DIVISION 22

PLUMBING

RELATED DOCUMENTS:
The Drawings and general provisions of the contract, including The General Conditions and Supplementary Conditions, Forms and Division-1 Specification sections, apply to the work of this Division.

DESCRIPTION OF WORK:
The Plumbing Contractor shall be responsible for the installation and connection of all items of plumbing work including those items supplied by other contractors that require plumbing connections.
The Plumbing Contractor shall coordinate and cooperate with other contractors for the satisfactory installation and completion of the project.
The Plumbing Contractor shall furnish all materials, labor, transportation, equipment and plant necessary to complete and install all Plumbing items and equipment specified in this Division and shown on the drawings.

STANDARDS AND CODES:
All work under this Division shall comply with all local, state, regional and/or national building codes or whichever building code that governs construction in that particular area. All reference specifications, standards, and codes referred to herein shall refer to the latest edition. In case of conflict between the reference specifications, standards, or codes, the reference having the more stringent requirements shall govern.

SHOP DRAWINGS, MANUFACTURER'S LITERATURE, SCHEDULES, AND SAMPLES:
See Division 1 Section 013300 – Submittal Procedures.
Shop Drawings, Manufacturer's Literature, and Schedules shall be submitted electronically unless permitted otherwise by the Architect.
Samples: Submit three (3) samples of items called for by the Architect and Owner. One sample will be returned and one sample will be retained by the Architect for his records and one will be provided to the Owner.
All samples shall be clearly labeled with Manufacturer's Name, Address, Identifying Number, Finish and Color. Improperly identified samples will be rejected.
Additional Submittals: The Architect may require additional supporting shop drawings, manufacturer's literature, schedules and samples to be furnished as required by the General Contractor, Subcontractors, and Materials Suppliers.

CERTIFICATION:
If required, furnish affidavits from the manufacturers certifying that the materials or products delivered to the project meet the requirements as specified herein. Certification shall not relive the responsibility of complying with any additional requirements as specified herein.

PROJECT COMPLETION:
Remove all unused material, equipment, trash, etc., and leave all areas clean. Repair or remove and replace any damaged or improperly installed, defective or improperly finished items as directed by the Architect at no additional expense to the Owner. Project shall be complete and ready for use by Owner.

IMPORTANT NOTE: **REFER TO DIVISION-1 FOR APPLICABLE ALLOWANCES REQUIRED FOR WORK UNDER THIS DIVISION.**

SECTION 220500 – PLUMBING GENERAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 (General Requirements) sections of the Project Manual apply to this Section.

B. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 22 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 22 sections contain statements more definitive or more restrictive.

1.2 SCOPE

A. Provide all labor, material, equipment, and services necessary and reasonably incidental to the proper completion and proper operation of the building plumbing systems. The work shall consist of but shall not necessarily limited to the following:

1. Domestic water system including extension of piping and connections to all fixtures and/or equipment. The domestic water system shall be extended from a point 5 (five) feet beyond the exterior face of the building.
2. Sanitary drain, waste and vent system including extension of piping and connection to all fixtures and/or equipment. The sanitary system shall be extended to a point 5 (five) feet beyond the exterior face of the building.
3. Rainwater collection system including extension of piping to roof drains. The rainwater collection system shall be extended to a point 5 (five) feet beyond the exterior face of the building.

1.3 DEFINITIONS

A. Words and phrases used throughout the Contract Documents shall be interpreted as indicated below:

1. Construction Documents – the basis for the work. It includes both the Drawings (plans) and Project Manual (specifications).
2. Contractor – The person or organization awarded the contract for construction services.
   In the case of a construction project administered as a multiple-prime contract, the term shall be further defined as the Contractor holding a prime contract for plumbing construction work.
   The term “Plumbing Contractor” is used interchangeably with the term “Contractor”.
3. Provide – To furnish and install materials, equipment, or systems.
4. Submittals – Submittals shall include Manufacturer’s Catalog Data, Shop Drawings, Calculations, Certificates of Compliance, Testing Reports, Samples, and Operation and Maintenance Manuals.
5. Professional – The Architect and/or Engineer of record.
6. Work by Others – Work provided by a person or organization other than the Contractor.

1.4 CODES, REFERENCES AND STANDARDS

A. The Contractor shall comply with all laws, ordinances, and regulations of all Authorities Having Jurisdiction, including those of all applicable City, County, State, and Federal. All licenses, permits, fees, connection fees, tapping fees, inspection fees, etc., shall be obtained by the Contractor and the cost shall be included in the Contract price.

B. The minimum standard of work under this contract shall be in accordance with the following model building codes:

1. North Carolina State Building Codes 2018 Edition:
   a. North Carolina State Building Code.
   b. North Carolina State Plumbing Code.
   c. North Carolina State Mechanical Code.
   d. North Carolina State Fire Prevention Code.

e. North Carolina State Fuel Gas Code.
f. North Carolina State Energy Code.

C. Other publications listed throughout Division 22 form a part of this specification to the extent referenced. All publications shall be the latest edition as adopted by the Authority Having Jurisdiction. The publications are referred to in the text by basic designation only.

1.5 QUALITY ASSURANCE, WORKMANSHIP AND COORDINATION

A. The Contractor must coordinate his work with that of the other trades so that all work will be performed in an orderly manner and with the least possible interference. Where coordination with other trades is required, the Professional shall make the final decision regarding changes to be made in the work.

B. The Contractor must thoroughly familiarize himself with all the Construction Documents for the project so that he clearly understands his responsibility in relationship to the work to be performed. The Contractor must plan and perform his work to permit the use of the building as soon as possible.

C. The Contractor shall guarantee the workmanship, materials, and equipment, furnished against defects, leaks, performance and non-operation for a period of one (1) year after the date of final acceptance. Defective workmanship shall be construed as meaning defective materials and unsatisfactory installation and not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by defective workmanship as construed herein within the period covered by the Guarantee, including all incidental work required to correct the deficiency.

D. The Contractor shall expressly and completely follow all manufacturers' instructions required for validation of the manufacturer's warranty agreement including but not limited to service, maintenance and adjustments of the equipment.

E. The Contractor shall be held responsible for the proper installation of all materials and equipment required for a complete installation within the intent and meaning of the Contract Documents.

1.6 PROJECT RECORD DRAWINGS

A. Changes from the Contract Drawings necessary to coordinate the work with other trades, to conform to the building conditions or to conform to the rules and regulations of Authorities Having Jurisdiction shall be made only after obtaining written permission from the Professional.

B. The Contractor shall keep a record of construction changes and deviations from the original Contract Drawings. All changes shall be recorded on a separate set of prints which shall be kept at the job site specifically for that purpose. The record shall be made immediately after the work is completed. Documentation shall include:

1. location and elevation of new and existing utility lines
2. points of connection to existing utility lines
3. changes in pipe routing location
4. valve locations
5. equipment locations, etc.
6. actual capacities and values of equipment provided as indicated in equipment schedules.

C. The marked-up record set of drawings shall be delivered to the Professional before final acceptance of the Plumbing Contract work.

1.7 FIELD MEASUREMENTS

A. It shall be the Contractor's responsibility to verify the location of any and all existing underground utilities in the vicinity of his work. When it has been indicated that these utilities are to remain in place, the Contractor shall provide adequate means of support and protection during excavation operations.

B. Before ordering any equipment and material, or performing any work, the Contractor shall verify all measurements and dimensions at the job site and shall be held responsible for the correctness of same.

C. No extra compensation will be allowed because differences between actual dimensions and measurements and those indicated on the drawings.

D. Any difference which may be found shall be submitted to the Professional for consideration before proceeding with the work.

1.8 PROTECTION OF SERVICES AND EQUIPMENT

A. The Contractor, at his own expense, shall repair, replace and maintain in service any utilities, facilities or services (underground, aboveground, interior or exterior) damaged, broken, or otherwise rendered inoperative during construction due to activities on the part of the Contractor. The method used by the Contractor in repairing, replacing or maintaining the services shall be approved by the Professional.

B. The Contractor shall protect, at his own expense, such of his work, materials or equipment that is subject to damage during the project duration. All openings into any piping, ducts or equipment must be securely covered, or otherwise protected, to prevent injury due to carelessly or maliciously dropped tools or materials, grit, dirt, or any foreign material. The Contractor shall be held responsible for all damage so done until his work is fully and finally accepted.

C. It shall be the responsibility of the Contractor to protect motors, pumps, electrical equipment, and all similar items of equipment from dirt, grime, plaster, water, etc. during all phases of construction. This protection shall be provided by covering equipment with transparent plastic sheeting and/or locating the materials and equipment in an area free from the elements.

1.9 INTERRUPTION OF SERVICES

A. The Contractor shall schedule his work to avoid any major interruption of any utility services.

B. Existing utilities serving facilities occupied and used by the Owner or others shall not be interrupted except when such interruptions have been authorized in writing by the Owner or the Professional. Interruptions shall occur only after acceptable temporary utility services have been provided. The Contractor shall provide a minimum of ten (10) working days notice to the Professional and receive written notice to proceed before interrupting any utility.

1.10 CLEANUP

A. The Contractor shall maintain buildings, grounds and public properties free from accumulations of waste materials, debris and rubbish. At reasonable intervals during the progress of work, and when directed by the Owner's Authorized Representative, the site and public properties shall be cleaned and waste materials, debris and rubbish shall be disposed of in appropriate manner. The Contractor shall provide containers for collection of waste materials, debris and rubbish. Waste materials, debris and rubbish shall be removed from the job site and legally disposed of at a landfill area in accordance with all applicable regulations. Burning or burying waste materials, debris or rubbish on project site shall not be permitted.

B. At the completion of the Project, remove waste materials, rubbish, tools, equipment, machinery, surplus materials, etc., and clean all sight-exposed plumbing fixtures and equipment. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed plumbing fixtures and equipment. Broom clean paved and concrete surfaces; rake clean other ground surfaces. Repair, patch and touch up marred surfaces to specified finish or to match adjacent surfaces.

1.11 SUBMITTALS

A. Submittals shall be in accordance with Division 01 of the Project Manual.

B. General
   1. The Contractor shall provide to the Professional for review 6 (six) copies of required submittals, unless noted otherwise. All Catalog Data, Shop Drawings, Calculations, and Certificates of Compliance shall be submitted as a single package. Failure of the contractor to provide a complete submittal package may result in delay in processing time. All such delays to the job resulting from the contractor's failure to provide submittals at one time will be the responsibility of the Contractor. Three (3) copies will be returned to the Contractor. Submittals shall clearly identify the contract documents specification section or drawing referenced, identifying and highlighting each item to be reviewed.
   2. Submittals provided for review shall clearly and completely describe the specific product(s) they represent. Where differences exist between the item specified and that submitted for review, the submittal shall be highlighted.
   3. Submittals shall bear the review stamp of the Contractor. The review stamp of the Contractor shall be affixed to shop drawings to indicate:
      a. The Contractor has coordinated the electrical characteristics of the equipment.
      b. The Contractor has verified that the equipment submitted will physically fit into the space allocated with adequate clearances for maintenance, access, and egress requirements.
      c. The Contractor shall bear all associated costs that may accrue due to failure to completely represent a given product.
   4. Material and equipment shown on the drawings or specified herein shall not be incorporated in the work of this Contract until shop drawings, engineering data and catalog information have been reviewed and accepted by the Professional.

C. Trade Name References
   1. Material and equipment are described and listed in the Project Documents by trade name, by manufacturer's name and model number, or by performance attributes. It is intended that trade names or manufacturer's names shall establish standards of quality, performance, capacity, materials, and design for the item specified.
   2. Where more than one manufacturer is listed for an item, those mentioned are considered equivalent if the quality, style, capacities, materials and performance of the specified item are equivalent. All materials and equipment shall be subject to the acceptance by the Professional.

