During the construction and remodeling, portions of the Project shall remain in service. Construction equipment, material tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

F. Certain work during the demolition phase of construction may require overtime, night time, or weekend shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

G. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately and disposed of lawfully.

H. Equipment, piping or other potential hazards to the working occupants of the building or the general public shall not be left overnight outside of the designated working or construction area.

I. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

J. Include in the contract price all rerouting of existing pipe, utilities, etc., and the reconnecting of the existing equipment and plumbing fixtures as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such

rerouting, reconnecting or relocating is shown on the Drawings. Provide all temporary pipe, utilities, controls, etc., as required to maintain heating, cooling, ventilation and plumbing services for the existing areas with a minimum of interruption.

K. All existing plumbing fixtures, pipe, utilities, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

L. Pipe, utilities, equipment and controls serving mechanical, plumbing and owner's equipment, etc., which is to remain but which is served by pipe, utilities, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

M. No portion of the **fire protection systems** shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner’s representative in order to protect systems that shall remain in service.

N. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

O. Refer to Architectural Demolition and/or Alteration plans for actual locations of walls, ceiling, etc., being removed and/or remodeled.

END OF SECTION

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SECTION 22 05 29 – HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe, and equipment hangers, supports, and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.2 RELATED WORK

A. Section 22 05 29 – Hangers and Support for Plumbing Piping and Equipment.

B. Section 22 07 19 – Plumbing Piping Insulation.

C. Section 22 07 16 – Plumbing Equipment Insulation.

D. Section 21 00 00 - Fire Protection and 21 13 13 Wet Pipe Sprinkler System.

E. Section 22 10 00 - Plumbing System.

1.3 REFERENCES

A. ANSI/ASME B31.1 - Power Piping.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems.

C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.4 QUALITY ASSURANCE

A. Supports for Sprinkler Piping: In conformance with NFPA 13.

B. Supports for Standpipes: In conformance with NFPA 14.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.

C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and Over: adjustable steel yoke and cast-iron roll.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

J. Roof Pipe Supports and Hangers: Galvanized Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.

For pipes 2-1/2” and smaller – Type PP10 with roller
For pipes 3” through 8” – Type PS
For multiple pipes – Type PSE - Custom

K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut “Cush-A-Clamp” or equal. Hangers: Plastic coated; Unistrut or equal.

L. For installation of protective shields refer to specification section 22 07 19 -3.3.

M. Shields for Vertical Copper Pipe Risers: Sheet lead.

N. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief “Pipe Titan” hold rite or equal.

2.2 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

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

2.4 FLASHING

A. Metal Flashing: 20 gage galvanized steel.

B. Lead Flashing: 4 lb./sq. ft. sheet lead for waterproofing; 1 lb./sq. ft. sheet lead for soundproofing.

C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.5 EQUIPMENT CURBS

A. Fabricate curbs of hot dipped galvanized steel.

2.6 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe, schedule 40.

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed.

D. Sleeves for Round Ductwork: Form with galvanized steel.

E. Sleeves for Rectangular Ductwork: Form with galvanized steel.

F. Fire Stopping Insulation: Glass fiber type, non-combustible, U.L. listed.

G. Caulk: Paintable 25-year acrylic sealant.

H. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.7 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.8 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify

with structural engineer prior to start of work.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7’-0”	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 and over	4'-0"	5/8"

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

J. Portable pipe hanger systems shall be installed per manufactures instructions.

3.3 Insulated Piping: Comply with the following installation requirements.

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

C. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

NPS	LENGTH	THICKNESS
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 THROUGH 14	24	0.075
16 THROUGH 24	24	0.105

D. Piping 2” and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.

E. Insert material shall be at least as long as the protective shield.

F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor shower mop sink and all other drains watertight to adjacent materials.

E. Provide curbs for mechanical roof installations 8 inches minimum high above roofing

surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.6 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermfiber and 3M caulking and provide floor plate.

C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with U.L. listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Fire protection sleeves may be flush with floor of stairways.

END OF SECTION

SECTION 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 Refer to Architectural Sections for additional requirements.

PART 2 - PRODUCTS

2.1 VALVE AND PIPE IDENTIFICATION

A. Valves:

1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.
2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.
3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.
4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.

B. Pipe Marking:

1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.
2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton nameplate company. Factory location 20 Thompson Road, Branford, Connecticut, or approved equal.
3. Generally, markers shall be located on each side of each partition, on each side of each tee, on each side of each valve and/or valve group, on each side of each piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.
4. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position.

Manufacturer's installation instructions shall be closely followed.

5. Markers shall be colored as indicated below per ANSI/OSHA Standards:

SYSTEM	COLOR	LEGEND
Sanitary Sewer	Green	Vent Sanitary Sewer
Storm Drain	Green	Storm Drain
Domestic Water	Green	Domestic Water
Domestic Hot Water Supply	Yellow	Domestic Hot Water Supply
Domestic Hot Water Recirculating	Yellow	Domestic Hot Water Return
Fire Protection	Red	Fire Protection
Automatic Sprinkler	Red	Fire Sprinkler
Gas	Yellow	Natural Gas
Compressed Air	Blue	Compressed Air
Oxygen	Yellow	Oxygen
Nitrogen	Green	Nitrogen
Deionized Water	Green	Deionized Water

C. Pipe Painting:

1. All piping exposed to view shall be painted as indicated or as directed by the Architect in the field. Confirm all color selections with Architect prior to installation.
2. The entire fire protection piping system shall be painted red.
3. All piping located in mechanical rooms and exterior piping shall be painted as indicated below:

System	Color
Storm Sewer	White
Sanitary Sewer Waste and Vent	Light Gray
Domestic Cold Water	Dark Blue
Domestic Hot Water Supply and Return	Orange

PART 3 - EXECUTION

3.1 All labeling equipment shall be installed as per manufacturers printed installation instructions.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor’s price shall include all items required as per manufacturers' requirements.

3.3 All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Install primer and a quality latex paint over all surfaces of pipe.

END OF SECTION

SECTION 22 07 16 – PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Work specified elsewhere.

1. Basic materials and methods.
2. Piping systems.
3. Air distribution equipment.

1.3 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.4 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.5 DELIVERY AND STORAGE

A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers clearly labeled with flame and smoke ratings.

PART 2 - PRODUCTS

2.1 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.2 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before

any insulation is installed.

2.3 A sample quantity of each type insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.4 Glass fiber materials as manufactured by Owens/Corning, PPG, CSG, or Johns Manville will be acceptable, if they comply with the specifications.

2.5 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

2.6 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.

2.7 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.1 All insulation shall be installed in accordance with the manufacturers recommendations and printed installation instructions.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION

SECTION 22 07 19 – PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Furnish and install piping insulation to:

1. Interior domestic hot water and hot water return piping.
2. Interior domestic cold water piping.
3. Interior domestic cold water piping located in exterior walls and to a point no less than 8'-0" inside the building.
4. Exterior domestic cold water piping.
5. Drain bodies and associated piping.
6. Condensate drainage piping.
7. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.

1. Painting.
2. Pipe hangers and supports.

D. For insulation purposes, piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer wells, unions, pressure reducing stations, and orifice assemblies.

1.3 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.4 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.5 DELIVERY AND STORAGE

A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers. Containers shall be clearly labeled with the insulation's flame and smoke ratings.

PART 2 - PRODUCTS

2.1 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.2 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved prior to installation.

2.3 A sample quantity of each type of insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.4 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

2.5 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.

2.6 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

2.7 APPROVED MANUFACTURERS

A. Calcium silicate materials shall be as manufactured by Johns Manville.

B. Glass fiber materials shall be as manufactured by Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

C. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armstrong, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

D. Armaflex elastomeric cellular thermal insulation by Armstrong.

E. Phenolic foam insulation shall be as manufactured by Kooltherm Insulation (Koolphen).

F. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products, Inc.

2.8 MATERIALS

A. INTERIOR DOMESTIC WATER PIPE: provide fiberglass pipe insulation with all service jackets with self sealing lap joint.

B. EXTERIOR DOMESTIC WATER PIPE: Provide elastomeric cellular thermal, or preformed phenolic foam pipe insulation with secured aluminum jacketing.

C. DRAIN BODIES AND DOWNSPOUTS: Insulate underside of roof and overflow drain bodies, associated horizontal piping, including first turn down to vertical conductor. Insulate chilled water waste lines from drinking fountain to junction with main waste stacks. Insulate branch lines including traps and exposed underside of floor drains receiving cooling coil condensate, same as water piping where exposed to building occupant view. When concealed, insulation may be same as specified for external duct wrap.

D. CONDENSATE DRAINAGE PIPING: Fire resistant fiberglass insulation; insulation not required when piping is exposed on roof.

E. ALUMINUM OR STAINLESS STEEL JACKETING: Utilize strap-on type jacketing, banding, and accessories. Provide pre-formed fitting covers for all elbows and tees.

PART 3 - EXECUTION

3.1 All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

3.3 Pipes located outdoors or in tunnels shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

3.4 All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

3.5 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, an isolating seal shall be formed between the vapor barrier jacket and the bare pipe. The seal shall be by the applications of adhesive to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass fiber covers finished with two brush coats of vapor barrier mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the SSL is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor barrier jacket.

D. At hangers and supports, provide a high-density foam insulation insert that extends 2" beyond the shield on each side and a protective shield/saddle to prevent

compression/damage. Secure shield/saddle to insulation using mastic or strapping tape.

3.6 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe.

B. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

PART 4 - SCHEDULES

4.1 LOW TEMPERATURE SURFACES	MINIMUM INSULATION THICKNESS BASED ON FIBERGLASS
A. Exposed exterior domestic water pipe:	1½ inch
B. Interior domestic cold water pipe:	1 inch
C. Condensate drain lines:	¾ inch
D. Drains receiving condensate:	1 inch
E. Concealed piping from roof drains:	1½ inch blanket wrap
F. Exposed piping from roof drains:	1 inch thick rigid with all service jacket

4.2 HIGH TEMPERATURE SURFACES	MINIMUM INSULATION THICKNESS
A. Domestic Hot Water and Domestic Hot Water Return Piping	
1. Pipe sizes 1-1/4 inch and smaller with Operating temperatures of 140°F or less	1 inch
2. Pipe sizes 1-1/2 inch and larger with Operating temperatures of 140°F or less	1-1/2 inch
3. Pipe sizes 1-1/4 inch and smaller with Operating temperatures greater than 140°F	1-1/2 inch
4. Pipe sizes 1-1/2 inch and larger with Operating temperatures greater than 140°F	2 inch

END OF SECTION

;SECTION 22 10 00 - PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the piping covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Pipe and pipe fittings:

a. Sanitary drainage piping system.

b. Storm drainage piping system.

c. Sub-surface drainage piping system.

d. Acid waste drainage piping system.

e. Domestic water piping system.

2. Adapters, Transitions, Unions, Couplings, Flanges, Connectors

3. Valves

4. Excavation, Bedding, and Backfill

1.3 RELATED WORK

A. Section 22 05 29 – Hangers and Support for Plumbing Piping and Equipment.

B. Section 22 05 53 – Identification for Plumbing Piping and Equipment.

C. Section 22 07 19 – Plumbing Piping Insulation.

D. Section 22 11 16 – Domestic Water Piping – Cross-Linked Polyethylene (PEX)

E. Section 22 40 00 – Plumbing Fixtures.

1.4 REFERENCES

A. ASME – Boiler and Pressure Vessel Code.

B. ASME Section IX – Welding and Brazing Qualifications.

C. ASME B1.20.1 – Pipe Threads, General Purpose.

D. ASME B16.1 – Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

E. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

F. ASME B16.4 – Gray Iron Threaded Fittings: Classes 125 and 250.

G. ASME B16.5 – Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.

H. ASME B16.14 – Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads.

I. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

J. ASME B16.23 – Cast Copper Alloy Solder Joint Drainage Fittings: DWV.

K. ASME B16.51 – Copper and Copper Alloy Press-Connect Pressure Fittings.

L. ASME B31.3 – Process Piping.

M. ASME B31.9 – Building Services Piping.

N. ASTM A47 – Standard Specification for Ferritic Malleable Iron Castings.

O. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

P. ASTM A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

Q. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

R. ASTM A197 – Standard Specification for Cupola Malleable Iron.

S. ASTM A395 – Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

T. ASTM A536 – Standard Specification for Ductile Iron Castings.

U. ASTM A582 – Standard Specification for Free-Machining Stainless Steel Bars.

V. ASTM B32 – Standard Specification for Solder Metal.

W. ASTM B42 – Standard Specification for Seamless Copper Pipe, Standard Sizes.

X. ASTM B43 – Standard Specification for Seamless Red Brass Pipe, Standard Sizes.

Y. ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings.

Z. ASTM B75 – Standard Specification for Seamless Copper Tube.

AA. ASTM B148 – Standard Specification for Aluminum-Bronze Sand Castings.