D. Substitutions
   1. No substitution shall be made without the review and acceptance by the Professional.
   2. Where the phrase "or accepted substitute" or "or equal" appears in the Contract Documents, it shall refer to the requirement of acceptance by the Professional of the material or equipment involved.
   3. It shall be the responsibility of the Contractor to ensure that each manufacturer can furnish a substitute in complete conformity with the requirements of this Project. The Contractor shall assume all costs or extra charges associated with the substitution, including: any architectural, structural, mechanical, or electrical changes required, costs in connection with work of the other trades necessitated substitutes, and any additional engineering costs required.
   4. The Contractor shall indicate the specified equivalent on shop drawings or catalog data which are submitted as substitutions.
   5. At the request of the Professional samples of items that are to be used in substitution of specified items shall be submitted. If such a request is made, a sample of both the specified item and the proposed substitute item shall be submitted simultaneously. The scheduling of the submission of such samples shall be as directed and shall in no

way delay the progress of the project. The Professional will assume no liability whatsoever for any samples submitted.

E. Operation and Maintenance Manuals
   1. Submit two (2) sets of 8-1/2" x 11" text sixty (60) days prior to operator training/pre-final inspection bound in three D side ring capacity expansion binders with durable plastic covers for review by the Professional.
   2. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
   3. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
   4. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified type on thirty (30) pound white paper.
      a. Part 1: Directory, listing names, addresses, and telephone numbers of Professional, Contractor, Subcontractors, and equipment suppliers.
      b. Part 2: Operation and maintenance instructions arranged by system or process floor and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
         1) Significant design criteria.
         2) List of equipment.
         3) Parts list for each component.
         4) Maintenance instructions for equipment and systems.
         5) Maintenance instructions for finishes, including recommended cleaning methods and materials and Operating instructions.
         6) Special precautions identifying detrimental agents.
         7) Special Requirements of other sections of this specification noted to be included in the operating and maintenance manual.
      c. Part 3: Project documents and certificates, including the following:
         1) All approved Submittals
         2) Certificates of Compliance
         3) Photocopies of warranties and bonds
         4) Material safety data sheets
   5. Submit five (5) copies of completed volumes in final form fifteen (15) days prior to owner training. These copies will include Professional's previous review comments.
   6. Submit eight final volumes revised, within ten (10) days after pre-final observation.

1.12 ELECTRICAL EQUIPMENT

A. The Contractor shall furnish all motors, combination starters/disconnects, overload protection and controls for equipment required to provide complete and workable systems, unless noted otherwise.

B. All motors, motor control equipment and wiring shall meet the requirements of the National Electric Code.

C. The contractor shall verify electrical characteristics at the site before ordering electrical equipment.

D. Motors under ½ (one-half) horsepower shall be 120 volts. Motors ½ (one-half) horsepower and over shall be 3 (three-phase. All motors to be 1750 revolutions per minute (rpm) unless noted otherwise. Combination motor starters shall of the fused switch type to complete with magnetic motor starter. Units shall be of the NEMA size and type applicable to motor size, with 3-pole overload. Overload elements and fuses shall be of the proper size to protect the motor. Unless noted otherwise, units shall be

equipped with indicating lights, HAND-OFF-AUTOMATIC (HOA) selector switch, 4 (four) auxiliary contacts 2 (two) normally open (N.O.) and 2 (two) normally closed (N.C.) and fused control transformer to provide 120-volt control voltage. Fusible disconnect switch operating handles shall be interlocked with the door so that the door cannot be opened with the switch in the "ON" position, except through a hidden release mechanism. The operating handle shall be arranged for padlocking in the "OFF" position with up to three padlocks. Fuses shall be furnished by the Contractor as required to comply with NEC requirements. Where R type fuses are indicated, fuse holders shall be provided with rejection clips. Equipment shall be Square D, Allen-Bradley, or General Electric or accepted substitute, and shall be provided with a NEMA Type 1 enclosure, unless noted otherwise.

1.13 CONTROL WIRING

A. The Contractor shall provide all necessary control wiring and related conduit required for complete and workable systems.

B. All conduit and wiring shall be in accordance with the latest edition of the National Electrical Code. Installation of control wiring shall be performed in a neat and workmanlike manner by competent workmen. Workmanship shall be as specified in Division 26.

C. Control circuits shall be wired for 110-volt control, using fused individual control transformers. Circuits shall be fused and shall be interrupted when the disconnect device is opened.

1.14 EXCAVATION, BACKFILLING AND COMPACTION

A. Excavation, Backfilling and Compaction shall comply with Division 31 of the Project Manual

B. General

1. The Contractor shall notify one call prior to any work.
2. The Contractor shall perform all excavation, backfilling, compaction and necessary finishing for all piping, equipment, and accessories. Piping installation shall be in accordance with local water, sewer and gas utility regulations and applicable State and Local codes.
3. Protect existing structures, utilities, sidewalks, pavements and other facilities not indicated for removal, from damage caused by settlement, lateral movement, undermining, washout and other hazards resulting from excavation operations.
4. Existing utility lines shown on the Project Documents may not indicate the exact in-place location of the lines. They do not show every pipe, fitting or appurtenance that may exist at the project site. The location and depth of all utilities shall be marked and recorded prior to any excavation. Should uncharted or incorrectly charted, existing piping or other utilities be uncovered during excavation, contact the Professional immediately for directions before proceeding further with work in this area. Cooperate with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.
5. If it becomes necessary to install any lines or equipment in locations other than those shown, the Professional's acceptance shall be obtained before starting the excavation.
6. The presence of explosives on the project site or the use of explosives in the execution of the work under this contract is not permitted.

C. Excavation

1. All plumbing excavation is unclassified.
    a. Paved Areas – When working within the right-of-way limits of all North Carolina State highways, backfilling must be in conformance with the requirements of the North Carolina Department of Transportation, which is made a part of these specifications by this reference thereto.

D. Compaction
   1. Comply with Division 31 of the Project Manual.

1.15 CONCRETE

A. Comply with Division 03 of the Project Manual.

B. Reinforcing shall conform to ASTM A-615, Grade 60. Concrete exposed to freezing and thawing, salts, sulfates and corrosion shall comply with International Building Code with North Carolina amendments.

C. All concrete shall be of minimum 3000 pounds per square inch (psi) strength in 28 (twenty-eight) days. All concrete shall be mixed by machine. No wet or moistened mixture containing cement shall remain unplaced for a period exceeding 30 (thirty) minutes and shall not be used after its initial set. Re-tempering after initial set is prohibited. Exposed surfaces shall be protected from drying for at least 7 (seven) days. All forms shall be built true and rigid. Form removal shall not injure the concrete.

D. All concrete is to be finished with a hard, smooth troweled finish and is to be faced smooth with rounded corners.

1.16 INSPECTION AND TESTING

A. General
   1. New plumbing systems and parts of existing systems which have been altered, extended or repaired shall be tested to disclose leaks and defects.
   2. The Contractor shall notify the Professional a minimum of 5 (five) working days prior to testing to coordinate the testing and inspection procedures.
   3. If the Professional determines that the plumbing systems do not pass the prescribed tests, then the Contractor shall be required to make the necessary repairs, at his own expense, and the Contractor shall re-inspect and re-test the systems. Repairing, inspection and testing shall be continued until all systems pass as determined by the Professional.
   4. All new, altered, extended or replaced plumbing shall be left uncovered and unconcealed until it has been inspected, tested and accepted by the Professional. Where such work has been covered, or concealed before it has been inspected, tested and accepted, it shall be uncovered by the contractor, at his own expense as directed by the Professional.
   5. All equipment, material, labor, etc., required for testing the plumbing systems shall be furnished by the Contractor.

B. Sanitary and Vent Collection Systems
   1. The system shall be tested in accordance with the North Carolina State Plumbing Code.
   2. Rough Plumbing – Systems shall be tested upon completion of the rough piping installation and proved watertight. The water test shall be applied to the system either in its entirety or in sections after rough piping has been installed.
      a. Where applied to the entire system, all openings in the piping shall be closed, except the highest opening, and the system filled with water to point of overflow.
      b. Where the system is tested in sections, each opening shall be plugged, except the highest opening of the section under test, and each section shall be filled with water. A section shall not be tested with less than a 10-foot head of water.
      c. In testing successive sections, at least the upper 10-feet of the next preceding section shall be tested, such that a joint or pipe in the building, except the uppermost 10 feet of the system, shall not have been subjected to a test of less than a 10-foot head of water.

d. The water shall be kept in the system or in the portion under test for a minimum of 2 (two) hours before inspection starts. The system shall then be inspected to ensure that it is tight at all points.
e. The Contractor shall provide a written Test and Inspection Report that the above prescribed test(s) have been performed in accordance with these Specifications. The report is subject to approval by the Professional.

3. Finished Plumbing – After the plumbing fixtures have been set and their traps filled with water, the plumbing fixture connections shall be tested and proved gas and water-tight.
   a. A smoke test shall be made by filling all traps with water and then introducing into the system smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1-inch water column shall be introduced and maintained for the period of the inspection.
   b. Where the local Authority Having Jurisdiction finds that a smoke test need not be performed, a peppermint test shall be performed. Two (2) ounces of oil of peppermint shall be poured into the roof terminal of every line or stack to be tested. The oil of peppermint shall be followed at once by 10 quarts of hot (140-degrees Fahrenheit) water. All roof vent terminals shall then be sealed. The system shall then be inspected for the detection of odor of peppermint. If odor of peppermint is detected, repairs shall be made, and the system shall be retested.
   c. The above tests shall be witnessed by the Authority Having Jurisdiction or by Professional or his representative.
   d. The Contractor shall provide a written Test and Inspection Report that the above prescribed test(s) have been performed in accordance with these Specifications. The report is subject to approval by the Professional.

C. Building Sewer
1. The building sewer shall be tested by insertion of a test plug at the point of connection with the septic system. The building sewer shall then be filled with water under a head of not less than 10-feet. The water level at the top of the test head of water shall not drop for at least 15 (fifteen) minutes.

D. Domestic Water Systems
1. The system shall be tested either in its entirety or in sections.
2. The system shall be tested and proved tight under a water pressure of 125 pounds per square inch for a period of 2 hours.
3. Potable water shall be used for testing.

E. Fuel Gas Systems
1. The systems shall be tested in accordance with NFPA 54.
2. All fuel gas piping shall be pneumatically tested for tightness prior to commencement of gas service. Air or nitrogen shall be used as the test medium. The piping system shall be pressurized to 100 psig for a period of 2 hours. All joints shall be leak tested with detection solution while the system is pressurized. The Contractor shall provide a valved ¼ inch FPT connection in the system to which shall be attached a 24-hour pressure recording gauge. The Contractor shall arrange for a gas company representative to witness the test. Leaks shall be repaired by tightening or replacing joints. Caulking of joints is not permitted.

1.17 STERILIZATION OF THE DOMESTIC WATER SYSTEM

A. After the system has been tested and approved, the entire new system, including valves and accessories, shall be chlorinated. Disinfecting shall be in accordance with AWWA C651.

B. Chlorine may be applied in any of the following forms:
   1. Liquid chlorine gas-water mixture
      a. Chlorine gas-water mixture shall be applied by a solution feed chlorinating device.
   2. Direct chlorine gas feed
      a. Chlorine gas shall b fed directly from a chlorine cylinder with a suitable device for regulating the rate of flow and the effective diffusion of gas within the line.
   3. Calcium hypochlorite and water mixture.
      a. Calcium hypochlorite shall be HTH, Perchlorene and Maxochlor, or accepted substitute. A solution consisting of five (5%) percent powder to ninety-five (95%) percent water by weight shall be prepared. The calcium hypochlorite and water mixture, first made into a paste and then thinned to a slurry, shall be injected or pumped into the system.

C. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million of chlorine and allowed to stand for 3 hours. During the chlorination process all valves and accessories shall be operated.

D. After the chlorination process, the chlorine shall be flushed from the system until the system water is equal in chemical and bacteriological composition to those of the permanent source of water supply.

E. Laboratory tests of the water shall be paid for by the Contractor.

1.18 INSTRUCTION OF THE OWNER

A. After acceptance of the Project, the Contractor shall furnish the services of personnel thoroughly familiar with the completed installation to instruct the Owner in the proper operation and maintenance of all equipment and appurtenances provided.

B. The Contractor shall provide the Owner with two weeks' notice before the instruction session.

1.19 CHASES AND OPENINGS

A. All chases and openings required for the installation of the work shall be coordinated with the other trades. The Contractor shall provide the other trades with sufficient time (1 (one) week minimum) for coordination of all chases and openings. The contractor shall be responsible for all work required to cut and patch the required openings. The work shall be performed to the satisfaction of the Professional.

B. Penetrations made in fire rated chases, partitions, floors, etc. shall be sealed with an approved material and method as required to maintain the integrity of the fire separation.

C. The Contractor shall provide all sleeves, hangers, and anchors required for installation of the work in chases and openings.

1.20 PAINTING

A. Painting shall be in accordance with Division 09.

1.21 RELATED WORK

A. All work related to providing complete plumbing systems and equipment shall be the responsibility of the Contractor. The following related work shall be provided as indicated in other specification Divisions, unless noted otherwise, but shall remain the responsibility of the Contractor for workmanship and completeness:
   1. General Contractor
      a. Installation of access panels.
      b. Leaders and gutters.

c. New catch basins and foundation drains. Final connections shall be by the Contractor, as indicated on the drawings and as herein specified.

d. Final painting of existing walls, floors and ceilings where the surfaces are being refinished and remodeled under the General Contract. Refer to General Construction Drawings.

e. Equipment and furnishings including shop equipment and laboratory equipment. Final connections to all equipment and furnishings shall be provided by the Contractor. The Contractor shall be responsible for coordination of plumbing services with the equipment and furnishings.

f. Installation and flashing of roof penetrations including but not limited to roof drains, vents through roof, gas piping, etc. Final connections shall be provided by the Contractor.

g. Casework mounted sinks and lavatories, including faucets, bubblers, strainers, tailpieces, traps, gas cocks, and inter-connecting piping. The Contractor shall install the sinks, equipment and appurtenances and shall make final plumbing connections. Rough-in plumbing work shall be in accordance with rough-in drawings as furnished by the General Contractor Final connections to all fixtures shall be provided by the Contractor. The Contractor shall be responsible for coordination of plumbing services with the fixtures and equipment.

h. Concrete housekeeping pads for plumbing equipment.

i. Removal of existing concrete housekeeping pads.

2. Food Service Equipment Contractor

a. Food service equipment including food preparation equipment, hand washing sinks, dishwashing equipment, dishwasher booster heaters, wash-down kitchen hoods, refrigeration equipment, and sink traps and faucets. Final connections to all fixtures and equipment and all associated work including inter-connecting piping, fittings, valves, gauges, gas lines, flexible quick disconnects, and hose assemblies shall be provided by the Contractor. The Contractor shall provide individual supply piping stops at each piece of equipment. All work shall be installed in accordance with the standards and requirements of the National Sanitation Foundation (NSF), the Department of Health and applicable plumbing codes. Rough-in plumbing work shall be in accordance with rough-in drawings as furnished by the Food Service Equipment Contractor. Final connections to all fixtures shall be provided by the Contractor. The contractor shall be responsible for coordination of the plumbing services with the food preparation equipment.

3. Mechanical Contractor

a. Steam supply and return piping.

b. Condensate drain piping.

4. Electrical Contractor

a. Installation of all combination starters/disconnects and overload protectors.

1.22 MISCELLANEOUS STEEL AND ACCESSORIES

A. The contractor shall provide all necessary steel angles, channels, pipe, rods, nuts, bolts, etc., as shown on plans, as specified, or as may be required for complete and proper installation of plumbing fixtures, systems and equipment. All material and workmanship shall be of the best quality and shall be installed in accordance with the best practices of the trade.

1.23 ACCESS PANELS

A. The Contractor shall furnish access doors to the General Contractor for installation in ceilings, walls, partitions, and floors for access to valves, traps, fittings, and all appurtenances.
B. Access panels shall be of sufficient size to permit removal or access to equipment, except that the minimum size shall be 12-inches by 16-inches.
C. Access door locations shall be as determined by field conditions for optimum access to equipment and shall be reviewed by the Professional before final installation and shall be subject to the following.
   1. Bottom of access doors shall not be lower than the top of the partition base, or a minimum of 6 inches above floor.
   2. Tops and/or sides of access panels shall be a minimum of 6-inches from the ceiling or opening or from the edge of a wall return.
D. Access doors shall be suitable for installation in the finish material of the ceilings, walls, partitions and floors.
E. Frame and panel access doors in restrooms, kitchens and as indicated shall be stainless steel.
F. Access doors with UL Listing shall be provided in rated construction assemblies. Access doors shall be "B-Label" and shall have a UL one and one-half (1-1/2) hour rating at 250 degrees F rating for both door and frame. Maximum size shall be 20" x 20" or 400 square inches in area. Frame shall be sixteen (16) gauge minimum steel, panel shall be twenty (20) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), continuous type hinge on one side, flush-face type lock with key operation and self-latching cylinder locks.
G. Access doors without UL label shall be provided in all non-rated construction assemblies: Frame shall be sixteen (16) gauge minimum steel, panel shall be fourteen (14) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), concealed spring type hinges and flush-face type lock with key operation and self-latching cylinder locks. Door shall open 175 degrees (minimum).
H. All access doors shall be keyed alike.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials used on plumbing systems shall comply with the following lead ban requirements:
   1. Solders with lead content exceeding 0.2% (two-tenths of a percent) are prohibited. Brass and bronze materials containing 8.0% (eight percent) or greater lead are prohibited.

PART 3 - EXECUTION

3.1 GENERAL

A. All materials and equipment used shall be installed in strict accordance with the Standards under which the materials are accepted and approved, and in strict accordance with the manufacturer's instructions.
B. The Contract Documents are not intended to indicate every bend, offset, change in direction and appurtenance required to provide a complete and workable system.
C. The contract drawings are diagrammatic and are indicative of the work to be performed. It is not intended that they show every pipe, fitting or apparatus required for a complete installation.
D. Except where otherwise indicated, minimum cover shall not be less than the following:
   1. sanitary sewer piping: 3'-0"
   2. water piping: 3'-0"
   3. gas piping: 2'-0"

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.3 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 220500

SECTION 220503 - PLUMBING PIPE, TUBE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. Domestic water piping within 5 feet of building.
   2. Sanitary waste and vent piping, within 5 feet of building.
   3. Equipment drains and overflows.
   4. Compressed air piping.
   5. Natural Gas piping.
   6. Flue and Combustion Air piping for sealed combustion, direct vent water heaters.
   7. Unions and flanges.
   8. Underground pipe markers.

B. Related Sections:
   1. Division 08 - Access Doors and Frames
   2. Division 09 - Painting
   3. Section 22 05 23 - General-Duty Valves for Plumbing Piping.
   4. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
   5. Section 22 07 00 - Plumbing Insulation.
   6. Division 31 - Excavation, Trenching and Backfill

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
   2. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings
   3. ASME B16.22 – Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
   4. ASME B16.51 – Copper and Copper Alloy Press-Connect Pressure Fittings

B. ASTM International:
   1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   2. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
   3. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
   4. ASTM B75 - Standard Specification for Seamless Copper Tube.
   5. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
   6. ASTM D1784 – Rigid Chlorinated Poly (Vinyl Chloride) (CPVC) Vinyl Compounds.
   7. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   8. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
   9. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
   10. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

C. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
   2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:
   1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
3. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

E. Cast Iron Soil Pipe Institute:
1. CISPI 301 - Standard Specification for Hub-less Cast-Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 – Standard Specification for Couplings for use with Hub-less Cast-Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
3. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe institute (CISPI) and be listed by NSF International.

1.3 SUBMITTALS
A. Division 01 - Submittal Procedures.
B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.
C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.
D. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.
E. Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series number.

1.4 QUALITY ASSURANCE
A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.
C. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.
B. Installer: Company specializing in performing work of this section with minimum 10 years documented experience.
C. Design pipe hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location

1.6 DELIVERY, STORAGE, AND HANDLING
A. Division 01 - Requirements for transporting, handling, storing, and protecting products.
B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.
C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS
A. Division 01 - Environmental conditions affecting products on site.
B. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS
A. Verify field measurements prior to fabrication.

1.9 COORDINATION
A. Division 01 - Requirements for coordination.
B. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

Pipe 3 inch and smaller:

A. Copper Tubing: ASTM B88, Type K, drawn-temper (hard) or soft annealed-temper (soft).
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Press Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper and performance criteria of ASME b16.51, with EPDM rubber O-rings at each end.
   3. Joints shall be one of the following:
      a. Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
      b. Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.
      c. Pressure-Seal-Joints, lead free, minimum 200-psig working pressure rating at 250 degrees F.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

Pipe 3” and smaller:

A. Copper Tubing: ASTM B88, Type L, drawn temper (hard).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Press Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper and performance criteria of ASME b16.51, with EPDM rubber O-rings at each end.
   3. Joints shall be one of the following:
      a. Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
      b. Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.
      c. Pressure-Seal-Joints, lead free, minimum 200-psig working pressure rating at 250 degrees F.

2.3 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

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

B. Cast Iron Pipe: CISPI 301, hub-less.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, ASTM C1540-15, Heavy-Duty assemblies of corrugated stainless-steel shield/housing, stainless steel bands with corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center stop.
      a. Accepted Manufacturers:
         1) NDS Clamp-All
         2) Anaco-Husky
         3) Mission Rubber Company
         4) Mifab MI-QXHUB

C. PVC Pipe: ASTM D2665, Solid Wall, Schedule 40, polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.
   1. Fittings: ASTM D2466, Schedule 40, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.4 SANITARY WASTE AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, ASTM C1540-15, Heavy-Duty assemblies of corrugated stainless-steel shield/housing, stainless steel bands with corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center stop.
      a. Accepted Manufacturers:
         1) NDS Clamp-All
         2) Anaco-Husky
         3) Mission Rubber Company
         4) Mifab MI-QXHUB

B. Copper Tube: ASTM B306, DWV.
   1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.
   2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

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

D. PVC Pipe: ASTM D1785 Schedule 40 polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

E. Couplings: Victaulic Style 177, 77, or 75 flexible type couplings only may be used with schedule 40 or 80 PVC pipe at ambient temperatures not exceeding 100 deg F.

2.5 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tubing: ASTM B88, Type DWV.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
   2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
   3. Fittings: ASME B16.18 cast copper alloy, or ASME B16.22 wrought copper and bronze, or ASTM B584 bronze sand castings with copper tube dimensioned grooved ends (flaring of tube and fitting ends to IPS dimensions is not permitted).
   4. Joints: Grooved mechanical couplings meeting ASTM F1476.
      a. Housing Clamps: ASTM ASTM A536 ductile iron, cast with offsetting, angle-pattern bolt pads to provide rigidity, copper-colored enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion. "Installation-Ready" design for direct stab installation without field disassembly. Victaulic Style 607 QuickVic™.
      b. Gasket: Grade "EHP" EPDM gasket for water service with operating temperature range from -30 degrees F to 250 degrees F or Grade" T" Nitrile gasket for oil service with operating temperature range from -20 degrees F to 180 degrees F.
      c. Accessories: Stainless steel bolts, nuts, and washers.

B. PVC Pipe: ASTM D1785, Schedule 40 polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
   3. Couplings: Victaulic Style 177, 77, or 75 flexible type couplings only may be used with schedule 40 or 80 PVC pipe at ambient temperatures not exceeding 100 deg F.