BB. ASTM B306 – Standard Specification for Copper Drainage Tube (DWV).

CC. ASTM B584 – Standard Specification for Copper Alloy Sand Castings for General Applications.

DD. ASTM B828 – Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

EE. ASTM C33/C33M – Standard Specification for Concrete Aggregates.

FF. ASTM C94 – Standard Specification for Ready-Mix Concrete.

GG. ASTM C150 – Standard Specification for Portland Cement.

HH. ASTM C1053 – Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.

II. ASTM C1173 – Standard Specification for Flexible Transition Couplings for Underground Piping Systems.

JJ. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

KK. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

LL. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

MM. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

NN. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

OO. ASTM D2464 – Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

PP. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

QQ. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

RR. ASTM D2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

SS. ASTM D2665 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

TT. ASTM D2672 – Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement.

UU. ASTM D2729 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

VV. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

WW. ASTM D2843 – Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.

XX. ASTM D2846 – Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot and Cold Water Distribution Systems.

YY. ASTM D2855 – Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.

ZZ. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

AAA. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

BBB. ASTM D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

CCC. ASTM D3311 – Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.

DDD. ASTM D4976 – Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

EEE. ASTM D5926 – Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems.

FFF. ASTM D6707 – Standard Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications.

GGG. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

HHH. ASTM F439 – Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

III. ASTM F441 – Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

JJJ. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

KKK. ASTM F493 – Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

LLL. ASTM F656 – Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

MMM. ASTM F913 – Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

NNN. ASTM F1336 – Standard Specification for Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings.

OOO. ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

PPP. ASTM F1548 – Standard Specification for Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications.

QQQ. AWS A5.8 – Specification for Filler Metals for Brazing and Braze Welding.

RRR. AWS 5.31 – Specification for Fluxes for Brazing and Braze Welding.

SSS. AWWA C105 – Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

TTT. AWWA C111 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

UUU. AWWA C209 – Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

VVV. AWWA C219 – Bolted, Sleeve-Type Couplings for Plain-End Pipe.

WWW. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.

XXX. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Services.

YYY. AWWA C651 – Disinfecting Water Mains.

ZZZ. ASSE 1003 Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.

AAAA. ASSE 1079 – Performance Requirements for Dielectric Pipe Unions.

BBBB. UL 94 Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

CCCC. UL 1285 Standard for Safety Pipe and Couplings, PVC and PVCO for Underground Fire Service.

DDDD. NSF/ANSI 61 – Drinking Water System Components – Health Effects.

EEEE. NSF/ANSI 372 – Drinking Water System Components – Lead Content.

FFFF. Federal Specifications and Standards DD-G-541B – Glass (Laboratory).

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and **country of origin**.

D. Foreign pipe, fittings or valves are unacceptable.

E. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

F. Welders Certification: In accordance with ASME Section IX.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit product data under provisions of Division One.

C. Include pipe materials, pipe fittings, valves, and accessories. Provide manufacturer's catalog information, product certifications, and **country of origin**. Indicate valve data and ratings.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of valves.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of 5 years documented experience and must be a domestic manufacturer.

B. Installer: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept product on site in original factory packaging. Receive valves on site in shipping containers with labeling in place. Inspect for damage. Damaged valves shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

E. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

F. Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

1.12 REGULATORY REQUIREMENTS

A. Perform work in accordance with plumbing and building codes having jurisdiction.

B. **No PVC pipe or fittings, or similar un-rated material, will be allowed in any areas where pipe is to penetrate a fire rated assembly or is to be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure**.

NOTE: If a PRV is required on a project due to high incoming water pressure or otherwise, this is an equipment item that must sized, selected, and scheduled on the Drawings. The paragraph below is intended as a safeguard only, in the absence of a flow test.

C. Provide a water pressure regulating valve assembly at the service entry where incoming water supply pressure is greater than 70 psi.

NOTE: Use PVC only on a case by case basis, confirm with project manager

A. PVC Pipe: ASTM D1785/D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311/D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

NOTE: SDR 35 pipe has a thinner pipe wall thickness than schedule 40 pipe, across the range of pipe sizes and should <u>not</u> be used in locations buried below a building slab; be aware that the CITY OF HOUSTON amendment to UPC 715.1 states that beginning 2 feet from a building, pipes 6" and smaller shall be schedule 40 PVC and pipes 8" or larger *<u>shall be permitted to be</u>*** SDR 35.**

B. PVC SDR 35 PSM Pipe: ASTM D3034, standard dimensional ratio 35; installed per ASTM D2321.

1. Fittings: PVC SDR 35, ASTM D3034 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: Elastomeric gasket seal or solvent welded. Gaskets must meet or exceed ASTM F 477 and gasketed joints must meet ASTM D3212.

2.1 SANITARY SOIL, WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING, BELOW GRADE

Note: Use PVC only on a case by case basis, confirm with project manager; ALSO, PVC should <u>never</u> be used in commercial kitchen applications due to the increased likelihood of a high temperature grease waste discharge. PVC is limited to a 140F temperature rating.

A. PVC Pipe: ASTM D1785/D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311/D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, clear, medium bodied, for sizes 3" and smaller and gray, heavy bodied, for sizes 4" and larger. Mating surfaces shall be prepared with ASTM F656 purple primer immediately prior to cement application.

3. Acceptable except for kitchen waste and vent systems including piping associated with the grease trap, which shall be as specified below.

Note: Spears CPVC is a specialized lab waste pipe system but the manufacturer has confirmed this is acceptable for kitchen grease waste applications. However, please note that this is not true for all CPVC lab waste piping - Charlotte Chem Drain is a similar CPVC product but it shall not be used because Charlotte has indicated it can fail if exposed continuously to FOG (fats, oils, and grease

A. CPVC Pipe and Fittings: All system pipe and fittings shall be from a single manufacturer, Schedule 40 CPVC manufactured of material in conformance with ASTM D1784 and in produced in accordance with ASTM F2618 from CPVC Type IV, ASTM Cell Classification 23447.

1. All pipe shall meet the dimensional requirements of ASTM F441 and all pipe markings shall be accompanied by a yellow stripe for ease of identification.
2. All fittings shall be drainage pattern meeting the requirements of ASTM D3311 and specialty patterns according to the manufacturer's specifications.
3. Joining shall be by solvent cement welding, using "one step" primer-less type CPVC cement specially formulated and manufactured in accordance with ASTM F493. Only cement from the system manufacturer shall be acceptable.
4. Mechanical connections for transition to other system materials shall be as specified by the pipe system manufacturer.
5. All installation shall be in accordance with the manufacturer's instructions and applicable codes.
6. Acceptable Manufacturer: Spears Manufacturing Company Lab Waste CPVC Drainage System only.

2.2 SANITARY SOIL, WASTE AND VENT PIPING, WITHIN BUILDING, ABOVE GRADE

A. Copper Tubing: ASTM B306, DWV, for sizes 2" and smaller.

1. Fittings: ASME B16.23 cast copper alloy solder joint drainage fittings (DWV), or ASME B16.29, wrought copper and wrought copper alloy solder joint drainage fittings (DWV).
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead).
3. Joints between copper and cast iron pipe shall be made by way of copper soldered to a brass ferrule and the ferrule joined to the cast iron hub by a compression or caulked joint.

Note: Use PVC only on a case by case basis; verify acceptability with project manager

B. PVC Pipe: ASTM D1785/D2665 schedule 40 solid wall.

1. Fittings: PVC, ASTM D3311/D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

C. Brass Pipe: ASTM B43, chrome plated

1. Fittings: ASME B16.23 cast bronze, chrome plated.

2. Joints: In accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead) or as recommended by the manufacturer.
3. Applies to exposed piping applications (such as kitchens), wherever required by the prevailing code or by the Authority Having Jurisdiction.

D. Galvanized Steel Pipe: ASTM A53, schedule 40.

1. Fittings: ASME B16.3, ASTM A153 hot-dip galvanized, ASTM A197 malleable iron, minimum pressure class 150.
2. Joints: Threaded joints in accordance with the manufacturer's installation instructions and ASME B1.20.1. Thread sealant tape or compound shall be applied only on male threads and shall be approved, insoluble in water, and non-toxic.
3. Applies only to limited installations such as services from submersible pumps and ejectors.

2.3 STORM DRAINAGE PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

A. PVC Pipe: ASTM D1785/D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311/D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

NOTE: SDR 35 pipe has a thinner pipe wall thickness than schedule 40 pipe, across the range of pipe sizes and should <u>not</u> be used in locations buried below a building slab; be aware that the CITY OF HOUSTON amendment to UPC 1102.2 states that storm leaders installed outside *<u>may be</u>*** SDR 35**

B. PVC SDR 35 PSM Pipe: ASTM D3034, standard dimensional ratio 35; installed per ASTM D2321.

1. Fittings: PVC SDR 35, ASTM D3034 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: Elastomeric gasket seal or solvent welded. Gaskets must meet or exceed ASTM F477 and gasketed joints must meet ASTM D3212.

2.4 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING, BELOW GRADE

A. Pipe and fittings shall be same as specified for sanitary soil, waste and vent piping system.

B. PVC Pipe: ASTM D1785/D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311/D2665 drainage pattern, with bell and spigot ends to be furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.5 STORM DRAINAGE PIPING, WITHIN BUILDING, ABOVE GRADE

A. PVC Pipe: ASTM D1785/D2665 schedule 40 solid wall.

1. Fittings: PVC, ASTM D3311/D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.6 SUB-SURFACE DRAINAGE PIPING SYSTEM

A. PVC Pipe: ASTM D1785/D2729 schedule 40 solid wall.

1. Fittings: PVC, ASTM D3311/D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

B. Perforations

1. Piping shall be provided with perforations direct from the manufacturer, from a fabrication shop, or on the job site.
2. Piping shall be uniformly perforated, with two rows of 5/8 inch diameter holes. Holes shall be located 120 degrees apart from the center line of the pipe and spaced 5 inches apart along the length of the pipe.

C. Filter Fabric

1. A suitable geotextile filter fabric (Mifafi 140N or equivalent) meeting ASTM D6707 shall be provided in accordance with the manufacturer's requirements and consistent with the recommendations of the project geotechnical report.
2. All perforated pipe and the associated fittings shall be wrapped with filter fabric.

2.7 ACID WASTE AND VENT PIPING SYSTEM

A. ACID WASTE BELOW GRADE

Note: Schedule 40 non-flame retardant polypropylene pipe and corresponding fitting offerings by manufacturer:
Georg Fischer: pipe 1-1/2" – 12" and fittings 1-1/2" – 6" (flame retardant), 8"-10"-12" (non-flame retardant)
IPEX Enfield: pipe 1-1/2" – 12" and fittings generally from 1-1/2" – 6" with various larger diameter fabricated fittings available (manufacturer is purposely not listed below)
Zurn: pipe 1-1/2" – 6" and fittings 1-1/2" – 6" (all of which are flame retardant) – LINE ENDS AT 6"
Orion: pipe 1-1/2" – 12" and fittings 1-1/2" – 6" molded / 8" – 12" fabricated (all of which are flame retardant)]

1. Pipe and Fittings: Shall be schedule 40 acid resistant special waste pipe and drainage pattern fittings and the product of a single manufacturer. Polypropylene (PP) material shall meet ASTM D4101, fittings shall meet ASTM D3311, and all components shall meet ASTM D1599, ASTM D2122, and **ASTM F1412**.
2. Joints: Shall be full socket electrofusion welded joints and conform to ASTM F1290 and manufacturer's recommendations.
3. Acceptable manufacturers:
   a. Georg Fischer (GF) Piping Systems Fuseal PP
   b. Zurn Fusion-Lock PP
   c. Orion Socket Fusion PP ("brownline")
4. Connections between polypropylene and other piping materials shall be made using manufacturer's recommended adapters.