2.6 COMPRESSED AIR PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, forged steel welding type.
2. Fittings: ASTM A536 ductile iron, or ASTM A234/A234M carbon steel, or factory-fabricated from ASTM A53 steel pipe; grooved ends.
3. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.
4. Joints: Grooved for pipe 2 inches and larger.
    a. Rigid Type: Housings shall be cast with offsetting, angle-bolt pads to provide sys-tem rigidity and support and hanging in accordance with ASME B31.1 and B31.9.
        1. 2 inches to 8 inches: "Installation Ready" couplings designed for direct "stab" installation without field disassembly, with Grade "EHP" EPDM gasket, -30 degrees F to +250 degrees F (suitable for oil-free air systems) and Grade "T" Nitrile gasket, -20 degrees F to +180 degrees F (suitable for air with oil vapors). Victaulic Style 107H "QuickVic".
        2. 10 inch and 12 inches: Standard rigid coupling with Grade "E" EPDM gasket, -30 degrees F to +230 degrees F (suitable for oil-free air systems) and Grade "T" Nitrile gasket, -20 degrees F to +180 degrees F (suitable for air with oil vapors). Victaulic Style 07 "Zero-Flex.
    b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors for vibration isolation at equipment connections. Three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration.
        1. 2 inches to 8 inches: "Installation Ready" couplings designed for direct "stab" installation without field disassembly, with Grade "EHP" EPDM gasket, -30 degrees F to +250 degrees F (suitable for oil-free air systems) and Grade "T" Nitrile gasket, -20 degrees F to +180 degrees F (suitable for air with oil vapors). Victaulic Style 177 "QuickVic".
        2. 10 inch and 12 inches: Standard flexible coupling with Grade "E" EPDM gasket, -30 degrees F to +230 degrees F (suitable for oil-free air systems) and Grade "T" Nitrile gasket, -20 degrees F to +180 degrees F (suitable for air with oil vapors). Victaulic Style 77.
5. Joints: Grooved for pipe 14 inches and larger shall be two ductile iron housings cast with a wide key profile and flat bolt pads for metal-to-metal contact. Wide-width, pres-sure-responsive gasket, Grade "E" EPDM of a FlushSeal® design, -30 degrees F to +230 degrees F (suitable for oil-free air systems) and Grade "T" Nitrile gasket, of a FlushSeal® design, -20 degrees F to +180 degrees F (suitable for air with oil vapors), and plated steel bolts and nuts.
    a. Rigid Type: Provides a rigid joint that corresponds with support spacings as defined by ASME B31.1 and B31.9. Victaulic Style W07.
    b. Flexible Type: Allows for linear and angular movement, vibration attenuation and stress relief. Victaulic Style W77.

B. Copper Tubing: ASTM B88, Type L, drawn.
1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints:

a. Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
b. Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.
c. Push-to-connect for pipe 1-1/2 inch and smaller, ASME B16.22 wrought copper or ASME B16.18 bronze casting with 301 stainless steel internal components, EPDM seals (suitable for oil-free compressed air systems only).
d. Grooved joint for pipe 2 inch to 8-inch, Couplings shall consist of two ductile iron housings conforming to ASTM A-536, cast with offsetting, angle-pattern bolt pads to provide system rigidity, coated with copper-colored enamel, with Grade "EHP" EPDM synthetic rubber gasket (suitable for oil-free compressed air systems) or Grade "T" Nitrile gasket (suitable for air with oil vapors), and plated steel bolts and nuts. Couplings shall be Installation-Ready stab-on design, for direct 'stab' installation onto roll grooved copper tube without prior field disassembly. Victaulic Style 607 QuickVic™.

C. Copper Tubing: ASTM B88, Type L annealed.
1. Fittings: ASME B16.26 cast bronze.
2. Joints: Flared.

D. Stainless Steel Pipe: ASTM A312, Type 304/304L, Schedule 5S, full finish annealed pipe certified for use with Vic Press 304™ couplings and fittings.
1. Fittings: Precision cold drawn austenitic stainless-steel housing, with synthetic rubber O-ring seals, Grade "E" EPDM (suitable for oil-free compressed air systems) or Grade "T" Nitrile (suitable for air with oil vapors), pipe stops and pressure-sealed end connections.
2. Joints: Vic-Press 304™ with 'PFT' series tool.

2.7 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASTM A234/A234M forged steel welding type.
2. Joints: ASME B31.9, welded.
3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.8 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

B. PE Pipe: ASTM D 2513, SDR 11.
1. Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

2.9 FLUE AND COMBUSTION AIR PIPING

A. CPVC Pipe: ASTM F441, Schedule 40, chlorinated polyvinyl chloride (CPVC) material.
1. Fittings: ASTM F441, Schedule 40, CPVC.
2. Joints: solvent weld with ASTM F493 solvent cement.

B. Stainless Steel Vent System: UL 1738, AL29-4C.

1. All flue-gas carrying components of the vent system shall be obtained from a single manufacturer.
2. Stainless steel vent system shall be warranted by the manufacturer against defects in material and workmanship for a period of (15) years from the date of manufacture.
3. Vent shall be factory-built special gas type, single wall, engineered and designed for use on Category I, II, II, and IV appliances, or as specified by the equipment manufacturer.
4. Vent shall be constructed of AL29-4C or 29-4 (S44735) superferritic stainless steel with minimum thickness of 0.015" for diameters 3"-8" and 0.020" for diameters 10"-16".
5. All conduit components shall be manufactured from AL29-4C or 29-4 (S44735). The joint closure system shall be a Ring-and-Tab mechanism that is integral to each joint. Use of gasket lube, available from the factory, should be used for maximizing gasket life and ease of installation.
6. Joints shall be designed with a male and female overlapping metal-metal connection to maintain condensate on the AL29-4C stainless steel. Proper ¼" per foot pitch must be maintained at all times and condensate should flow back toward the appliance to the required number of drains.
7. Vent shall be rated for an internal static pressure of 9" w.g.
8. All parts shall be compatible with other single wall or double wall products of the same manufacturer.

2.10 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with soldered joints.
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   4. PVC Piping: PVC.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. PVC Piping: PVC flanges.
   4. Gaskets: 1/16-inch-thick preformed neoprene gaskets.

C. Flange Adapter for Pipe 2 inches and Larger:
   1. Ferrous Piping: Class 125, 150 & 300, ductile iron, flat faced. Victaulic Style 741, 743 & W741.
   2. Copper Piping: 300 psi, ductile iron coated with copper-colored enamel, flat faced. Victaulic Style 641.

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Verification of existing conditions before starting work.
B. Verify excavations are to required grade, dry, and not over-excavated.
C. Verify trenches are ready to receive piping.

3.2 PREPARATION

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

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to site piping system size, location, and invert are as indicated on Drawings.
B. Establish elevations of buried piping with not less than 2 ft of cover.
C. Establish minimum separation from other services in accordance with applicable codes.
D. Install plastic pipe as required per ASTM D2321.
E. Install pipe to elevation as indicated on Drawings.
F. Install pipe on prepared bedding.
G. Route pipe in straight line.
H. Install pipe to allow for expansion and contraction without stressing pipe or joints.
I. Install plastic ribbon tape continuous, buried 12 inches below finish grade and above pipe line; coordinate with Division 31. Refer to Section 22 05 00.
J. Pipe Cover and Backfilling:
    1. Backfill trench in accordance with Section 22 05 00.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
C. Group piping whenever practical at common elevations.
D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 22 05 29.
E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.
H. Install non-conducting dielectric connections wherever jointing dissimilar metals.
I. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum (1/4 inch per foot for 2” pipes). Maintain gradients.
J. Slope piping and arrange systems to drain at low points.
K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
L. Install piping penetrating roofed areas to maintain integrity of roof assembly.
M. Install valves in accordance with Section 22 05 23.
N. Insulate piping. Refer to Section 22 07 00.
O. Install pipe identification in accordance with Section 22 05 53.
P. Grooved joint piping systems shall be installed in accordance with the manufacturer's (Victaulic) guidelines and recommendations. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by Victaulic. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A Victaulic factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation and visually verify correct installations. Contractor shall remove and replace any improperly installed products. At the owner’s discretion, Victaulic inspection services may be requested to review every Victaulic joint on the job site.

Q. Vic Press 304™ Pressure-Sealed Joints: Pipe shall be certified for use with the Vic Press 304™ system. Pipe shall be square cut, +/- 0.030", properly deburred and cleaned. Pipe ends shall be marked at the required location, using a manufacturer-supplied gauge, to ensure full insertion into the coupling or fitting during assembly. Use a Victaulic "PFT" Series tool with the proper sized jaw for pressing.

3.5 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping system in accordance with ASME B31.9.

B. Pipes carrying pressurized water and laid under the building shall be installed with NO joints.

3.6 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

A. Install sanitary waste and vent piping systems in accordance with ASME B31.9.

B. Install sanitary waste and vent piping systems in accordance with local plumbing code.

C. Install bell and spigot pipe with bell end upstream.

D. Support cast iron drainage piping at every joint.

3.7 INSTALLATION - STORM DRAINAGE PIPING SYSTEMS

A. Install storm drainage piping systems piping in accordance with ASME B31.9.

B. Install storm drainage piping systems in accordance with local plumbing code.

C. Install bell and spigot pipe with bell end upstream.

D. Support cast iron drainage piping at every joint.

3.8 INSTALLATION - COMPRESSED AIR PIPING SYSTEMS

A. Install compressed air piping systems piping in accordance with ASME B31.9.

B. Install drip connections with valves at low points of piping system.

C. Install take-off to outlets from top of main, with shut off valve after takeoff. Slope take-off piping to outlets.

D. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated on Drawings.

E. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

F. Cut pipe and tubing accurately and install without springing or forcing.

G. Slope piping in direction of flow.

H. Install strainers on inlet side of pressure reducing valves. Install pressure reducing valves with bypasses and isolation valves to allow maintenance without interruption of service.

3.9 INSTALLATION - GAS PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Provide support for utility meters in accordance with requirements of utility company.

C. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood.

D. Install gas pressure regulator vent full size opening on regulator and terminate outdoors or as indicated on Drawings.

3.10 FIELD QUALITY CONTROL

A. Refer to Division 01 - Execution and Closeout Requirements: Field inspecting, testing and adjusting.

B. Test domestic water piping system in accordance with applicable code. Refer to Section 22 05 00.

C. Test sanitary waste and vent piping system in accordance with applicable code. Refer to Section 22 05 00.

D. Test storm drainage piping system in accordance with applicable code. Refer to Section 22 05 00.

E. Pressure test natural gas piping in accordance with NFPA 54.

F. Test for Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.9.

3.11 CLEANING

A. Division 01 – Execution and Closeout Requirements: Field inspecting, testing and adjusting.

B. Clean and disinfect domestic water distribution system in accordance with Section 22 05 00.

END OF SECTION 220503

SECTION 220523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gate valves.
   2. Ball valves.
   3. Plug valves.
   4. Butterfly valves.
   5. Check valves.

B. Related Sections:
   1. Section 22 05 03 – Plumbing Pipe, Tube and Fittings
   2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
   3. Section 22 07 00 - Plumbing Insulation

1.2 REFERENCES

A. ASTM International:
   1. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 67 - Butterfly Valves.
   2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
   3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
   5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series number.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves.

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

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

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet or frozen.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.
B. Furnish five-year manufacturer warranty for valves excluding packing.

1.9 EXTRA MATERIALS

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

PART 2 PRODUCTS

2.1 GATE VALVES

A. Manufacturers:
1. Apollo Valves, Conbraco Company.
2. Crane Valve, North America.
3. Hammond Valve.
4. Milwaukee Valve Company.
5. NIBCO, Inc.
6. Stockham Valves & Fittings.
B. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, rising stem, hand-wheel, inside screw with back-seating stem, solid wedge disc, alloy seat rings, solder or threaded ends.
C. 2-1/2 inches and Larger: MSS SP 70, Class 125, cast iron body, bronze trim, bolted bonnet, non-rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.2 BALL VALVES

A. Manufacturers:
1. Apollo Valves, Conbraco Company.
2. Crane Valve, North America.
3. Hammond Valve Model.
4. Jomar Valve
5. Milwaukee Valve Company.
6. NIBCO, Inc. Model.
7. Stockham Valves & Fittings Model.
8. Victaulic
B. 4 inch and Smaller: MSS SP 110, 600 psi WOG, two-piece brass or bronze body, chrome plated brass ball and stem, full port, PTFE seats, blow-out proof stem, solder or threaded ends, lever handle.
C. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two-piece body, type 316 stainless steel ball, full port, Teflon seats, blow-out proof stem, solder or threaded ends, lever handle.
D. Drain valves at bottom of domestic water risers: ¾" in size, MSS SP 110, 600 psi WOG, two-piece brass or bronze body, full port, blowout-proof stem, stainless steel ball and stem, solder end x ¾" hose connection with cap and chain, lever handle.
E. 2 inches and smaller: MSS SP 110, 300 psi CWP, forged brass two-piece body, chrome-plated brass ball and stem, TFE seats, Fluoro-elastomer seals, blow-out proof stem, pressure-sealed ends, lever handle.
F. 1-1/2" and smaller: MSS SP 110, 200 psi CWP, forged brass two-piece body, chrome-plated copper alloy ball and copper alloy stem, PTFE seats, Fluorocarbon or ring stem seal, push-to-connect ends, lever handle.

2.3 PLUG VALVES

A. Manufacturers:

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

B. 2 inches and Smaller: MSS SP 78, Class 150, semi-steel construction, round port, full pipe area, pressure lubricated, Teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 150, semi-steel construction, round port, full pipe area, pressure lubricated, Teflon packing, flanged ends. Furnish wrench operated.

2.4 BUTTERFLY VALVES

A. Manufacturers:
1. Apollo Valve, Conbraco Company
2. Crane Valve, North America.
3. Hammond Valve.
4. Jomar Valve
5. Milwaukee Valve Company.
6. NIBCO, Inc.
7. Stockham Valves & Fittings.
8. Victaulic Series Vic®-300 Master Seal™ and Vic®-300 AGS.

B. 2-1/2 inches and Larger: MSS SP 67, Class 200.
1. Body: Cast or ductile iron, lug or grooved ends, stainless steel stem, extended neck.
2. Disc: Chrome plated, electro-less nickel coated, or PPS coated ductile iron or stainless steel, offset disc to provide continuous 360-degree seating.
3. Seat: Resilient replaceable EPDM [Buna N for compressed air applications].
4. Handle and Operator: Infinite position lever handle with memory stop, gear operator with hand-wheel or power actuator.

2.5 CHECK VALVES

A. Horizontal Swing Check Valves:
1. Manufacturers:
a. Apollo Valve, Conbraco Company.
b. Crane Valve, North America
c. Hammond Valve.
d. Jomar Valve
e. Milwaukee Valve Company.
f. NIBCO, Inc.
g. Stockham Valves & Fittings.
h. Victaulic Company.
2. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N or PTFE disc, solder or threaded ends.
3. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast-iron disc, renewable disc seal and seat, flanged ends.
4. 2 inches through 4 inches: 300 psi, cast ductile iron body, bonnet cap drilled and tapped with 1/2" NPT, stainless steel Type 316 clapper and clapper pin, grooved ends, Teflon, EPDM or fluoro-elastomer seat and EPDM, fluoro-elastomer bonnet gasket.

B. Spring Loaded Check Valves:
1. Manufacturers:
a. Apollo Valve, Conbraco Company
b. Crane Valve, North America.
c. Hammond Valve.
d. Milwaukee Valve Company.

e. NIBCO, Inc.
f. Stockham Valves & Fittings.
g. Victaulic Company.

2. 2 inches and Smaller: MSS SP 80, Class 250 bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.
3. 2-1/2 inches and Larger: MSS SP 71, Class 125, wafer or globe style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.
4. 2 inches through 3 inches: 365 psi CWP rating, non-slam, silent type with ductile iron body, stainless steel spring, brass shaft and stainless-steel disc seats against the o-ring seal which is mounted on the electro-less nickel-plated end face. Victaulic Series 716H.
5. 4 inches through 12 inches: 300 psi CWP rating, non-slam, silent type with ductile iron body and stainless-steel spring and shaft. Victaulic Series 716 and Series 779 with venturi-taps.
6. 14 inches through 24 inches: 230 psi CWP rating, ductile iron body, spring actuated stainless steel disc and shaft, EPDM seat bonded to the valve body. Victaulic Series W715.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.
B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
C. Install 3/4-inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
D. Install valves with clearance for installation of insulation and allowing access.
E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.
F. Refer to Section 22 05 29 for pipe hangers.
G. Refer to Section 22 07 00 for insulation requirements for valves.
H. Refer to Section 22 05 03 for piping materials applying to various system types.
I. Grooved end valves shall be installed in accordance with the manufacturer's (Victaulic) guidelines and recommendations. Grooved end shall be clean and free from indentations and projections. A Victaulic factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

3.3 VALVE APPLICATIONS

A. Valves installed in the domestic water piping system shall be Lead-Free per NSF 61, Annex G or NSF 372 requirements.
B. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
C. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
D. Install globe valves for throttling, bypass, or manual flow control services.

E. Install spring loaded check valves on discharge of water pumps.
F. Install lever and weight, lever and spring check valves on discharge of pumps in pumped sanitary pumped storm water piping.
G. Install lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
H. Install ball valves in domestic water systems for shut-off service.
I. Install globe valves in domestic water systems for throttling service.
J. Install gate valves in sanitary systems for shut-off service.
K. Install gate valves in storm water systems for shut-off service.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to plumbing work.
9. Firestopping accessories.
10. Equipment bases and supports.

B. Related Sections:

1. Section 22 05 03 – Plumbing Pipe, Tube and Fittings.
2. Division 03 - Concrete Forming and Accessories.
3. Division 03 - Cast-In-Place Concrete.
4. Division 07 - Joint Protection.
5. Division 09 - Painting and Coating.
6. Division 07 - Requirements for roof flashing installation.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.

4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

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

D. FM Global:

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

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

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: shall comply with ASTM E119, ASTM E814, and/or UL 263, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

C. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

2. Firestopping: Submit preparation and installation instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

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

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with 5 years documented experience.

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

1.9 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

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

1.10 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Carpenter & Paterson Inc.

2. Creative Systems Inc.

3. Flex-Weld, Inc.

4. Glope Pipe Hanger Products Inc.

5. Michigan Hanger Co.

6. Superior Valve Co.

B. Plumbing Piping - DWV:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.

2. Hangers for Pipe Sizes 1-1/2 inches and Larger: Carbon steel, adjustable, clevis.

3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

4. Vertical Support: Steel riser clamp.

5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

6. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.

2. Hangers for Pipe Sizes 1/2 to 4 inches: Carbon steel, adjustable, clevis.

3. Hangers for Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

5. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.

6. Vertical Support: Copper-plated, Steel riser clamp.

7. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

8. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

9. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

10. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

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

2.3 INSERTS

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

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb./sq. ft sheet lead.

2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mils thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

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

C. Sealant: Acrylic; refer to Section 07 90 00.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Thunderline Link-Seal, Inc.

2. NMP Corporation.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:

1. B-Line Systems.

2. Unistrut Corp.

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

2.8 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. International Protective Coating Corp.
5. 3M fire Protection Products.
6. Specified Technology, Inc.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single or Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single or Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer's full range of colors.

2.9 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL listed products or products tested by other approved independent testing laboratory.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing or damming materials to arrest liquid material leakage.

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

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, MSS SP 89.

B. Where insulated horizontal piping occurs, provide hanger of adequate size to allow for pipe insulation to be run continuously through the hanger assembly.

C. Support vertical piping and tubing at base and at each floor.

D. Support horizontal piping as scheduled.

E. Install hangers with minimum 1/2-inch space between finished covering and adjacent work.

F. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

G. Maximum spans below were taken from MSS SP-69 for water service and from model plumbing codes. Most restrictive piping and spacing dimensions are shown.

H. Install hangers for CAST-IRON SOIL piping with the following maximum horizontal spacing and minimum rod diameters:

PIPE SIZE (IN.)	HORIZONTAL HANGER SPACING (FT)	ROD DIAMETER (IN.)
1½, 2	5	3/8
3	5	1/2
4, 5	5	5/8
6	5	3/4
8 - 12	5	7/8

1. Install supports for vertical cast-iron soil piping every 15 feet.

I. Install hangers for STEEL piping with the following maximum horizontal spacing and minimum rod diameters:

PIPE SIZE (IN.)	HORIZONTAL HANGER SPACING (FT)	ROD DIAMETER (IN.)
½ - 1¼	7	3/8
1½	9	3/8
2	10	3/8
3	11	1/2
4	12	5/8
6	12	3/4
8 - 12	12	7/8

1. Install supports for vertical steel piping every 15 feet.

J. Install hangers for COPPER tubing with the following maximum horizontal spacing and minimum rod diameters:

PIPE SIZE (IN.)	HORIZONTAL HANGER SPACING (FT)	ROD DIAMETER (IN.)
½ - 1¼	5	3/8

1½, 2	6	3/8
2½	8	1/2
3, 4, 5	10	1/2
6	10	5/8
8	10	3/4

1. Install supports for vertical copper tubing every 10 feet (3 m).

K. Support horizontal CPVC piping as scheduled below:

PIPE SIZE (IN.)	HORIZONTAL HANGER SPACING (FT)	ROD DIAMETER (IN.)
½ - 1	3	3/8
1¼, 2	4	3/8
2½, 3	4	1/2
4, 5	4	5/8
6	4	3/4
8	4	3/4

1. Install vertical supports for CPVC piping every 5 ft for piping 1” and smaller and every 6 ft for 1¼” and larger

L. Install hangers for DWV PVC piping with the following maximum horizontal spacing and minimum rod diameters:

PIPE SIZE (IN.)	HORIZONTAL HANGER SPACING (FT)	ROD DIAMETER (IN.)
½ - 1	3	3/8
1¼, 2	4	3/8
2½, 3	4	1/2
4, 5	4	5/8
6	4	3/4
8	4	3/4

1. Install supports for vertical PVC piping every 48 inches.

M. Place hangers within 12 inches of each horizontal elbow.

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

O. Support horizontal cast iron pipe adjacent to each hub.

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

Q. Support piping and tubing not listed above per MSS SP-69 and manufacturer's written instructions.

R. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

S. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

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

3.6 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls and floors.

B. Flashing for roof penetrations shall be provided by the roofing contractor.

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 and/or mop sink drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

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

D. Extend sleeves through floors 1inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk [airtight]. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel or stainless steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.

B. Fire Rated Surface:

1. Seal opening at rated floor, wall, partition, ceiling, and/or roof as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Pack void with backing material.

d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

C. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition, floor, ceiling, and/or roof opening as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Install type of firestopping material recommended by manufacturer.

2. Install wall escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

4. Interior partitions: Seal pipe penetrations at clean rooms, laboratories, hospital spaces, computer rooms, telecommunication rooms, data rooms and. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.9 FIELD QUALITY CONTROL

A. Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.10 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.11 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 220529

SECTION 220553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

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

B. National Fire Protection Association:

1. NFPA 99 - Standard for Health Care Facilities.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

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

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

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

1.5 QUALITY ASSURANCE

A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

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

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two containers of spray-on adhesive.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:

1. Craftmark Identification Systems.
2. Safety Sign Co.

3. Seton Identification Products.

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

2.2 TAGS

A. Manufacturers:
1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.

B. Plastic Tags:
1. Laminated three-layer plastic with engraved letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

C. Metal Tags:
1. Aluminum with stamped letters; tag size minimum 1½ inches diameter with finished edge.

D. Information Tags:
1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

E. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.3 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
1. Up to 2 inches Outside Diameter of Insulation or Pipe: ½ inch-high letters.
2. 2½ to 6 inches Outside Diameter of Insulation or Pipe: 1-inch-high letters.
3. Over 6 inches Outside Diameter of Insulation or Pipe: 2-inch-high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1; “Scheme for the Identification of Piping Systems”

B. Pipe markers installed above ceiling in return air plenums shall be plenum rated.

C. Plastic Pipe Markers:
1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

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

E. Plastic Underground Pipe Markers:
1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mils thick, manufactured for direct burial service.