Note: Schedule 40 plenum rated, flame retardant polyvinylidene pipe and corresponding fitting offerings by manufacturer:
Georg Fischer: pipe 1-1/2" – 6" and fittings 1-1/2" – 6"
IPEX Enfield: only offers *screw type mechanical joints*, not electrofusion joints, so they are not listed below
Zurn: pipe 1-1/2" – 4" and fittings 1-1/2" – 4" – LINE ENDS AT 4"
Orion: pipe 1-1/2" – 12" and fittings 1-1/2" – 6" molded / 8" – 12" fabricated]

B. ACID WASTE PIPING, ABOVE GRADE (EXPOSED OR IN A RETURN AIR PLENUM)

1. Pipe and Fittings: Shall be flame-retardant schedule 40 acid resistant special waste pipe and drainage pattern fittings and the product of a single manufacturer. All components of the system shall be tested to UL 273/ASTM E84 and listed as having flame spread/smoke developed values not to exceed 25/50. Polyvinylidene fluoride (PVDF) material shall meet ASTM D3222, fittings shall meet ASTM D3311, and all components shall meet ASTM D1599, ASTM D2122, and **ASTM F1673**.
2. Joints: Shall be full socket electrofusion welded joints and conform to ASTM F1290 and manufacturer's recommendations.
3. Acceptable manufacturers:
   a. Georg Fischer (GF) Piping Systems Fuseal 25/50 PVDF
   b. Zurn Fusion-Lock PVDF
   c. Orion Socket Fusion PVDF
4. Connections between PVDF and other piping materials shall be made using manufacturer's recommended adapters

C. ACID WASTE PIPING, ABOVE GRADE (CONCEALED AND NOT IN A RETURN AIR PLENUM)

1. Pipe and Fittings: Shall be **flame-retardant** schedule 40 acid resistant special waste pipe and drainage pattern fittings and the product of a single manufacturer. Flame retardant polypropylene (PP) material shall meet ASTM D4101, fittings shall meet ASTM D3311, and all components shall meet ASTM D1599, ASTM D2122, and **ASTM F1412.** Additionally, the material shall demonstrate a flammability rating not to exceed V-2 per UL 94 and a classification of HB per ASTM D635.
2. Joints: Shall be full socket electrofusion welded joints (unless specifically stated otherwise below) and conform to ASTM F1290 and manufacturer's recommendations.
4. Acceptable manufacturers:
   a. George Fischer (GF) Piping Systems Fuseal FRPP
   b. Zurn Fusion-Lock FRPP
   c. Orion Socket Fusion FRPP ("blueline")
5. Connections between flame-retardant polypropylene and other piping materials shall be made using manufacturer's recommended adapters.
6. Provide the same manufacturer's mechanical joint type fittings (in lieu of socket fusion) for piping located in the following special situations:
   a. Within accessible equipment chases.
   b. Within millwork designed for piping access.
   c. Immediately below all fixtures including fixture traps and trap arms.

Note: CPVC is frequently being presented as a V.E. option for acid waste and vent systems, in the K-12 project sector in particular. For such applications, where harsh or high-concentration chemicals are not expected, CPVC *can* be appropriate. While this pipe material is more cost effective, it must be remembered that it is <u>not</u> nearly as robust as PVDF or polypropylene.

Additionally, these system manufacturers rely on either a *modified version* of UL 273/ASTM E84 (in the case of Spears) or an *alternative* test protocol (CAN/ULC-S102.2-03, in the case of Charlotte) to gain acceptance for return air plenum use.

Both systems below are accepted by City of Houston for plenum use. HOWEVER, DO NOT SPECIFY EITHER SYSTEM IN ABILENE.

Please be aware that in the absence of a specific, documented request from an Owner, our "go-to" standard should remain PVDF and polypropylene as specified above.

Paragraph D below should only be used where CPVC is specifically requested and also is acceptable to the local AHJ for plenum use.]

CPVC Pipe and Fittings (Above and below grade): All system pipe and fittings shall be from a single manufacturer, Schedule 40 CPVC manufactured of material in conformance with ASTM D1784 and in produced in accordance with ASTM F2618 from CPVC Type IV, ASTM Cell Classification 23447.

1. All pipe shall meet the dimensional requirements of ASTM F441 and all pipe markings shall be accompanied by a yellow stripe for ease of identification.
2. All fittings shall be drainage pattern meeting the requirements of ASTM D3311 and specialty patterns according to the manufacturer's specifications.
3. Joining shall be by solvent cement welding, using "one step" primer-less type CPVC cement specially formulated for chemical waste applications and manufactured in accordance with ASTM F493. Only cement from the system manufacturer shall be acceptable.
4. Mechanical connections for transition to other system materials shall be as specified by the pipe system manufacturer.
5. All installation shall be in accordance with the manufacturer's instructions and applicable codes.
6. **Compliance: Pipe material shall be tested to UL 273/ASTM E84 (or other such protocol acceptable to the local AHJ), shall be documented as having demonstrated flame spread/smoke developed values not to exceed 25/50, and as such be approved by the local AHJ as acceptable for use in return air plenums.**
7. Acceptable Manufacturers:
   a. Spears Manufacturing Company Lab Waste CPVC Drainage System.
   b. Charlotte Pipe and Foundry Chem-Drain CPVC Drainage System.

Note: Glass pipe is impervious to almost every corrosive and reagent known. It also doesn't burn or give off toxic vapors and therefore is inherently acceptable for return air plenum applications.

However glass is not typically used for acid waste and vent systems in the K-12 project sector. Paragraph E below is intended primarily for true research laboratories, medical projects, and higher education applications. Do not specify glass without first confirming with project manager, owner, or practice area leader.

Additionally, this paragraph is meant to be used in conjunction with buried polypropylene piping. Glass pipe *can* be buried underground, but as currently written, this paragraph does not address such installation.

B. Glass Pipe and Fittings (Above grade): All system pipe and fittings shall be from a single manufacturer, UL classified borosilicate glass conforming to ASTM C1053 and Federal Specification DD-G-541B.

   1. System shall include all glass straight lengths, fittings, traps, and compression type tetra-fluoro-ethylene (TFE) lined couplings for bead-to-bead or bead-to-plain end

joints made in accordance with manufacturer's requirements.

2. System couplings shall include a 300 series stainless steel outer band, Buna-N compression liner, TFE seal ring, and stainless steel bolt and silver plated stainless steel hex nut. Only glass and TFE seal rings may contact the waste fluid.
3. Joints between glass and other types of piping material shall be made with system manufacturer's adapters and/or according to manufacturer's recommendations.
4. System shall include padded pipe hanger supports, provided on horizontal runs at 8'-0" to 10'-0" on centers. Vertical risers shall be supported by padded risers clamps designed to restrict lateral and downward movement. Vertical risers shall be supported at every floor level.
5. System pipe shall not be installed with glass in direct contact with concrete. Provide fiberglass insulation or other type padding as approved by the pipe manufacturer.
6. Unless specifically noted otherwise, associated sink outlets, tailpieces, traps, and cup sinks shall be provided in system manufacturer's borosilicate glass.
7. Acceptable manufacturer: Kimax Laboratory Glass Drain and Vent System by Schott.

2.8 DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

SELECT ONE, but keep in mind that:
Ductile iron pipe is only available in sizes 3" and larger;
C900 is only available in sizes 4" and larger

A. Copper Tubing: ASTM B88, Type K, hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper alloy solder joint pressure fittings.
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.
3. Provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, for all buried piping. Chase Construction Products Tapecoat H35 or approved equivalent.

Note that in sizes 3" – 12" it appears ductile iron pipe is only available in pressure class 350, which exceeds the 150 minimum indicated below]

B. Ductile Iron Pipe: Minimum pressure class 150, ANSI/AWWA C151/A21.51

1. Fittings: Standard ductile iron or gray iron, ANSI/AWWA C110/A21.10.
2. Joints: Rubber-gasketed push-on joints, ANSI/AWWA C111/A21.11. Installation shall be in accordance with ANSI/AWWA C600.
3. Provide continuous polyethylene encasement for all piping in accordance with ANSI/AWWA C105/A21.5.

Note: Use PVC PIPE only on case by case basis, confirm project requirements with project manager

C. PVC Pipe: AWWA C900 PVC pressure pipe for potable water, UL 1285. Minimum pressure class 150. Gasketed integral bell type.

1. Fittings and Joints: ASTM D1784 PVC gasketed bell fittings for C900 pipe. Gaskets shall conform to ASTM F477.

2. Joints shall conform to ASTM D3139.

D. PVC Pipe: ASTM D1785, NSF 61 schedule 80 system, the product of a single manufacturer.

1. Fittings: ASTM D2464/D2467 schedule 80 PVC.
2. Joints: ASTM D 2855, solvent weld with ASTM D2564 solvent cement.

E. PVC Pipe: ASTM D1785, NSF 61 schedule 40 system, the product of a single manufacturer.

1. Fittings: ASTM D2466 schedule 40 PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

F. PVC Pipe: ASTM D2241, NSF 61, not to exceed SDR-26, and with no less than a 150 psi pressure rating, the system shall be the product of a single manufacturer.

1. Fittings: ASTM D2466 PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.9 DOMESTIC WATER PIPE, BURIED WITHIN 5 FEET OF BUILDING EDGE, BELOW GRADE

DBR standard is for piping for domestic water service entries to be wrapped or coated for corrosion protection as a matter of good practice, <u>regardless</u> of soil conditions. This will also help ensure consistency and ease of recognition during site observation visits.

Note that ductile iron is only available in sizes 3" and larger. Also, it appears that DI pipe in sizes 3” through 12” is only available in pressure class <u>350</u>, exceeding the 150 minimum indicated below.

A stainless steel riser is an excellent option but is available in sizes 4" and larger only (4”, 6”, 8”, 10”).]

A. Copper Tubing: ASTM B88, Type K, soft annealed. Provide for pipe sizes up to and including 2-1/2”.

1. Fittings: ASTM B16.22 wrought copper pressure fittings.
2. Joints shall be as follows:
   a. **No joints shall be permitted for pipe sizes 2” and smaller. All such piping must be run continuous below slab on grade and brought up to no less than 12” above the finished floor before any joint is provided.**
   b. For sizes larger than 2”, joints between copper pipe and fittings shall be brazed and shall be made in accordance with all the applicable portions of ASTM B828, manufacturer’s recommendations, and AWS requirements. Brazing filler metal shall be in accordance with AWS A5.8 and any required flux shall meet AWS A5.31, Type FB3-A or FB3-C.
8. Beginning at no closer than the 5’-0” mark from the building, all piping buried or in contact with concrete shall be provided with one of the following, which shall also extend to a minimum of 6” above the finished floor:
   a. AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer’s installation guidelines. Chase Construction Products Tapecoat H35 or approved equivalent.
   b. Continuous polyethylene lining, minimum 60 mil nominal thickness.

C. Ductile Iron Pipe: Minimum pressure class 150, ANSI/AWWA C151/A21.51. Provide for pipe sizes 3” and larger.

1. Fittings: Standard ductile iron, ANSI/AWWA C110/A21.10.
2. Joints: Rubber-gasketed and bolted mechanical joints, ANSI/AWWA C111/A21.11. Installation shall be in accordance with ANSI/AWWA C600 and approved pipe lubricant shall be used for optimum gasket sealing and long-term performance.
3. Note: A single fitting may be installed below slab on grade to facilitate underground pipe entry up to above floor from an immediately adjacent exterior building wall.
4. Provide continuous polyethylene encasement for all piping buried or in contact with concrete in accordance with ANSI/AWWA C105/A21.5, beginning at no closer than the 5’-0” mark from the building and to a minimum of 6” above the finished floor.

D. Stainless Steel Pre-Fabricated In-Building Riser (acceptable for sizes 4” and larger).

1. Corrosion resistant Type 304 stainless steel construction single, extended 90 degree fitting.
2. UL listed, FM approved and NFPA 24 compliant.
3. Lead free and NSF/ANSI 61 (372) certified.
4. Acceptable manufacturers:
   a. Ames Fire & Waterworks Series IBR
   b. Zurn Wilkins Model WBR
5. Note: For this application, the inlet joint (which **shall not** be located below a building slab or foundation) can be rubber gasketed push-on type, ANSI/AWWA C111/A21.11. Installation shall be in accordance with ANSI/AWWA C600.
6. Provide continuous polyethylene encasement for all piping buried or in contact with concrete in accordance with ANSI/AWWA C105/A21.5, beginning at no closer than the 5’-0” mark from the building and to a minimum of 6” above the finished floor.

2.10 DOMESTIC WATER PIPING, WITHIN BUILDING, BELOW GRADE

A. Copper Tubing: ASTM B88, Type K, soft annealed.

1. No joints allowed below slab, run tubing continuous.
2. Provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer’s installation guidelines, for all piping buried or in contact with concrete, to a minimum of 6" above finished floor. Chase Construction Products Tapecoat H35 or approved equivalent.
3. Applies to installations including services to island sinks and trap primer lines.

2.11 DOMESTIC WATER PIPING, WITHIN BUILDING, ABOVE GRADE

Note: There are a variety of methods for joining copper pipe. Solder (aka sweat) joints are the traditional, tried and true, universally accepted method for joining copper pipe.

There are also mechanical joining methods, including: grooved joint and coupling systems and press-connect fitting and joining systems.

HOWEVER, The acceptability of grooved joints and press-connect joints must be confirmed with the owner; some owners may still insist on sweat fittings across the full range of pipe sizes.

Grooved copper joining systems are available for pipe sizes 2 inches and larger.

Press-connect joining systems are available for pipe sizes 1/2" through 4” in size.

Our standard is to call for sweat joints for sizes 2" and smaller and for grooved joints for pipe sizes 2-1/2" and larger.

The inclusion of paragraph A3 below allows for the use of press-connect fittings in the available sizes in lieu of sweat joints. Please note that A3 as written does not allow for the use of press-connect valves and we do not have press-connect valves listed in our "valve" articles.

For a system with sweat fittings only, delete both A3 and A4 below and make sure to also delete paragraph 2.18 BUTTERFLY VALVES (GROOVED).]

A. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper alloy solder joint pressure fittings.
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.
3. Fittings and joints for pipe sizes 1/2" through 4" may be mechanical press-connect system joints with ASME B16.51 lead-free copper bodied fittings with integral ethylene-propylene diene monomer rubber (EPDM) sealing gaskets. All fittings, couplings, and adapters shall be the product of a single system manufacturer and only that manufacturer's approved press tools, kits, and jaws shall be used.
   a. EPDM o-rings shall be pre-installed and lubricated with ANSI/NSF 61 listed lubricant.
   b. All installers of copper press-connect fittings shall be trained by the fitting manufacturer's appointed representative and carry such credentials for the duration of the project.
   c. The fitting manufacturer's representative shall conduct periodic inspections of the installation and shall provide written reports of such inspections to the Contractor and Engineer, including any observed deviations from the manufacturer's recommended installation practices.
   d. Acceptable system manufacturers: Viega or pre-approved equal.
4. Fittings and joints for pipe sizes 2-1/2 inch and larger shall be rolled groove type for copper tubing with all tools, couplings, adapters, fittings, gaskets, and **valves** the product of a single system manufacturer.
   a. Fittings shall be cast bronze using lead-free alloys per ASTM B584 or copper wrought copper constructed to ASTM B75, compliant with NSF/ANSI 61 for potable water service applications, and meet ASTM F1548.
   b. Couplings shall be epoxy/enamel (rust-inhibiting) coated ductile iron housings conforming to ASTM A536.
   c. Gaskets shall be EPDM for potable water, meeting ASTM F1476, and NSF 61/NSF 372 certified for potable water service from 30 degrees to 180 degrees F.
   d. Acceptable system manufacturers: Victaulic, Grinnell, Anvil Gruvlok.

Note: Use PVC only on case by case basis, confirm with project manager

Remember that PVC (regardless of wall thickness) is not suited for applications where the operating temperature will exceed 140F; as such it should not be used for domestic hot water

CPVC is suited for temperatures up to and including 200F, but the pressure rating varies with pipe schedule, pipe size, and (most importantly) fluid temperature

When using/allowing CPVC, we have standardized on schedule 80 wall thickness. This provides increased crush resistance, increased puncture resistance, and less tendency for installed piping to sag when compared to schedule 40. Schedule 80 pipe and fittings are available across a range of sizes (1/2" through 24")

While schedule 80 CPVC technically may be threaded, this is not recommended and we do not allow it – rather, molded threaded adapters must be used where threaded connections are needed.]

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B. PVC Pipe: ASTM D1785, NSF 61 schedule 40 system, the product of a single manufacturer.

1. Fittings: ASTM D2466 schedule 40 PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

C. PVC Pipe: ASTM D1785, NSF 61 schedule 80 system, the product of a single manufacturer.

1. Fittings: ASTM D2464/D2467 schedule 80 PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

D. CPVC Pipe: ASTM D1784 minimum cell classification 23447 for chlorinated polyvinyl chloride compounds, NSF 61 schedule 80 system, the product of a single manufacturer per ASTM F441.

1. Fittings: ASTM F439 schedule 80 CPVC.
2. Joints: solvent cement in accordance with manufacturer's recommendations using ASTM F493 cement, in conjunction with ASTM F656 primer when recommended or when required by code.
3. **Compliance: Pipe material shall be tested to UL 273/ASTM E84 and listed as having flame spread/smoke developed values not to exceed 25/50 and be approved by the local AHJ as acceptable for use in return air plenums.**
4. Acceptable system manufacturers:
   a. Spears Manufacturing Company EverTUFF
   b. Georg Fischer Harvel, LLC

2.12 ADAPTERS, TRANSITIONS, UNIONS, COUPLINGS, FLANGES, CONNECTORS

A. (Non-Acid Waste) Drainage Applications:

1. Provide approved listed adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements.
2. For dissimilar piping above ground, provide stainless steel shielded, molded elastomeric couplings and adapters meeting ASTM C564 and ASTM C1460. Applies to installations including PVC transitions immediately adjacent to building slabs on grade.
3. For dissimilar underground piping not below building slab, provide shear resistant .012" thick 300 series stainless steel shielded, PVC gasketed flexible couplings and adapters meeting ASTM D5926 and ASTM C1173. For direct-bury applications, provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, to completely wrap the shield, banding, and screws. Chase Construction Products Tapecoat H35 or approved equivalent.
4. Acceptable manufacturers:

a. Anaco-Husky/Cremco
b. Mission Rubber Company LLC
c. Fernco, Inc.
d. Fernco, Inc. Strong Back RC 1000 Series (underground piping, not below building slab; or readily accessible underground piping transitions in backwater valve pits, etc.)

5. Adapters, couplings, bushings for copper DWV pipe shall be cast bronze or wrought copper, ASME B16.23/B16.29.

B. Domestic Water Applications:

1. Provide joints between various materials with approved adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements and the manufacturer's instructions.
2. For copper tube and pipe: adapters, bushings, plugs, caps, and couplings shall be wrought copper or cast bronze; flanges (minimum class 150) and unions shall be cast bronze. Provide with solder or threaded connections as necessary and as produced to applicable ASME standards B16.15, B16.18, B16.22, B16.24, B16.50, B1.20.1. All such appurtenances shall be for use in above ground potable water systems.
3. Above slab transitions for water service entries:
   e. 100% fusion bonded epoxy coated ASTM A536 cast ductile iron construction coupling with acrylonitrile butadiene rubber (NBR) gaskets and EPDM insulating boot for water service. 5/8 inch high strength stainless steel bolts and nuts. Coupling shall meet AWWA C219. Romac Industries, Inc. IC501 or pre-approved equivalent.
   f. 100% fusion bonded 14 mil epoxy coated coupling with ASTM A536 cast ductile iron rings. Complete with acrylonitrile butadiene rubber (NBR) gaskets and type 304 stainless steel bridge, spacers, nuts, and bolts. Coupling shall meet AWWA C219, NSF 61, and NSF 372. Krausz USA Hymax Grip Coupling Restraint or pre-approved equivalent.
4. Dielectric connections:
   a. For pipe sizes 2 inch and smaller, provide lead-free dielectric unions, rated to 180 F at 250 psi and compliant to ASSE 1079.
   b. For pipe sizes larger than 2 inches, provide lead-free dielectric flanged pipe fittings, rated to 180 F at 175 psi and meeting ASME B16.1.
   c. For grooved copper joining systems, provide grooved end dielectric transition fitting from system manufacturer, with virgin polypropylene internal lining, meeting NSF 61.

C. General:

1. Unions for ferrous pipe shall be ASTM B16.39 galvanized malleable iron, threaded, minimum pressure class 150.
2. Plugs and bushings for ferrous pipe shall be ASME B16.14 galvanized malleable iron, threaded.
3. Nipples for ferrous pipe shall be schedule 40, galvanized, ASTM A53 welded steel pipe nipples, threaded, meeting ASTM A733.
4. Couplings for ferrous pipe shall be galvanized steel, threaded, manufactured in accordance with ASTM A865.
5. Flanges for ferrous pipe shall be galvanized forged steel construction, either socket weld or slip-on weld type, minimum pressure class 150, manufactured to ASME B16.5.
6. Bolts, nuts, and gaskets for flanged connections shall be appropriate to the pipe material, fluid type, temperature, and pressure. 1/16" thick pre-formed neoprene, typical.

7. Provide flexible stainless steel connectors at pumps and other such equipment, in accordance with manufacturer's recommendations. Connectors shall have corrugated hose and braided 300 series stainless steel jacketing. Carbon steel flanged or grooved ends as appropriate. NSF 372 lead-free for all potable water applications. Metraflex Company or pre-approved equivalent.

Note: Kitz is a reputable but Japanese based manufacturer. They do NOT offer valves that meet domestic manufacture requirements so they are no longer listed as a first spec manufacturer. They may come up as a V.E. item, and are a valid consideration. Kitz could potentially apply to iron gate valves, ball valves (forged brass in sizes up through 3"and cast bronze bodied in 4" only), butterfly valves, and iron check valves (flanged).

2.13 GATE VALVES (IRON)

A. ASTM A126 cast iron bodied, class 125 gate valve with bolted bonnet, non-rising ASTM B16 brass stem and packing gland, solid wedge, cast iron hand-wheel. Bronze wedge for sizes up through 6" and cast iron wedge with bronze bushing and wedge face rings for sizes 8" and larger.

B. Basis of design:

1. NIBCO T-619 (threaded) for sizes 2" through 4".
2. NIBCO F-619 (flanged) for sizes 6" and larger.

C. Acceptable alternate manufacturers:

1. Apollo
2. Milwaukee

D. Applies to only to limited installations such as services from submersible pumps and ejectors. Not to be used for domestic water systems.

2.14 GATE VALVES (DUCTILE IRON)

A. Fusion bonded epoxy coated ASTM A536 ductile iron bodied, class 125 gate valve with bolted bonnet, non-rising Type 304 stainless steel stem, resilient wedge. End connections as suited for adjacent piping. Provide with square operating nut for extended handle operation or with hand-wheel as appropriate for depth of burial and access. Certified lead-free to NSF 61/NSF 372 and AWWA C509 & C515 compliant (3" and larger).

B. Basis of design:

1. NIBCO 619 series for sizes 2" through 12".

C. Applies to outdoor, buried below grade domestic water main installations beyond 5 feet from the building edge. Not to be used inside of buildings.

2.15 BALL VALVES

NIBCO T-585-66-LF is a very robust valve, cast construction. For reference, NIBCO T-685-66-LF (not listed) is also a good valve, but it is forged construction and doesn't have as much mass/material by comparison; additionally it is made in MEXICO – therefore the 685 series may be suited for very budget conscious projects or perhaps as a V.E. item

"66" suffix indicates stainless steel trim (ball, valve handle, and valve stem); a FULL stainless steel ball is superior to and offers more longevity than a chrome plated ball; the chrome plating can flake off over time

Note: Regarding ball valves 2-1/2" and larger: they are rather expensive, they take up significant space to install and fully operate the handle, and they can take significant effort to physically operate in larger sizes – although gear operated versions are available.
Therefore, for sizes 2-1/2" and larger, if acceptable to the owner, butterfly valves are preferable to ball valves. This must be confirmed on a project by project basis. IF butterfly valves are acceptable, then delete B2, C, D3 and D4 immediately below.

Note: While press-connect fitting manufacturers also offer ball valves with press-fit ends, these are not included below.