2.5 CEILING TACKS

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

B. Color code as follows:
1. Plumbing valves: Green.

2.6 LABELS

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

2.7 LOCKOUT DEVICES

A. Lockout Hasps:
1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices:

1. Steel device preventing access to valve operator, accepting lock shackle.

PART 3 EXECUTION

3.1 PREPARATION

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

B. Prepare surfaces in accordance with Division 09 for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting in accordance with Division 09.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify valves in main and branch piping with tags.

J. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

K. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

B. Related Sections:

1. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
2. Division 09 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
4. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
5. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
6. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
7. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
8. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
9. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Division: Submittal procedures.

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

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84, UL 723, and NFPA 255.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

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

1.6 DELIVERY, STORAGE, AND HANDLING
A. Division 01: Requirements for transporting, handling, storing, and protecting products.
B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS
A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS
A. Verify all field measurements prior to fabrication.

1.9 WARRANTY
A. Division 01: Product warranties and product bonds.
B. Furnish one year minimum.
C. Furnish five-year manufacturer warranty for manmade fiber.

PART 2 PRODUCTS

2.1 MANUFACTURER
A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
1. CertainTeed.
2. Knauf.
3. Johns Manville.
4. Owens-Corning.
B. Manufacturers for Closed Cell Elastomeric Insulation Products:
1. Aeroflex. Aerocell.
2. Armacell, LLC. Armaflex.
3. Nomaco. K-flex.

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

2.3 PIPE INSULATION JACKETS
A. Vapor Retarder Jacket:
1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.

2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

B. PVC Plastic Pipe Jacket:

1. Product Description: ASTM D1784, one-piece molded type fitting covers and sheet material, off-white color.
2. Thickness: 15 mils.
3. Connections: Pressure sensitive color matching vinyl tape.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum or stainless-steel jacket single piece construction with self-adhesive closure. Thickness to match pipe insulation.

E. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

F. Adhesives: Compatible with insulation.

1. Indoor Vapor Retarder Finish:
   a. Cloth: Untreated; 9 oz/sq yd weight.
   b. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.5 EQUIPMENT INSULATION

A. TYPE E-1: ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.

1. Thermal Conductivity: 0.24 at 75 degrees F.
2. Operating Temperature Range: 0 to 450 degrees F.
3. Density: 1.65 pound per cubic foot.

B. TYPE E-2: ASTM C612; glass fiber, rigid board, noncombustible with factory applied kraft reinforced aluminum foil jacket.

1. Thermal Conductivity: 0.24 at 75 degrees F.
2. Operating Temperature Range: 0 to 450 degrees F.
3. Density: 3.0 pound per cubic foot.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

C. EQUIPMENT INSULATION JACKETS

B. PVC Plastic Equipment Jacket:

1. Product Description: ASTM D1785, sheet material, off-white color.
2. Minimum Service Temperature: -40 degrees F.
3. Maximum Service Temperature: 150 degrees F.
4. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
5. Thickness: 30 mil.
6. Connections: Brush on welding adhesive with VOC content of 50 g/l according to CFR 59, Subpart D (EPA Method 24).

C. Aluminum Equipment Jacket:

1. ASTM B209.
2. Thickness: 0.020-inch-thick sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2-inch laps.
5. Fittings: 0.02-inch-thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015-inch-thick aluminum. 0.020-inch-thick stainless steel.

D. Canvas Equipment Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

E. Vapor Retarder Jacket:

1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

F. Field Applied Glass Fiber Fabric Jacket System:

1. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
2. Glass Fiber Fabric:
   a. Cloth: Untreated; 9 oz/sq yd weight.
   b. Blanket: 1.0 lb/cu ft density.
3. Indoor Vapor Retarder Finish:
   a. Cloth: Untreated; 9 oz/sq yd weight.
   b. Vinyl emulsion type acrylic, compatible with insulation, black, white color.

1.2 EQUIPMENT INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12 inch centers.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

E. Adhesives: Compatible with insulation.

1.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.

1. Manufacturers:
   a. Childers Products, Division of ITW; CP-97.
   b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
   c. Marathon Industries, Inc.; 290.
2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Products, Division of ITW; CP-96.
   b. Foster Products Corporation, H. B. Fuller Company; 81-33.
2. calculated per 40 CFR 59, Subpart D (EPA Method 24).

D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers:
   a. Aeroflex USA Inc.; Aeroseal.

b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

G. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers:
a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

1.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content that meets the requirement of the South Coast Air Quality Management District Rule #1168. VOC limits to be per amendment date 1/7/05.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Manufacturers:
a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. Marathon Industries, Inc.; 590.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
   1. Manufacturers:
      a. Childers Products, Division of ITW; CP-30.
      b. Foster Products Corporation, H. B. Fuller Company; 30-35.
      c. Marathon Industries, Inc.; 501.
   2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
   3. Service Temperature Range: 0 to 180 deg F.
   4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
   5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
   1. Manufacturers:
      a. Childers Products, Division of ITW; Encacel.
      b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
      c. Marathon Industries, Inc.; 570.
   2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
   3. Service Temperature Range: Minus 50 to plus 220 deg F.
   4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
   5. Color: White.
   6. For outdoor aluminum finish, use 60-39 mastic.

1.5 SEALANTS

A. Joint Sealants:
   1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products - Manufacturers:
      a. Childers Products, Division of ITW; CP-76.
      b. Foster Products Corporation, H. B. Fuller Company; 30-45.
      c. Marathon Industries, Inc.; 405.
   2. Joint Sealant for Polystyrene Products - Manufacturers:
      a. Childers Products, Division of ITW; CP-70.
      b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
      c. Marathon Industries, Inc.; 405.
   3. Materials shall be compatible with insulation materials, jackets, and substrates.
   4. Permanently flexible, elastomeric sealant.
   5. Service Temperature Range: Minus 100 to plus 300 deg F.
   6. Color: White or gray.
   7. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:
   1. Manufacturers:
      a. Childers Products, Division of ITW; CP-76-8.
      b. Foster Products Corporation, H. B. Fuller Company; 95-44.
      c. Marathon Industries, Inc.; 405.
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Manufacturers:
a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

1.6 FIELD APPLIED FABRIC – REINFORCING MASH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
1. Manufacturers:
a. Vimasco Corporation; Elastafab 894.

B. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.
1. Manufacturers:
a. Childers Products, Division of ITW; Chil-Glas No. 5.

C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for equipment and pipe.
1. Manufacturers:
a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
b. Vimasco Corporation; Elastafab 894.

1.7 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
1. Manufacturers:
a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

1.8 SECUREMENTS

A. Bands:
1. Manufacturers:
a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.

4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
5. Copper clad annealed steel wire having a minimum 16-gauge thickness.

B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
a. Manufacturers:
1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
a. Manufacturers:
1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
a. Manufacturers:
1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
a. Manufacturers:
1) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.
1. Manufacturers:
a. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.

1.9 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC per ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1-inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01: Coordination and project conditions.

B. Verify piping and or equipment has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Install insulation continuously through all hanger assemblies.

C. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.

D. Piping Systems Conveying Fluids Below Ambient Temperature:

1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

E. Glass Fiber Board Insulation

1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

F. Hot Piping Systems less than 140 degrees F:

1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
3. Do not insulate unions and flanges at equipment, but bevel and seal end of insulation at such locations.

G. Inserts and Shields:

1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.

a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.

3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

H. Insulation Terminating Points:
1. Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the control valve.
2. Condensate Piping: Insulate entire piping system and components to prevent condensation.

I. Closed Cell Elastomeric Insulation:
1. Push insulation on to piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer's recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.

K. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum or stainless-steel jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.

L. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

M. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Below Ambient Temperature:
1. Insulate entire equipment surfaces.
2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
4. Finish insulation at supports, protrusions, and interruptions.

E. Equipment Containing Fluids 140 degrees F or Less:
1. Do not insulate flanges and unions, but bevel and seal ends of insulation.
2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
3. Finish insulation at supports, protrusions, and interruptions.

F. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.
G. Equipment Located Exterior to Building: Install vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.
H. Cover insulation with aluminum jacket.
I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
K. Prepare equipment insulation for finish painting. Refer to Division 09.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.
B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.
D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements for firestopping and fire-resistive joint sealers.
F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies.

3.5 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS (inches)
Domestic Hot Water Supply and Recirculation	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	1.0 1.5

Domestic Cold Water	P-1 or P-5	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0

B. Drainage Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS (inches)
Sanitary Sewer Piping (exposed)	P-1 or P-5	All sizes	1.0

C. Equipment Insulation Schedule:

EQUIPMENT	INSULATION TYPE	INSULATION THICKNESS (inches)
Domestic Hot Water Storage Tanks	E-1, E-2	2.0

END OF SECTION 220700

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:

1. Domestic water piping within 5 feet of building.
2. Unions and flanges.
3. Underground pipe markers.

B. Related Sections:

1. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
2. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
3. Section 22 05 23 - General-Duty Valves for Plumbing Piping.
4. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
5. Section 22 07 00 - Plumbing Insulation.
6. Division 31 - Soils for Earthwork
7. Division 31 - Aggregates for Earthwork.
8. Division 31 – Excavation, Trenching and Backfill

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
3. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
4. ASTM B75 - Standard Specification for Seamless Copper Tube.
5. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

6. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).

7. ASTM D1784 – Rigid Chlorinated Poly (Vinyl Chloride) (CPVC) Vinyl Compounds.

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

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

10. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

C. American Welding Society:

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

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

D. American Water Works Association:

1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

3. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.

C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

D. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 10 years documented experience.

C. Design pipe hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Environmental conditions affecting products on site.

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

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Division 01 - Requirements for coordination.

B. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

Pipe 3 inch and larger:

A. Ductile Iron Pipe: AWWA C151.

1. Fittings: AWWA C110, ductile or gray iron, standard thickness.

2. Joints: AWWA C111, rubber gasket with rods.

Pipe 2½ inch and smaller:

B. Copper Tubing: ASTM B88, Type K hard drawn or annealed.

1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.

2. Joints:

a. 1” and smaller: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

b. 1-1/4” and larger: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

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

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints:

a. 1” and smaller: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

b. 1-1/4” and larger: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B. Copper Tubing: ASTM B88, Type L hard drawn, rolled grooved ends.

1. Fittings: ASME B16.18 cast copper alloy, or ASME B16.22 wrought copper and bronze, or ASTM B584 bronze sand castings,] grooved ends.

2. Joints: Grooved mechanical couplings meeting ASTM F1476.

a. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.

b. Gasket: Elastomer composition for operating temperature range from -30 degrees F to 230 degrees F.

c. Accessories: Stainless steel bolts, nuts, and washers.

C. CPVC Pipe: ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M, chlorinated polyvinyl chloride (CPVC) material.

1. Fittings: ASTM D2846/D2846M, ASTM F437, ASTM F438, ASTM F439, or ASTM F441/F441M, CPVC.

2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

2.1 RECLAIMED (NON-POTABLE) WATER PIPING, ABOVE GRADE

A. CPVC Pipe: ASTM D2846, chlorinated polyvinyl chloride (CPVC) material.

1. Fittings: ASTM D2846 CPVC.

2. Joints: ASTM D2846, solvent weld with ASTM F493 solvent cement.

B. Pipe shall be purple in color, and marked with two lines of type clearly identifying the contents as "WARNING: NON-POTABLE WATER. DO NOT DRINK".

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Verification of existing conditions before starting work.

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

C. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Establish elevations of buried piping with not less than 2 ft of cover.

B. Establish minimum separation from other services in accordance with applicable codes.

C. Install pipe on prepared bedding.

D. Route pipe in straight line.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints.

F. Install plastic ribbon tape continuous, buried 12 inches below finish grade and above pipe line; coordinate with Division 31. Refer to Section 22 05 00.

G. Pipe Cover and Backfilling:

1. Backfill trench in accordance with Section 22 05 00.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 22 05 29.

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

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Slope piping and arrange systems to drain at low points.