A. All bronze cast construction two-piece 600 psi body, blow-out proof stem, Teflon seated, lead-free, with stainless steel trim (including ball, stem, and valve handle). Threaded connections. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

B. Basis of design (bronze valves):

1. NIBCO T-585-66-LF (full port) for all sizes up through 2".
2. NIBCO T-580-66-LF (conventional port) for sizes 2-1/2" and 3".

C. Valves 4" and larger shall be split body stainless steel construction, 275 psi cold working pressure, blow-out proof stem, PTFE seated, type 316 stainless steel trimmed, class 150, full port design with manual gear operator. NIBCO F-515-S6-F-66-FS.

D. Acceptable alternate manufacturers:

1. Apollo 77 CLF-A series (full port) for all sizes up through 2".
2. Milwaukee UPBA-400S (full port) for all sizes up through 2".
3. Apollo 77 CLF-A series (full port) for size 2-1/2" and Apollo 70LF-140 series (standard port) for 3".
4. Milwaukee UPBA-100S (standard port) for sizes 2-1/2" and 3".

E. Applies to domestic water system installations.

F. Provide valves complete with extended lever handles as required to accommodate insulation and full valve operation.

G. Provide valves complete with memory stop kit where used for balancing applications.

Note: Keep section below for butterfly valves IF these are acceptable to the owner for larger size (2-1/2" and larger) isolation valves. If acceptable, also make the appropriate deletions to ball valve paragraph as indicated above.

2.17 BUTTERFLY VALVES

A. ASTM A536 ductile iron bodied, (minimum) 200 psi lug type wafer style butterfly valve with ASTM A582 Type 400 series stainless steel stem, ASTM B148 aluminum bronze disc, and EPDM rubber seat/lining. Extended neck. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

B. Basis of design:

1. NIBCO LD-2000-3 (lever handle operated) for sizes 2-1/2" through 4".

2. NIBCO LD-2000-5 (manual gear operated) for sizes 6” and larger.
3. Install between standard ASME (minimum) class 125 flanges in accordance with manufacturer’s recommendations.

C. Acceptable alternate manufacturers:

1. Apollo
2. Milwaukee ML233E (lever handle operated) and ML333E (manual gear operated).

D. Applies to domestic water system installations.

2.16 BUTTERFLY VALVES (GROOVED)

A. Grooved end, lead-free, copper alloy bodied, 300 psi butterfly valve with EPDM encapsulated ductile iron or aluminum bronze disc, EPDM seat/seal, stainless steel stem and trim, and extended neck. ANSI/NSF 61 certified for potable water systems. Lever handle operated for sizes 2-1/2” through 4” and manual gear operated with handwheel for sizes 6” and larger.

B. Acceptable manufacturers:

1. Victaulic 608N (cast brass body with aluminum bronze construction disc).
2. Grinnell B680 (ASTM B584 bronze bodied).
3. Anvil Gruvlok Series 6700 CTS (ASTM B584 bronze bodied).

C. Applies only to domestic water system installations employing grooved copper joining systems, as specified elsewhere in this section. Manufacturers shall only be acceptable where their grooved systems are provided.

2.17 CHECK VALVES (BRONZE)

A. ASTM B62/ASTM B584 bronze body and disc, minimum 200 psi (cold working pressure) Y-pattern horizontal swing type check valve with removable bronze bonnet, Type 300 series stainless steel nuts and hinge pin, and PTFE disc seat. Threaded connections. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

B. ASTM A126 cast iron bodied, (minimum) class 125 globe style spring loaded (silent) check valve with ASTM B584 bronze disc and seat. Flanged connections. Certified lead-free to NSF 61/NSF 372 and suited to 200 degrees F.

C. Basis of design:

1. NIBCO T-413-Y-LF (Y-pattern swing type) for sizes up through 2”.
2. NIBCO F-910-B-LF (globe style spring loaded type) for sizes 2-1/2” and larger.

D. Acceptable alternate manufacturers:

1. Apollo (for sizes up through 2”)

E. Applies to domestic water system installations including associated pump discharge lines. Valves shall be suited for installation in both horizontal lines and vertical lines with upward flow, in accordance with manufacturer’s recommendations.

2.18 CHECK VALVES (IRON)

A. ASTM A126 cast iron bodied, (minimum) class 125 conventional horizontal swing type check valve with bronze, cast or ductile iron disc. 200 psi cold working pressure. Threaded or flanged connections.

B. Basis of design:

1. NIBCO T-918-B (threaded connections) for sizes 2” through 4”.
2. NIBCO F-918-B (flanged connections) for sizes 6” and larger.

C. Acceptable alternate manufacturers:

1. Apollo (flanged in all sizes)
2. Milwaukee F-2974A (flanged in all sizes)

D. Applies only to limited installations such as services from submersible pumps and ejectors. Not to be used for domestic water systems.

Note: Pressure reducing valves come in two main types: direct-acting (DA) and pilot operated (PO). Direct-acting valves typically use a screw adjustable spring which regulates the position of a piston or diaphragm to control the pressure. Pilot operated valves are more complex and themselves integrate a direct-acting valve into their design to help throttle the main valve open and closed.

Generally speaking:
DA valves are less expensive in initial cost and maintenance compared to PO valves.
PO valves are well suited to function efficiently over a very wide range of inlet pressures and flow rates. That is, they tend to regulate pressure very uniformly throughout their capacity (flow rate) range.
DA valves should not be used for large flows where a high initial pressure must be greatly reduced to a low system pressure. PO valves are best for large pressure reductions.
Conversely, PO valves are not well suited for operation with small pressure differentials.

For assistance with PRV selection, scheduling, and specification editing, see Practice Area Leader and/or consult manufacturer’s representative.]

2.19 PRESSURE REGULATING VALVES (PRV’s)

A. ASTM B62/ASTM B584 bronze bodied direct acting, ASSE 1003 single diaphragm type pressure regulating valve with removable bronze bonnet, in-line stainless steel strainer and spring, and FDA approved EPDM seat disc and Buna-N diaphragm. Threaded connections. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

B. NSF 61 epoxy coated ductile iron bodied pilot-operated globe style pressure regulating valve assembly. Complete with low-flow bypass and stainless steel, bronze, and copper trim and fittings. NSF 61 EPDM seat disc and diaphragm. Threaded or flanged connections. Suited to 180 degrees F.

C. Basis of design:

1. Apollo PRH-T-Y-LF (36HLF series) for direct acting valves, sizes up through 3”.
2. Apollo A127-LF series for pilot operated valves, sizes 1-1/4” through 4”.

D. Acceptable alternate manufacturers:

1. Cla-Val
2. Victaulic (pilot-operated valves)

E. PRV's shall automatically reduce inlet pressure to a steady lower downstream pressure, regardless of changing flow rate. Provide complete with inlet strainer, inlet and outlet pressure gauges, isolation valves, and unions. Provide bypass line around assembly with normally closed valve.

Note: ThermOmega Tech offers balancing valves up through 2" in size. If there is a need for a domestic hot water balancing valve in a larger size, confer with practice area leader.

2.20 BALANCING VALVES

A. Self-contained, fully automatic thermally actuated balancing valve shall continuously adjust flow to maintain the desired domestic hot water temperature within the branch line, regardless of system operating pressure. Valve shall modulate between open and closed position within a 10 degrees F range. Valve body and all internal components shall be constructed of stainless steel with major components constructed of Type 303 stainless. Rated for 200 psi maximum working pressure and no less than 250 degrees F maximum working temperature. Lead-free and ANSI/NSF 61 compliant. Threaded connections.

B. Basis of design:

1. ThermOmegaTech Circuit Solver, sizes 1/2" through 2". Provide a union and ball type shutoff valve on both sides of the balancing valve.
2. ThermOmegaTech Circuit Solver with integrated union (CSU) assembly, sizes 1/2" and 3/4". Balancing valve assembly shall come complete with union body and ball type shutoff valves on both sides.

C. Applies to circulated domestic hot water system installations including multi-branch parallel piping circuits and single-loop piping circuits.

1. Provide balancing valve at end of **each** domestic hot water supply line (after last fixture served) just prior to the hot water return line, as indicated on Drawings and in accordance with manufacturer's installation recommendations.
2. Provide a pipe tee or elbow with bushing as appropriate, 3/4" threaded thermowell, and bi-metal adjustable angle 3 inch dial thermometer upstream of each balancing valve. Thermowell stem length and thermometer temperature probe length to be suited for pipe size, insulation thickness, and to ensure clearance for maintenance access and easy viewing of thermometer. Trerice bimetal/sensor, threaded-stepped shank thermowell (style 76) of lead-free brass (PBF) material. Trerice Model B836 thermometer with 300 stainless steel case and stem, hermetically sealed, double strength glass windowed, aluminum white-faced dial, complete with external reset and 0 to 200 degrees F range. Thermowell and thermometer face to be oriented upright for readability.

PART 3 - EXECUTION

3.1 EXCAVATION, BEDDING AND BACKFILL

A. This section shall apply for the excavation, bedding, and backfill of all buried piping unless specifically noted otherwise. All work shall be coordinated with any job site subsurface drainage/dewatering and adjusted accordingly.

B. Establish elevations of buried piping outside the building to ensure the following:

1. Not less than 2 feet of cover, or not less than maximum depth of frost penetration, whichever is the greater.

2. For water lines intended for fire protection service, the depth of cover shall be:
   a. Not less than 2'-6" in those locations where frost is not a factor.
   b. Not less than 1'-0" below the frost line for the locality.
   c. Not less than 3'-0" for piping under driveways.
   d. Not less than 1'-0" below the bottom of the building foundation/footers.
   e. In full compliance with the requirements of NFPA 13 and NFPA 24.

C. Excavation:

1. Excavate trenches for underground piping to the required depths.
2. The bottom of the trench or excavation shall be cut to a uniform grade.
3. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp to existing density.
4. Coordinate alignment of pipe trenches to avoid obstructions. Ensure that proposed routing of pipe will not interfere with building foundation before any trenching has begun. Should conflicts occur, contact Architect/Engineer before proceeding.
5. Should any sleeving of the building foundation be required, this shall be provided as directed by the structural engineer of record AND in accordance with the prevailing code, but in no case shall the sleeve be any less than two (2) pipe sizes greater than the pipe it serves.

D. Bedding and Backfill:

1. Backfill shall not be placed until the piping has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades indicated on drawings. **Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe**. Provide select fill up to finished surface or grade, unless indicated otherwise by project geotechnical report or specified otherwise in Division 02.
2. Compacting Backfill: Place material in uniform layers of 8 inches maximum, loose measure and compact to not less than 95% of maximum soil density as determined by ASTM D-698 Standard Proctor.
3. Restoration: Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks and similar areas, to a condition equal to the adjacent undisturbed earth and restore surface of the area to the condition existing prior to trenching or excavating operation.
4. A clay fill "trench plug" extending 3 feet inside the building line and 5 feet outside the building line shall be placed to completely surround utility lines passing beneath the foundation and grade beam. The materials shall consist of on-site soils with a plasticity index (PI) between 30 and 40 percent compacted to at least 95 percent of the Standard Proctor and maximum dry density as determined by ASTM D-698.

E. Cement Stabilized Sand:

1. Materials:
   a. Cement shall be Type I Portland cement conforming to ASTM C150.
   b. Sand shall be clean, durable sand meeting grading requirements for fine aggregates of ASTM C33 and free of organic matter and deleterious substances.
   c. Water shall be potable and free of oils, acids, alkalis, organic matter, or other deleterious substances, meeting requirements of ASTM C94.
2. Mixture:
   a. Product shall consist of not less than 1.5 sacks of Portland cement per ton of dry sand.
   b. Mixture shall contain sufficient water to hydrate the cement and be thoroughly mixed in a pugmill type mixer.

F. For water lines (including In-Building Risers) intended for fire protection service, provide joint restraints by way of concrete thrust blocks in accordance with the requirements of NFPA 13 and NFPA 24.