J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

K. Install piping penetrating roofed areas to maintain integrity of roof assembly.

L. Install valves in accordance with Section 22 05 23.

M. Insulate piping. Refer to Section 22 07 00.

N. Install pipe identification in accordance with Section 22 05 53.

3.5 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping system in accordance with ASME B31.9.

3.6 FIELD QUALITY CONTROL

A. Refer to Division 01 - Closeout Requirements.

B. Test domestic water piping system in accordance with applicable code. Refer to Section 22 05 00.

3.7 CLEANING

A. Division 01 - Execution and Closeout Requirements.

B. Clean and disinfect domestic water distribution system in accordance with Section 22 05 00.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:

1. Sanitary sewer piping, within 5 feet of building.

2. Underground pipe markers.

B. Related Sections:

1. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.

2. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.

3. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.

4. Division 31 - Soils for Earthwork.

5. Division 31 - Aggregates for Earthwork.

6. Division 31 – Excavation, Trenching and Backfill

1.2 REFERENCES

A. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

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

3. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

4. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).

5. ASTM D1784 – Rigid Chlorinated Poly (Vinyl Chloride) (CPVC) Vinyl Compounds.

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

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

8. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

B. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

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

3. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast iron Soil Pipe institute (CISPI) and be listed by NSF International.

1.3 SUBMITTALS

A. Division 01 - Submittal procedures.

B. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 10 years documented experience.

C. Design pipe hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Environmental conditions affecting products on site.

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

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Soil Pipe: ASTM A74, service weight [extra heavy], bell and spigot ends.

1. Fittings: Cast iron, ASTM A74.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

B. Cast Iron Pipe: CISPI 301, hub-less.

1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

Do not use PVC pipe for high temperature waste water (140 F or higher).

C. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.

1. Fittings: ASTM D2466, Schedule 40, PVC.

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

D. Plastic Pipe: ASTM D2665, polyvinyl chloride (PVC) material.

1. Fittings: PVC, ASTM D2665.

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

2.2 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. Copper Tube: ASTM B306, DWV.

1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

Do not use PVC pipe for high temperature waste water (140 F or higher).

Do not use PVC pipe in return plenum ceilings.

C. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2665, PVC.

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

D. PVC Pipe: ASTM D1785 Schedule 40 polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2466, Schedule 40, PVC.

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

2.3 CHEMICAL RESISTANT WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. CPVC Pipe, Type IV, ChemDrain™: ASTM D1784, ASTM D3311, ASTM F441/F441M Schedule 40 chlorinated polyvinyl chloride (CPVC) material. ASTM Cell Class 24448 for pipe compound and ASTM Cell Class 23447 for fitting compound. NSF certified for use in corrosive waste drainage systems.

1. Fittings: ASTM F441/F441M, CPVC.

2. Joints: ASTM D3311, solvent weld with ChemDrain™ One-stop, ASTM F493 solvent cement

B. Polypropylene Pipe, Non-Fire Retardant: ASTM D4101, ASTM F1412, Schedule 40 [Schedule 80] polypropylene material, NSF listed, CSA certified.

1. Fittings: ASTM D4101, ASTM F1412, polypropylene, NSF listed.

2. Joints: Electrofusion joints conforming to ASTM F1290.

2.4 CHEMICAL RESISTANT WASTE AND VENT PIPING, ABOVE CEILING

A. CPVC Pipe, Type IV: ASTM D1784, ASTM D3311, ASTM F441/F441M Schedule 40 chlorinated polyvinyl chloride (CPVC) material. ASTM Cell Class 24448 for pipe compound and ASTM Cell Class 23447 for fitting compound. NSF certified for use in corrosive waste drainage systems.

1. Fittings: ASTM F441/F441M, CPVC.

2. Joints: ASTM D3311, solvent weld with ASTM F493 solvent cement

B. Polypropylene Pipe, Fire Retardant: ASTM D4101, ASTM F1412, Schedule 40 [Schedule 80] polypropylene material, NSF listed, CSA certified.

1. Fittings: ASTM D4101, ASTM F1412, polypropylene, NSF listed.

2. Joints:

a. Electrofusion joints conforming to ASTM F1290.

b. Mechanical Joints: NSF listed, all fittings shall have integrally molded union connections designed to lock onto a machined groove on the mating piping.

c. Mechanical Joints: NSF listed, no-hub style, stainless steel outer coupling, designed to lock onto a machined groove on the mating piping.

2.5 CHEMICAL RESISTANT WASTE AND VENT PIPING, ABOVE CEILING, PLENUM RATED

A. Polyvinylidene Fluoride (PVDF) Pipe, Fire Retardant: ASTM D3222, ASTM F1673, Schedule 40 polyvinylidene fluoride material (PVDF). Pipe and fittings shall be third party certified to ASTM E84. PVDF material shall meet UL-723 requirements for flame spread rating less than 25 and smoke developed less than 50.

1. Fittings: ASTM D3222, ASTM F1673, polyvinylidene fluoride.

2. Joints:

a. Electrofusion joints conforming to ASTM F1290.

b. Mechanical Joints: NSF listed, all fittings shall have integrally molded union connections designed to lock onto a machined groove on the mating piping.

c. Mechanical Joints: NSF listed, no-hub style, stainless steel outer coupling, designed to lock onto a machined groove on the mating piping.

2.6 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tubing: ASTM B88, Type DWV.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

B. PVC Pipe: ASTM D1785, Schedule 40 polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2466, Schedule 40, PVC.

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Verification of existing conditions before starting work.

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

C. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to [site piping system] [existing piping system] size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than 2 ft of cover.

C. Establish minimum separation from other services in accordance with applicable codes.

D. Install pipe to elevation as indicated on Drawings.

E. Install pipe on prepared bedding.

F. Route pipe in straight line.

G. Install pipe to allow for expansion and contraction without stressing pipe or joints.

H. Install plastic ribbon tape continuous, buried 12 inches below finish grade and above pipe line; coordinate with Division 31. Refer to Section 22 05 00.

I. Pipe Cover and Backfilling:

1. Backfill trench in accordance with Section 22 05 00.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 22 05 29.

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

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

G. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum (1/4 inch per foot for 2” pipes). Maintain gradients.

H. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

I. Install pipe identification in accordance with Section 22 05 53.

3.5 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

A. Install sanitary waste and vent piping systems in accordance with ASME B31.9.

B. Install sanitary waste and vent piping systems in accordance with local plumbing code.

C. Install bell and spigot pipe with bell end upstream.

D. Support cast iron drainage piping at every joint.

3.6 FIELD QUALITY CONTROL

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

B. Test sanitary waste and vent piping system in accordance with applicable code. Refer to Section 22 05 00.

3.7 CLEANING

A. Division 01 - Execution and Closeout Requirements

B. Clean and disinfect domestic water distribution system in accordance with Section 22 05 00.

END OF SECTION

SECTION 221323 - SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of interceptors outside the building:

1. Grease interceptors.
2. Oil interceptors.
3. Sand interceptors.
4. Sediment interceptors.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. HDPE: High-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of [**metal**] [**metal and plastic**] [**plastic**] interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

B. Shop Drawings: For each type and size of cast-in-place-concrete interceptor indicated.

1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.
2. Include reports and calculations for design mixes of concrete.

C. Shop Drawings: For each type and size of precast concrete interceptor indicated.

1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

D. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Interceptors.
2. Piping connections. Include size, location, and elevation of each.
3. Interface with underground structures and utility services.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:

1. Notify [**Architect**] [**Construction Manager**] [**Owner**] no fewer than [**seven**] <**Insert number**> days in advance of proposed interruption of service.
2. Do not proceed with interruption of sewer services without [**Architect's**] [**Construction Manager's**] [**Owner's**] written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GREASE INTERCEPTORS

A. Grease Interceptors: Cast-in-place-concrete or precast concrete structure complying with requirements of <**Insert authority title**>.

B. Grease Interceptors: Construct bottom, sidewalls, and top of reinforced, cast-in-place concrete. Include[**vent connections,**] manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.

1. Concrete: Comply with ACI 318/318R, ACI 350R.

a. Design Mix: 4000 psig (27.6 MPa) minimum, with 0.45 maximum water-to-cementitious materials ratio.
b. Portland Cement: ASTM C 150, Type II.
c. Fine Aggregate: ASTM C 33, sand.
d. Coarse Aggregate: ASTM C 33, crushed gravel.
e. Water: Potable.

f. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
g. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

C. Grease Interceptors: Precast concrete complying with ASTM C 913. Include rubber-gasketed joints, [**vent connections,**]manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.

1. Protective Coating: Plant-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all [**exterior**] [**exterior and interior**] [**interior**] concrete surfaces.
2. Structural Design Loads:

a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10- 44).
b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
d. Walkway Load: Comply with ASTM C 890, A-03.

3. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.
4. Steps: [**Individual FRP steps or FRP ladder**] [**Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP**] [**ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP**] <**Insert other**>, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of interceptor to finished grade is less than [**60 inches (1500 mm)**] <**Insert other**>.
5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
6. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.

a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
c. Include indented top design with lettering cast into cover, using wording equivalent to "[**INTERCEPTOR**] [**GREASE INTERCEPTOR**] [**SANITARY SEWER**] <**Insert other**>."
d. Protective Coating: Foundry-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all ferrous surfaces.

D. Grease Interceptor Capacity and Characteristics:

1. Length by Width by Depth: <**Insert values.**>
2. Number of Compartments: [**One**] [**Two**] <**Insert other**>.
3. Retention Capacity: <**Insert value.**>
4. [**Inlet and**]Outlet Pipe Size: <**Insert value.**>

a. Centerline of Inlet to Floor: <**Insert value.**>
b. Centerline of Outlet to Floor: <**Insert value.**>

5. Trapped Outlet Required: [**Integral**] [**No**] [**Yes**].
6. Vent Pipe Size: [**Not required**] <**Insert value**>.
7. Installation Position: [**Top flush with grade**] [**Underground with manhole riser to grade**] <**Insert other**>.

2.3 OIL INTERCEPTORS

A. Oil Interceptors: Cast-in-place-concrete or precast concrete structure complying with requirements of <**Insert authority title**>.

B. Oil Interceptors: Construct bottom, sidewalls, and top of reinforced, cast- in-place concrete. Include waste oil and vent connections, manholes, compartments or baffles, and piping or openings to draw off oil and to permit wastewater flow.

1. Concrete: Comply with ACI 318/318R, ACI 350R.

    a. Design Mix: 4000 psig (27.6 MPa) minimum, with 0.45 maximum water-to-cementitious materials ratio.
    b. Portland Cement: ASTM C 150, Type II.
    c. Fine Aggregate: ASTM C 33, sand.
    d. Coarse Aggregate: ASTM C 33, crushed gravel.
    e. Water: Potable.
    f. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
    g. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

C. Oil Interceptors: Precast concrete comply with ASTM C 913. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.

1. Protective Coating: Plant-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all [**exterior**] [**exterior and interior**] [**interior**] concrete surfaces.
2. Structural Design Loads:

    a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10- 44).
    b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
    c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
    d. Walkway Load: Comply with ASTM C 890, A-03.

3. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.
4. Steps: [**Individual FRP steps or FRP ladder**] [**Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP**] [**ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP**] <**Insert other**>, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of interceptor to finished grade is less than [**60 inches (1500 mm)**] <**Insert other**>.

5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
6. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.

    a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
    b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
    c. Include indented top design with lettering cast into cover, using wording equivalent to "[**INTERCEPTOR**] [**OIL INTERCEPTOR**] [**SANITARY SEWER**] <**Insert other**>."
    d. Protective Coating: Foundry-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all ferrous surfaces.