G. Aggressive Soil Conditions: Soil shall be considered aggressive and protection of buried metallic piping shall be provided as specified if any of the following situations exist:

1. Conditions are identified as such by the project geotechnical report or project geotechnical engineer.
2. The soil environment is a landfill area, swamp, marsh, polluted river bottom, cinder bed, or has alkaline soils.
3. A score of ten or higher is tallied when applying the soil assessment tool detailed in Appendix A of AWWA C105. An excerpt of this evaluation procedure is provided below for reference but is not intended as a substitute for the complete and latest Standard:

Numerical Corrosivity Scale

Soil Parameter	Assigned Points
Resistivity (ohm-cm)	
<700	10
700 – 1,000	8
1,000 – 1,200	5
1,200 – 1,500	2
1,500 – 2,000	1
>2,000	0
pH	
0 – 2	5
2 – 4	3
4 – 6.5	0
6.5 – 7.5	0
7.5 – 8.5	0
>8.5	3
Redox Potential (mV)	
>100	0
50 – 100	3.5
0 – 50	4
<0	5
Sulfides	
Positive	3.5
Trace	2
Negative	0
Moisture	
Poor drainage continuously wet	2
Fair drainage generally moist	1
Good drainage generally dry	0

H. Building Sub-Surface Drainage System Installation:

1. The following general installation provisions are intended to complement, not conflict with, the recommendations of the project geotechnical report. In the event of a conflict with or more stringent requirements in this report, it shall govern the installation of this system.
2. Such pipe shall be bedded and surrounded by filter material of suitable gradation. Refer to the recommendations of the project geotechnical report.
3. Drainage system shall be provided directly behind and at the bottom of below grade walls, within granular drainage medium as specified and in accordance with the latest project geotechnical report.

3.2 INSTALLATION

A. General requirements for piping:

1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
2. Remove any scale, oil and dirt, on inside and outside, before assembly.
3. Prepare piping connections to equipment with flanges or unions.
4. Confirm pipe placement, depth/elevation, and flow lines prior to any installation.

B. General requirements for valves:

1. Install valves with stems upright or horizontal, not inverted.
2. Valves shall be line-sized unless specifically noted otherwise.
3. Provide clearance for installation of insulation and access to valves and operable fittings. Valves installed beyond reasonable reach shall be provided with a chain operator.
4. Provide access doors where valves and operable fittings are not otherwise accessible. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.
5. Gate valves installed below grade shall be covered with an adjustable cast iron roadway box extended to grade. Cover shall be cast iron with 'water' cast on top of cover and shall be set flush to finished paving or 2" above finished earthen grade. Box shall be supported from undisturbed soil or concrete base and shall not introduce any stress to piping under all traffic conditions.

C. Install all materials in accordance with the manufacturer's published instructions.

D. All exposed sewer and water pipe in toilet rooms or other finished areas of the building shall be chrome plated.

E. Provide non-conducting dielectric connections wherever joining dissimilar metals.

F. Route piping in an orderly manner, parallel and perpendicular to building column grid lines, unless indicated otherwise on drawings, and maintain gradients.

G. Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

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 encasement for and support for utility meters in accordance with the requirements of utility companies.

L. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

M. Maintain uniformity in the installation of piping materials and joining methods. Do not mix material types.

N. Where connecting new underground sanitary, storm, or vent piping to existing piping of dissimilar material, provide suitable mechanical transition fittings complete with corrosion protection for metallic elements. Chase Construction Products Tapecoat H35 or approved equivalent and a final coat of coal tar to completely cover the transition.

O. Solder joints shall be wiped clean at each joint, remove excess metal while molten and flux residue when cooled.

P. Waste nipple from wall to tapped tee shall be schedule 40 threaded galvanized steel pipe or brass or copper with threaded adapter.

Q. General requirements for cast iron piping installation:

1. Install all pipe and fittings in accordance with published recommendations from the manufacturer and the Cast Iron Soil Pipe Institute (CISPI). Specific items referenced below are not intended as a substitute for the complete and latest recommendations.
2. Install bell and spigot type pipe with bell end upstream.
3. Above ground horizontal pipe (suspended) shall:
    a. Be supported at no less than at every joint, and within 18” of the hub or coupling.
    b. Be maintained in alignment. Sagging or grade reversal shall be unacceptable.
    c. Be supported at terminal ends of all runs or branches and at each change of direction or alignment.
    d. Have all closet bends, traps, trap arms, and similar branches firmly secured.
    e. Be braced to prevent movement or joint separation.
    f. Be provided with suitable sway bracing (such as clamps, rods, and hardware) where pipe and fittings are suspended in excess of 18” by means of non-rigid hangers.
4. Above ground vertical pipe shall:
    a. Be secured at each stack base.
    b. Be secured at each floor and riser clamps shall be provided on no greater than 15’-0” intervals.
    c. Be adequately supported to keep the system (pipe and contents) in alignment.
5. Provide seismic restraints in seismically active areas, whether specifically required by the prevailing code or not.

Note: Paragraphs R, S, T, U, V and W below apply to projects with PVC piping and can be deleted as appropriate when there is no PVC piping specified.

R. For all underground non-metallic piping outside the building, provide minimum 14 AWG solid copper tracer wire (ASTM B-1, B-3) with high molecular weight polyethylene insulation

(HMWPE) per ASTM D-1248. Wire shall be suited for direct bury applications to facilitate the detection and tracing of underground piping systems. THHN wire and other such nylon jacketing shall not be allowed. Insulation color shall be provided per the particular utility, in accordance with the American Public Works Association (APWA) uniform color code. Provide corrosion proof wire connectors with twist locking design and protective dielectric sealant. Copperhead Industries, LLC Snakebite or pre-approved equivalent. Tracer wire shall be placed in the same orientation as the installed pipe and laid six inches directly above the piping. One end of the tracer wire shall be brought aboveground at a building wall or riser for easy identification.

S. **No PVC pipe or fittings, or similar un-rated material, will be allowed in any areas where pipe is to penetrate a fire rated assembly or is to be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure**

T. Installations of underground thermoplastic piping systems shall be in strict conformity with the manufacturer's published instructions and the requirements of ASTM D2321 (gravity pipe) and ASTM D2774 (pressure pipe).

U. Installation of above ground thermoplastic piping systems shall be in accordance with the manufacturer's recommendations. The specific items indicated below are not intended as a substitute for the complete and latest manufacturer's recommendations.

1. Hangers and supports shall not compress, distort, cut, or abrade the piping. Nor shall they force the pipe and fittings into position.
2. Piping shall be supported at intervals sufficiently close to maintain pipe alignment and to prevent any sagging or grade reversal. System maximum operating temperature will determine support spacing.
3. Piping shall be supported at all branch ends and at all changes of direction, as close as practical to the fitting to avoid introducing excessive torsional stresses into the system.
4. Directly support (or if need be, immediately adjacent to) concentrated loads in the system, such as valves and other appurtenances.
5. Allowances must be made for thermal expansion and contraction of the piping system where temperature fluctuations can reasonably be expected to produce such movement. Provide and place hangers accordingly so as not to restrict.
6. Plastic piping systems shall not be placed alongside steam or other high temperature pipe lines or other high temperature objects.
7. Drainage piping shall be supported at trap arms as close as possible to the trap and all closet bends shall be supported and braced.

V. Installation of solvent cement joints for PVC and CPVC piping shall be in strict conformity with the requirements of ASTM D2855 and manufacturer's published instructions.

W. Provide approved heavy duty transition coupling at each transition from above ground cast iron pipe to underground PVC pipe as specified elsewhere in this section. Transition shall be made as close as possible to the floor for sanitary DWV piping systems and at test tee "minimum 12 inches A.F.F." for storm drainage piping. Support vertical cast iron pipe from floor anchors using riser clamp and galvanized all thread rod as specified in Section 22 05 29.

X. All grooved system tools and components (couplings, adapters, fittings, gaskets, **valves**, and specialties) shall be the product of a single domestic system manufacturer.

Y. Grooved pipe system manufacturer shall provide on-site training for contractor's field personnel by a factory trained representative in the proper use of grooving tools,

application of groove, and product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products at no additional cost to the owner.

3.3 APPLICATION

A. Provide union downstream of all valves at equipment or apparatus connections.

B. Provide male adapters each side of threaded valves in copper piped system. Sweat solder adapters to tube prior to make-up of threaded connections.

C. Provide approved isolation valves for shut-off and to isolate all equipment items and distinct parts of systems. Isolation valves shall be provided for both hot and cold water in locations including, but not necessarily limited to, the following:

1. At each floor for each domestic water tap branching off from a vertical riser.
2. At each domestic water branch line capped for future use.
3. At each restroom or restroom group.
4. At each hose bibb, wall hydrant, hose reel, and trap primer device (except for flush valve or tailpiece type trap primer devices).
5. At each domestic water branch line within 24” of the corresponding main.
6. At each plumbing fixture not otherwise served by a localized fixture group isolation valve.

D. Each plumbing water rough-in stub out shall be fitted with a supply stop.

E. Valves installed in insulated piping shall be fitted with extended lever operators of sufficient length to raise handle above the insulation jacket material. Where valve is used for throttling service, the valve handle shall be equipped with adjustable memory stop device.

F. Provide non-slam type check valves on discharge lines from all water pumps. Install at a minimum length of 5 times the pipe diameter from the pump and in accordance with manufacturer’s installation recommendations.

3.4 ERECTION TOLERANCES

A. All gravity drainage lines in the building shall have 1/4 inch per foot fall where possible and not less than 1/8 inch per foot fall toward the main sewer. Pipe must be laid so that the slope will be uniform and continuous. Permission shall be secured from the Architect and Engineer before proceeding with any Work where existing conditions prevent the installation at the minimum grade specified.

B. All vent and branch vent pipes shall be graded and connected as to drip back by gravity to the drainage pipe it serves. A slope of 1 inch per 40 feet will suffice for this requirement, subject to the approval of the local Authority Having Jurisdiction.

C. Slope all horizontal water piping with uniform pitch of 1/8 inch per 10 feet to low points to allow for complete system drainage. For long runs, where constant pitch cannot be maintained, provide intermediate low points and rise up again from such locations. Slope horizontal branches back to mains or risers. Provide clearly identified supplementary drain valves where hose bibbs, hydrants, or sill cocks will not suffice for this requirement.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, all domestic water systems shall be complete, thoroughly flushed clean and free of all foreign matter or erection residue.

B. Ensure 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. On building side of the main shut off valve, provide a 3/4" connection through which chlorine can be introduced into the water piping

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, in sufficient quantity to obtain 50 to 80 mg/L residual free chlorine solution throughout the entire domestic water piping systems.

E. Bleed water from outlets as required to ensure complete distribution and test for disinfectant residual at a minimum 15 percent of total outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.6 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services connecting to existing building services or utility lines as shown on the drawings.

B. Before commencing work, field verify invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover as required.

C. Provide new domestic water service connecting to existing building services or utility lines as shown on plans. Assure connections are in compliance with requirements of the jurisdiction having authority.

D. Extension of services to the building shall be fabricated from the same materials as the utility service lines or those materials specified herein.

E. Should points of connection vary from those indicated on the drawings contractor shall properly allow for this in the actual connections field fabricated.

3.7 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out after completion of the installation.

B. This Work shall be done, as part of the contract, to make certain that all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned.

3.8 TESTING OF PLUMBING PIPING SYSTEMS

A. During the progress of the work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Architect. The Architect or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires

action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems testing shall be accomplished prior to the application of insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 24 hours. Tests shall be witnessed by the Architect or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

G. Domestic Water: Pressure test at one and one half times the normal working pressure or 125 psig, whichever is the greater, for 24 hours.

H. Sanitary Soil, Waste and Vents and Storm Sewer:

1. After the rough-in soil, waste and vent and other parts of the sanitary sewer including branch laterals have been set from the lowest level, at point of connection to existing utility lines, to above the floor line, all outlets shall be temporarily plugged or capped, except as are required for testing as described herein. Ground work shall not permit the backfill of trenches to cover any joints until the completion of testing. Back fill shall be limited to mid sections of full joints of piping only. For pipe in ground the piping shall be readied as described herein and filled with water to a verifiable and visible level to 10' above the lowest portions of the system being tested.
2. On multi-level buildings only one floor level shall be tested at a time. Each floor shall be tested from a level below the structure of the floor, or the outlet of the building in the case of the lowest level, to a level of 12 inches above the floor immediately above the floor being tested, or the top of the highest vent in the case of the highest building level. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 24 hours. If after 24 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test repeated until, after a 24 hour retention period, there shall be no perceptible lowering of the water level in the system being tested.
3. Should the completion of these tests leave any reasonable question or doubt of the integrity of the installation, additional tests including peppermint smoke, or other measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such

tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

3.9 COMPLETE FUNCTIONING OF WORK

A. All work reasonably implied as essential to the complete functioning of the systems shown on the Drawings and Specification shall be completed as part of the work of this Division, unless specifically stated otherwise. It is the intention of the Drawings and Specification to establish the type and function of systems but not to set forth each item essential to the functioning of any system. In case of doubt as to the work intended or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for Supplementary Instructions and Drawings, etc.

END OF SECTION

SECTION 22 11 16 – DOMESTIC WATER PIPING AND VALVES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product Data: Submit product data sheets for all products specified in Part 2 of this Section except for pipe and fittings, and chlorine.

B. Water Purity Data: Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance.

1.2 NSF/ANSI 61, DRINKING WATER SYSTEM COMPONENTS-HEALTH EFFECTS

A. All products specified in this Section that are in contact with domestic water are to be NSF/ANSI 61 certified.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS

A. PVC: UL listed, rigid, Class 150, DR18,150 psi pressure rated bell and spigot pattern PVC pipe and fittings to AWWA C900, complete with gasket joints, and proper restraint collars as per Part 3 of this Section.

B. Soft Copper: Type "K" soft copper to ASTM B88, supplied in a continuous coil with no joints if possible, and complete with, if joints are required, compression type flared joint couplings.

C. Hard Copper - Solder Joint: Type "L" hard drawn seamless copper to ASTM B88, complete with wrought copper solder type fittings to ASME/ANSI B16.22 and soldered joints using NSF/ANSI 61 certified silver alloy lead-free solder for cold water pipe, and 95% tin/5% Antimony or silver alloy lead free solder for other services, with flux to ASTM B813.

D. Copper Pressure Coupled Joint: Type "L" hard drawn seamless copper to ASTM B88 with Viega "ProPress” copper fittings with “Smart Connect” feature, EDPM seals, and pressure type crimped joints made by use of a Rigid Tool Co. Model 330-B or Model 330-C electro-hydraulic crimping tool.

E. Stainless Steel: Schedule 10 Type 304/304L to ASTM A312/A312M, threaded with screwed stainless steel fittings to ASTM A403/A403M for piping to 2½” diameter, roll grooved with Victaulic Co. factory grooved end Type 304/304M stainless steel fittings and cast stainless steel coupling joints with gaskets meeting NSF/ANSI 61 requirements and Type 316 stainless steel bolts, Victaulic Style 807N rigid type or Style 877N flexible type as required by the location and application.

F. Semi-Rigid Polyethylene Tubing: High density, ½” diameter, semi-rigid polyethylene tubing, 200 psi rated.

G. CPVC: SDR 11 CPVC pipe and fittings to ASTM F442 and ASTM 438, 25/50 flame spread and smoke developed rated in accordance with UL 723/ASTM E84, certified to NSF/ANSI 61, complete with primer/solvent weld joints, and with a pressure rating of 100 psi at 180° F.

H. PEX Tubing: Non-barrier type cross-linked polyethylene piping in accordance with NSF 372 and ASTM F876, colour coded and tested for compliance by an independent third-party agency. The piping is to be complete with brass inserts and crimp-ring joint fittings and couplings.

2.2 DIELECTRIC UNIONS

A. Lead-free dielectric unions, each complete with a thermoplastic liner and rated minimum 250 psi at 250º F.

2.3 SHUT-OFF VALVES

A. Brass & Bronze Ball Valves: Lead free, Class 600, 600 psi non-shock WOG rated, 2-piece, full port ball type valves, each complete with a forged brass or bronze body, blowout-proof stem, solid forged brass or bronze chrome plated ball, "Teflon" or "PTFE" seat, a removable coated steel lever handle marked with valve identification and ends to suit the piping being connected. Valves in insulated piping are to be complete with stem extensions.

B. Butterfly Valves - Flanged Joint: Lead free, non-corrosive, minimum 175 psi cold water pressure rated, resilient seated butterfly valves, each complete with a coated cast ductile iron lug type body, stainless steel shaft, bronze disc, and EPDM seat, and each suitable for domestic water bubble-tight dead end service with the valve in position and either side of the connecting piping removed. Butterfly valves to and including 4" diameter are to be equipped with lever handles. Butterfly valves larger than 4" diameter are to be equipped with worm gear operators.

C. CPVC Ball Valves: ASTN and ANSI certified CPVC body union type full port ball valves, 230 psi rated at 73° F, equipped with PTFE seats and EDPM seals.

2.4 CHECK VALVES

A. Horizontal: Class 125, bronze, lead-free with identifying tag, 200 psi WOG rated horizontal swing type check valves with ends to suit the connecting piping.

B. Vertical: Bronze, lead-free, 250 psi WOG rated vertical lift check valve with ends to suit the connecting piping.

2.5 DRAIN VALVES

A. Refer to Part 2 of the mechanical work Section entitled Basic Mechanical Materials and Methods.

2.6 PRESSURE REDUCING VALVE STATIONS

A. Refer to the drawing detail.

2.7 DOMESTIC CLOTHES WASHER WALL BOX WATER CONNECTION

A. Equal to Sioux Chief white plastic recess wall box assembly as per the drawing schedule, with ¼ turn indexed hot and cold water brass ball valves with hose ends and tailpieces, and a centre or side indirect drain connection suitable for a drain hose.

2.8 ICE MAKER WALL BOX WATER CONNECTION

A. Equal to Sioux Chief white plastic recess wall box assembly as per the drawing schedule, with ¼ cold water brass ball valve.

2.9 CHLORINE

A. Sodium hypochlorite to AWWA B-300, Hypochlorites.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION REQUIREMENTS

A. Provide all required domestic water piping, extended from the termination of the underground service piping as indicated on the drawings.

B. Piping, unless otherwise specified, is to be as follows:

1. for underground service piping to inside the building just above the floor or just inside the wall as applicable - rigid PVC

2. for any underground distribution piping less 4" diameter inside building - Type "K" soft copper

3. for trap seal primer tubing located underground or in concrete or masonry construction - ½” diameter semi-rigid polyethylene

4. for pipe risers in sizes to 4" diameter- 25/50 rated rigid CPVC

5. for branch hot and cold piping from risers to suite fixtures, fittings, and equipment where fire rated construction is not penetrated, PEX tubing installed and joined in strict accordance with the manufacturer’s printed instructions

6. for pipe inside building and above ground except as specified above- Type "L" hard copper with solder joints or, at your option, Type "L" hard copper with pressure coupled mechanical joints, or Type 304/304L stainless steel with screwed joints or grooved end coupling joints

C. If and where required, brace and secure underground water service pipe entering the building at bends, tees and similar fittings with restraint devices, and provide concrete thrust blocks in accordance with Municipal standards and details. Regardless of what is specified elsewhere in this Specification regarding provisions of concrete, provide thrust block concrete. Paint all restraint devices with two coats of corrosion resistant black asphalt base coating prior to backfilling.

D. Slope all piping so that it can be completely drained.

E. Provide proper dielectric unions in all connections between copper pipe and ferrous pipe or equipment.

F. Secure trap seal primer tubing embedded in concrete to reinforcing steel in a secure manner and be present during the concrete pour to ensure that the tubing is not damaged or dislodged.

G. Provide a valved piping connection for pool equipment.

H. Provide a valved cold water connection to trash chute flushing spray head. Refer to the drawing detail.

3.2 INSTALLATION OF SHUT-OFF AND CHECK VALVES

A. Refer to Part 3 of the mechanical work Section entitled Basic Mechanical Materials and Methods.

B. Valves to and including 4” diameter are to be ball type. Valves larger than 4” diameter are to be butterfly type.

C. Valves in CPVC rigid piping are to be CPVC ball valves.

3.3 INSTALLATION OF DRAIN VALVES

A. Refer to Part 3 of the mechanical work Section entitled Basic Mechanical Materials and Methods.

3.4 INSTALLATION OF PRESSURE REDUCING VALVE STATIONS

A. Provide domestic water pressure reducing valve stations in piping where shown and/or specified. Install so that each valve is readily accessible. Whenever possible, provide pressure reducing valves factory pre-set to required pressures.

B. Check and test operation and adjust as required.

3.5 INSTALLATION OF CLOTHES WASHER AND ICE MAKER CONNECTION BOXES

A. Provide flush wall mounted clothes washer water and drain connection boxes and ice maker connection boxes where indicated.

B. Confirm exact locations prior to installation.

3.6 FLUSHING AND DISINFECTING PIPING

A. Flush and disinfect all new and/or reworked domestic water piping after leakage testing is complete.

B. Flush piping until all foreign materials have been removed and the flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.

C. When flushing is complete, disinfect the piping with a solution of chlorine in accordance with Building Code requirements under supervision of a P.E. authorized by the State of Florida to perform such work.

D. When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of the test results and fill the systems.

END OF SECTION 22 11 16

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SECTION 22 11 21 - NATURAL GAS PIPING SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. Scope of the Work shall include the furnishing, complete installation and testing of the gas piping system, with all metering, valves, piping and auxiliaries, ready for owner's use.

B. Coordinate with the gas company and pay all fees and permits required for a complete and operating gas service to the project.

PART 2 - PRODUCTS

2.1 All gas piping above ground shall be Schedule 40 black steel as manufactured by National Tube, Republic, Youngstown, or approved equal domestic manufacturer.

2.2 All gas piping larger than 2” shall be of welded construction. Screwed fittings will only be permitted for size 2" and smaller. Unions and valves will not be permitted above furred ceiling areas or in walls or chases.

2.3 All pipe fittings shall be of materials as follows:

A. All welding fittings shall be factory-made and shall be full line size, for each tee, branch, elbow, etc., with reducers after fittings, if required.

B. All screwed fittings shall be Crane, or approved equal, Class 150 malleable iron. Screw joints shall be made up with graphite and oil or Teflon tape. Screwed threads shall be in accordance with American Pipe Thread Standards.

C. All piping and fittings shall be from a domestic manufacturer.

2.4 All underground gas piping with 5 pound working pressure or less shall be as follows:

A. The pipe shall be yellow polyethylene with socket heat fusion joints and fittings. Pipe sizes 1-1/2" and 2" shall be SDR 11, (PE 2406) and pipe sizes 3" and 4" shall be SDR 11.5 (PE 2406).

B. All socket heat fusion fittings shall be D.O.T. approved and meet ASTM D-2513 and ANSI B31.8 codes.

C. All gas valves shall be polyethylene ball type, doubled union, rated for natural gas use. All valves shall be placed in a cast-iron valve box of an adequate size for accessibility and maintenance.

D. All transition meter risers shall be D.O.T. approved anode-less service type, fusion coupled and PE 2406 rated.

E. The contractor shall take thermal expansion under consideration during installation. The contractor shall follow all requirements set by the manufacturer to protect the system from damage due to thermal expansion.

F. The contractor shall provide detector tape approximately 12" above all gas piping.

G. Wrap pipe with 18 gauge minimum copper tracer wire.

2.5 Gas piping installed in unventilated spaces shall be routed in properly vented continuous sleeve where required by the building code.

2.6 Gas valves shall be U.L. listed as follows:

A. Ball Valves: Nibco T585-70-UL for ¼” to 1” and T580-70-UL for 1-¼” to 3”.

B. Plug Valves: DeZurick Series 425 or 435 Eccentric valves with RS 49 plug seals.

2.7 Gas pressure regulators shall be capable of reducing 75 psi pressure gas to 0.5 psi gas at capacities required by Gas Demand. Install per A.G.A. Bulletin 90. Regulators shall be as manufactured by Rockwell, Fisher-Governor or approved equal.

2.8 All gas regulators located inside the building shall be vented to atmosphere with schedule 40 black steel pipe. This includes all regulators provided with mechanical and plumbing equipment and all other regulators provided under this contract. Vent piping shall be the full size of regulatory port opening, or as recommended by regulator manufacturer, and shall run independent of any other regulator vent through to point of termination.

PART 3 - EXECUTION

3.1 All piping shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

3.3 All underground gas piping shall be laid on 6" of wet compact banksand approximately 24" below grade. Backfill trench with wet compacted banksand to 6" above pipe. The remainder of backfill shall be selected backfill and shall meet all compaction requirements set forth by the general trenching and backfill requirements.

3.4 Provide lever handle gas valve, drip leg and union to each piece of equipment and where indicated.

3.5 All gas lines entering building shall be valved on the exterior of the building above grade.

PART 4 - TESTING

4.1 TESTING OF GAS PIPING SYSTEMS

A. All gas system testing shall be in compliance with local codes or as required in NFPA 54 National Fuel Gas Code whichever is the more stringent requirement.

B. All work shall be performed by a Journeyman Plumber holding current State and local licenses.

C. All tests shall be accomplished during normal working hours and after having given due notification to building owner, construction manager or designee, of tests to be performed. All tests shall be performed in the presence of and witnessed by the building owners representative or designee

D. All gas system piping shall be subjected to a pneumatic test pressure of 60 psig for not less than 2 hours upon completion of all rough-in work and prior to covering. While the systems are subjected to this air pressure test, all joints shall have a soapy water solution applied and shall be observed for leaks. During test period there shall be no perceptible drop in test gage pressure

E. A final test shall be performed after all portions of the piping system are completely installed and covered. The entire system shall be tested, with all system outlets plugged or capped, before any equipment or appliances are connected to the piping.

1. Final test shall be with mercury, measured with a manometer or slope gage. Test pressures shall in no case be less than one and one half times the normal operating pressure or as listed below; which ever is the greater:
   a. 10.5 inches mercury (5 psig) for 4 ounce system.
   b. 21.0 inches mercury (10 psig) for 8 ounce system.
2. Tests shall be for a period of not less than 30 minutes and shall prove absolutely tight, showing no perceptible drop, for the entire test period.

F. Purge air from test piping before connecting equipment or appliances. Purge air to outdoors or to ventilated space of sufficient volume to prevent accumulation of flammable mixtures.

END OF SECTION

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SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the fixtures covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Plumbing Fixtures

2. Fixture Carriers

3. Faucets, Supplies, and Trim

4. Flushometers

1.3 RELATED WORK

A. Section 22 05 29 – Hangers and Support for Plumbing Piping and Equipment

B. Section 22 10 00 – Plumbing Piping

1.4 REFERENCES

A. ASME A112.4.3 – Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System

B. ASME A112.6.1M – Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use

C. ASME A112.18.1 – Plumbing Supply Fittings

D. ASME A112.18.2 – Plumbing Waste Fittings

E. ASME A112.18.9 – Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures

F. ASME A112.19.1 – Enameled Cast Iron and Enameled Steel Plumbing Fixtures

G. ASME A112.19.2 – Ceramic Plumbing Fixtures

H. ASME A112.19.3 – Stainless Steel Plumbing Fixtures

I. ASME A112.19.7 – Hydromassage Bathtub Systems

J. NSF/ANSI 61 – Drinking Water System Components – Health Effects

K. ANSI Z358.1 – Emergency Eyewash and Shower Equipment

L. ASSE 1016 – Performance Requirements for Individual Thermostatic, Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings.

M. ASSE 1037 – Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures

N. ADA (Americans with Disabilities Act)

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Warranty: Warrant the work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from defective or non-conforming materials and workmanship.

C. Defects shall include, but not necessarily be limited to, the following:

1. Noisy operation.
2. Noticeable deterioration of finish.
3. Leakage of water.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit product data under provisions of Division One.

C. Include component sizes, rough-in requirements, service sizes, finishes, materials, dimensions, performance information, and accessories.

D. Manufacturer’s Installation Instructions: Indicate assembly and support requirements.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Provide pre-printed operating and maintenance instructions for each item specified. Instruct and demonstrate the proper operation and maintenance to the Owner's designated representative.

1.8 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled specialties to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept specialties on site in original factory packaging. Inspect for damage. Damaged specialties shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on the Contract Documents.

B. Confirm and field coordinate that millwork is constructed with adequate provisions for the installation of counter top lavatories and sinks.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. GENERAL: Provide plumbing fixtures in accordance with manufacturer's recommendations and as indicated and scheduled on Drawings. Acceptable manufacturers of each fixture type are as indicated below.

1. Provide floor-affixed fixture carriers as appropriate for all wall-hung plumbing fixtures unless specifically noted otherwise.
2. Fixture drilling shall match faucet spread and match any related trim and accessories.

B. WATER CLOSETS, URINALS, LAVATORIES (Vitreous China)

1. American Standard
2. Kohler
3. Zurn
4. Sloan
5. Toto

C. WATER CLOSETS, URINALS, LAVATORIES, COMBINATION UNITS (Stainless Steel, Security Fixtures)

1. Acorn
2. Willoughby

D. SINKS – COUNTER MOUNTED (Stainless Steel)

1. Elkay
2. Just
3. Moen Commercial

E. SINKS – FREESTANDING (Stainless Steel)

1. Elkay
2. Just
3. Advance Tabco
4. Amtekco Industries

F. BATHTUBS

1. American Standard
2. Kohler

3. Toto

G. SHOWER ENCLOSURES

1. Comfort Designs
2. Aquarius Bathware
3. Hamilton Bathware

H. SHOWER SYSTEMS **these are *typically* modular, multi-station shower units, often surface mounted or freestanding column type**

1. Acorn
2. Bradley
3. Symmons Commercial
4. Willoughby Industries

I. WASH FOUNTAINS AND SOLID SURFACE LAVATORY SYSTEMS

1. Acorn
2. Bradley
3. Willoughby Industries

J. LAUNDRY TUBS **these are thermoplastic or molded stone type**

1. Fiat
2. E.L. Mustee & Sons
3. Zurn

K. MOP SINKS

1. Stern-Williams
2. Fiat
3. E.L. Mustee & Sons

L. SERVICE SINKS (Enameled Cast Iron) **these are traditional style, mounted off-the-floor, with a P-trap standard**

1. American Standard
2. Kohler
3. CECO (Commercial Enameling Company)

M. EMERGENCY SAFETY FIXTURES

1. Bradley
2. Guardian
3. Chicago
4. Haws

N. DRINKING FOUNTAINS AND WATER COOLERS

1. Halsey Taylor
2. Elkay
3. Haws
4. Oasis

2.2 FAUCETS, SUPPLIES, AND TRIM

A. GENERAL: Provide faucets, supplies, and trim in accordance with manufacturer's recommendations, as appropriate for fixtures to be served, and as indicated and scheduled on Drawings. Acceptable manufacturers for each type of appurtenance are as indicated below.

1. Flushometer flush rate shall match gallon-per-flush criteria of fixtures served.
2. Strainers shall be heavy cast brass chrome plated with matching grid type strainer, with or without overflow as required, 17 gauge seamless brass tailpiece of length determined by installation requirements. Provide complete with washers and brass locknut.
3. P-traps shall be 17 gauge seamless chrome plated brass, adjustable type. Provide complete with cleanout plug, chrome plated brass slip nuts, wall bend, and wrought brass escutcheon of depth determined by installation requirements.
4. Angle stops shall be lead-free commercial pattern chrome plated brass, quarter turn ball type with loose key handles. Provide complete with chrome plated copper supply risers and wrought brass escutcheon of depth determined by installation requirements.
5. Toilet seats shall be commercial grade and provided complete with stainless steel posts and self-sustaining check hinges.
6. Pipe trim insulation shall be compliant, white molded vinyl, fade/discoloration-resistant, bacteria/fungal-resistant insulation.

B. FAUCETS

1. Chicago
2. T&S Brass
3. Zurn
4. Moen Commercial
5. Delta Commercial
6. American Standard
7. Kohler
8. Symmons Commercial

C. SHOWER VALVES

1. Acorn
2. Bradley
3. Symmons Commercial
4. Chicago
5. Powers
6. Zurn

D. FLUSHOMETERS

1. Sloan
2. Zurn
3. Moen Commercial
4. Delta Commercial
5. American Standard
6. Toto

E. SUPPLY STOPS

1. McGuire

2. Zurn
3. Chicago

F. CHROME PLATED TUBULAR BRASS

1. McGuire
2. Zurn
3. Kohler

G. TOILET SEATS

1. Church
2. Bemis
3. American Standard
4. Zurn
5. Toto

H. PIPE TRIM INSULATION

1. Truebro
2. McGuire
3. Plumberex

2.3 FIXTURE CARRIERS

A. GENERAL: ANSI/ ASME A112.6.1M; Provide floor-affixed fixture carriers as appropriate for all wall-hung plumbing fixtures unless specifically noted otherwise. Fixture carrier foot supports shall be securely anchored to the floor with 1/2” bolts and anchors at all locations.

1. Chair type carriers shall be adjustable, with coated cast iron body with integral no hub waste and vent connections, complete with gasketed adjustable faceplate assembly, adjustable nipple with test cap, neoprene bowl gasket, lugs for floor and wall attachment, threaded fixture studs, and hardware. Provide single or double type of vertical or horizontal configuration as required and with auxiliary inlet as required.
2. Lavatory carriers shall be adjustable, with steel uprights and welded base feet, coated cast iron support brackets, cast or ductile iron concealed support arms, alignment rod, complete with leveling and support hardware. Provide single or back to back configuration as required.
3. Drinking fountain and urinal carriers shall be adjustable, with steel uprights and welded base feet, upper and lower bearing plates, threaded rods, and mounting hardware. Provide single or side-by-side configuration as required

B. ACCEPTABLE MANUFACTURERS

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam

PART 3 – EXECUTION

3.1 PREPARATION

A. EXAMINATION OF CONDITIONS: Examine conditions affecting this work. Report unsatisfactory conditions to the proper authority and do not proceed until those conditions have been corrected. Commencing work implies acceptance of existing conditions as satisfactory to the outcome of this work.

B. Coordinate cutting] [formingof roof floor construction to receive drains to required invert elevations.

3.2 INSTALLATION

A. Install fixtures in locations and heights as shown on Drawings and as directed by the Architect.

B. Install materials plumb, level, securely, and in accordance with manufacturer's recommendations.

C. All rough-in pipe openings for final connections with supply, waste, vent, and storm systems shall be closed with caps or plugs during early stages of construction and installation. Tape shall not be considered sufficient protection.

D. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

E. Provide ball valves in piping serving batteries of fixtures. Label stops "Hot" and "Cold." Valves shall be located above accessible ceilings. If ceilings are not accessible, provide access panels of adequate size to ensure valves are fully accessible and can be fully operated.

F. Provide lockable ball valves in piping serving emergency safety fixtures and clearly label such valves as to the fixtures served.

G. Plumbing fixtures shall be supported by a concealed carrier where required to properly support the fixture specified. All carriers to be securely mounted, bolted and checked prior to concealment.

H. Caulk around fixtures with best grade white silicone caulking. Do not use grout.

I. All handles on supply and drainage fittings or other brass items shall be properly lined up and adjusted. Fittings shall not be left in any haphazard manner.

J. All fixtures shall have individual chrome plated heavy pattern loose key quarter-turn cutoff stops on supply lines, complete with escutcheons. Where same are not specified as a part of the fixture trim, they shall be installed as close to fixtures as possible in the hot and cold water supply.

K. Install each fixture with trap, easily removable for servicing and cleaning.

L. All showers and similar installations shall be installed with type “L” copper pipe between shower valve and shower head rough-in. The termination point shall have a brass drop ear elbow for shower head arm connection. Contractor shall provide proper anchoring support.

3.3 INTERFACE WITH OTHER PRODUCTS

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

B. Review architectural drawings. Confirm configuration and orientation of shower controls and trim prior to rough-in and installation.

3.4 ADJUSTING

A. Adjust work under provisions of Division One.

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

3.5 CLEANING

A. Clean work under provisions of Division One.

B. At completion clean plumbing fixtures and appurtenances.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Division One.

B. Do not permit use of fixtures.

3.7 ADA ACCESSIBLE FIXTURES

A. At all locations required to be accessible, such fixtures, controls, and final installations shall comply with the requirements of ADA and any applicable state accessibility standards. Install fixtures to heights, indicated on architectural drawings.

B. All exposed water supply and drain pipes under accessible lavatories and sinks shall be insulated with securely fastened pipe trim insulation kits of the proper model for the fixtures specified.

C. Wall mounted drinking fountains and coolers which protrude into passages or corridor space, whether single or paired with an adjacent accessible fixture, shall be supplied with a matching skirt or apron to lower the underside clearance of the non-accessible fixture equal to that required for accessible fixture.

END OF SECTION