7. Waste-oil storage tank and piping are specified in Division 23 Section "Facility Fuel-Oil Piping."

D. Oil Interceptors: Factory-fabricated, cast-iron or steel body; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.

1. [**Available**]Manufacturers:

    a. Enpoco Div.; Watts Industries, Inc.
    b. Josam Company.
    c. MIFAB Manufacturing Inc.
    d. Rockford Sanitary Systems, Inc.
    e. Schier Products Company.
    f. Smith, Jay R. Mfg. Co.
    g. Wade Div.; Tyler Pipe.
    h. Waterlink, Inc.
    i. Watts Industries, Inc.
    j. Zurn Specification Drainage Products; Zurn Plumbing Products Group.
    k. <**Insert manufacturer's name.**>

2. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
3. Extension: Cast-iron or steel shroud, full size of interceptor, extending from top of interceptor to grade.
4. Cover: Cast iron or steel, with steel reinforcement to provide ASTM C 890, [**A-03, walkway**] <**Insert other**> load.
5. Protective Coating: Factory-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all ferrous surfaces, except bucket or strainer, unless otherwise indicated.
6. Waste-oil storage tank and piping are specified in Division 23 Section "Facility Fuel-Oil Piping."

E. Oil Interceptors: Plastic body; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.

1. [**Available**]Manufacturers for FRP Units:

    a. Proceptor Div.; Green Turtle Technologies, Ltd.
    b. Waterlink, Inc.
    c. <**Insert manufacturer's name.**>

2. [**Available**]Manufacturers for PE or HDPE Units:

    a. Schier Products Company.
    b. Town & Country Plastics, Inc.
    c. <**Insert manufacturer's name.**>

3. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
4. Extension: Plastic shroud, full size of interceptor, extending from top of interceptor to grade.
5. Cover: Plastic[**with steel reinforcement to provide ASTM C 890,**] [**A-03, walkway**] <**Insert other**> load.
6. Protective Coating: Factory-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all ferrous surfaces, except bucket or strainer, unless otherwise indicated.
7. Waste-oil storage tank and piping are specified in Division 23 Section "Facility Fuel-Oil Piping."

F. Oil Interceptor Capacity and Characteristics:

1. Capacity: [**Not applicable**] <**Insert value.**>
2. Overall Dimensions: <**Insert values.**>
3. Inlet and Outlet Pipe Size: <**Insert value.**>

    a. Centerline of Inlet to Floor: <**Insert value.**>
    b. Centerline of Outlet to Floor: <**Insert value.**>

4. Waste-Oil-Outlet Pipe Size: <**Insert value.**>

    a. Centerline of Outlet to Floor: <**Insert value.**>

5. Trapped Outlet Required: [**Integral**] [**No**] [**Yes**].
6. Vent Pipe Size: <**Insert value.**>
7. Installation Position: [**Top flush with grade**] [**Underground with extension to grade**] [**Underground with manhole riser to grade**] <**Insert other**>.
8. Waste-Oil Storage Tank: [**Not required**] <**Insert value**>.

2.4 SAND INTERCEPTORS

A. Description: Factory-fabricated, cast-iron or steel body and inlet grate; with settlement chamber and removable basket or strainer.

1. [**Available**]Manufacturers:

a. MIFAB Manufacturing Inc.
b. Rockford Sanitary Systems, Inc.
c. Smith, Jay R. Mfg. Co.
d. Wade Div.; Tyler Pipe.
e. <**Insert manufacturer's name.**>

B. Outlet Piping Connection: Hub, hubless, or threaded, unless otherwise indicated.

C. Grate: Cast iron or steel with reinforcement to provide ASTM C 890, [**A-03, walkway**] <**Insert other**> load.

D. Protective Coating: Factory-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all [**exterior**] [**exterior and interior**] [**interior**] ferrous surfaces except basket or screens.

E. Sand Interceptor Capacity and Characteristics:

1. Capacity: [**Not applicable**] <**Insert value.**>
2. Overall Dimensions: <**Insert values.**>
3. Outlet Pipe Size: <**Insert value.**>
4. Trapped Outlet Required: [**Integral**] [**No**] [**Yes**].
5. Vent Pipe Size: [**Not required**] <**Insert value**>.
6. Installation Position: [**Top flush with grade**] <**Insert other**>.

2.5 SEDIMENT INTERCEPTORS

A. Sediment Interceptors: Cast-in-place-concrete or precast concrete structure complying with requirements of <**Insert authority title**>.

B. Sediment Interceptors: Construct bottom, sidewalls, and top of reinforced, cast-in-place-concrete. Include manholes, compartments or baffles, and piping or openings to retain sediment and to permit wastewater flow.

1. Concrete: Comply with ACI 318/318R, ACI 350R.

a. Design Mix: 4000 psig (27.6 MPa) minimum, with 0.45 maximum water-to-cementitious materials ratio.
b. Portland Cement: ASTM C 150, Type II.
c. Fine Aggregate: ASTM C 33, sand.
d. Coarse Aggregate: ASTM C 33, crushed gravel.
e. Water: Potable.
f. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
g. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

C. Sediment Interceptors: Precast concrete comply with ASTM C 913. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.

1. Protective Coating: Plant-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all [**exterior**] [**exterior and interior**] [**interior**] concrete surfaces.
2. Structural Design Loads:

    a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10- 44).
    b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
    c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
    d. Walkway Load: Comply with ASTM C 890, A-03.

3. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into interceptor sidewalls, for each pipe connection.
4. Steps: [**Individual FRP steps or FRP ladder**] [**Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP**] [**ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP**] <**Insert other**>, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of interceptor to finished grade is less than [**60 inches (1500 mm)**] <**Insert other**>.
5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
6. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.

    a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
    b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
    c. Include indented top design with lettering cast into cover, using wording equivalent to the following:

        1) Sediment Interceptors in Sanitary Sewerage System: "[**INTERCEPTOR**] [**SEDIMENT INTERCEPTOR**] [**SANITARY SEWER**]<**Insert other**>."
        2) Sediment Interceptors in Storm Drainage System: "[**INTERCEPTOR**] [**SEDIMENT INTERCEPTOR**] [**STORM SEWER**] <**Insert other**>."

    d. Protective Coating: Foundry-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all ferrous surfaces.

7. Cast Ferrous Gratings: Frame and [**flat grate with small-square or short slotted drainage openings**] <**Insert other**>.

    a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
    b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
    c. Minimum Size: [**24 by 24 inches (610 by 610 mm)**] <**Insert other**>, unless otherwise indicated.
    d. Free Area: Approximately [**50**] <**Insert other**> percent, unless otherwise indicated.

e. Protective Coating: Foundry-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all ferrous surfaces.

8. Steel Gratings: Steel frame and welded heavy-duty steel grating with galvanized finish. Refer to Division 05 Section "Metal Gratings."

D. Sediment Interceptors: Factory-fabricated, cast-iron or steel body and cover; with settlement chambers; baffles; and removable basket, strainer, or screens.

1. [**Available**]Manufacturers:

a. Enpoco Div.; Watts Industries, Inc.
b. Josam Company.
c. MIFAB Manufacturing Inc.
d. Rockford Sanitary Systems, Inc.
e. Schier Products Company.
f. Smith, Jay R. Mfg. Co.
g. Wade Div.; Tyler Pipe.
h. Watts Industries, Inc.
i. Zurn Specification Drainage Products; Zurn Plumbing Products Group.
j. <**Insert manufacturer's name.**>

2. Inlet and Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
3. Extension: Cast-iron or steel shroud, full size of interceptor, extending from top of interceptor to grade.
4. Cover: Cast iron or steel, with steel reinforcement to provide ASTM C 890, [**A-03, walkway**] <**Insert other**> load.
5. Protective Coating: Factory-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all ferrous surfaces except basket or strainer.

E. Sediment Interceptor Capacity and Characteristics:

1. Length by Width by Depth: <**Insert values.**>
2. Number of Compartments: [**One**] [**Two**] <**Insert other**>.
3. Retention Capacity: <**Insert value.**>
4. [**Inlet and**]Outlet Pipe Size: <**Insert value.**>

a. Centerline of Inlet to Floor: [**Not required**] <**Insert value.**>
b. Centerline of Outlet to Floor: <**Insert value.**>
c. Trapped Outlet Required: [**Integral**] [**No**] [**Yes**].

5. Vent Pipe Size: [**Not required**] <**Insert value**>.
6. Installation Position: [**Top flush with grade**] [**Underground with extension to grade**] [**Underground with manhole riser to grade**] <**Insert other**>.

2.6 PRECAST CONCRETE MANHOLE RISERS

A. Precast Concrete Manhole Risers: ASTM C 478 (ASTM C 478M), with rubber-gasket joints.

B. Precast Concrete Manhole Risers: ASTM C 913, [**36-inch (915-mm)**] <**Insert other**> ID. Include rubber-gasketed joints.

1. Structural Design Loads:

   a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10- 44).
   b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
   c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
   d. Walkway Load: Comply with ASTM C 890, A-03.

2. Length: From top of underground concrete structure to grade.
3. Riser Sections: 3-inch (75-mm) minimum thickness and [**36-inch (915-mm)**] <**Insert other**> diameter.
4. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
5. Gaskets: ASTM C 443 (ASTM C 443M), rubber.
6. Steps: [**Individual FRP steps or FRP ladder**] [**Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP**] [**ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP**] <**Insert other**>, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals.

C. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.

D. Protective Coating: Plant-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all [**exterior**] [**exterior and interior**] [**interior**] concrete surfaces.

E. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.

1. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
2. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
3. Include indented top design with lettering cast into cover, using wording equivalent to the following:

   a. Grease Interceptors in Sanitary Sewerage System: "[**INTERCEPTOR**] [**GREASE INTERCEPTOR**] [**SANITARY SEWER**] <**Insert other**>."
   b. Oil Interceptors in Sanitary Sewerage System: "[**INTERCEPTOR**] [**OIL INTERCEPTOR**] [**SANITARY SEWER**] <**Insert other**>."
   c. Sediment Interceptors in Sanitary Sewerage System: "[**INTERCEPTOR**] [**SEDIMENT INTERCEPTOR**] [**SANITARY SEWER**] <**Insert other**>."
   d. Sediment Interceptors in Storm Drainage System: "[**INTERCEPTOR**] [**SEDIMENT INTERCEPTOR**] [**STORM SEWER**] <**Insert other**>."

4. Protective Coating: Foundry-applied, [**SSPC-Paint 16, coal-tar, epoxy-polyamide paint**] <**Insert other**>; [**10-mil (0.26-mm)**] [**15-mil (0.38-mm)**] <**Insert other**> minimum thickness applied to all ferrous surfaces.

2.7 MISCELLANEOUS MATERIALS

A. Concrete Paint: [**SSPC-Paint 16, coal-tar, epoxy polyamide**] <**Insert other**>.

B. Metal Paint: [**SSPC-Paint 16, coal-tar, epoxy polyamide**] <**Insert other**>.

C. PE Film: ASTM D 4397, 0.10-inch (0.25-mm) thickness sheet.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 22 Section "Earth Moving."

3.2 INSTALLATION

A. Install interceptor inlets and outlets at elevations indicated.

B. Place concrete for cast-in-place interceptors according to ACI 318/318R and ACI 350R.

1. Refer to Division 03 Section "[**Cast-in-Place Concrete**] [**Miscellaneous Cast-in-Place Concrete**]"for formwork, reinforcement, and concrete.

C. Install precast concrete interceptors according to ASTM C 891. Set level and plumb.

D. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

E. Set tops of manhole frames and covers flush with finished surface in pavements. Set tops [**3 inches (75 mm)**] <**Insert other**> above finish surface elsewhere, unless otherwise indicated.

F. Set tops of grating frames and grates flush with finished surface.

G. Clean and prepare concrete surfaces to be field painted. Remove loose efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen surface as required to remove glaze. Paint the following concrete surfaces as recommended by paint manufacturer:

1. Cast-in-Place-Concrete Interceptors: All [**exterior, except bottom**] [**exterior, except bottom and all interior**] [**interior**].
2. Precast Concrete Interceptors: All [**exterior**] [**exterior and interior**] [**interior**].

H. Install sheet PE film on earth where cast-in-place-concrete interceptors are to be built.

I. Clean and prepare metal surfaces to be field painted according to SSPC- PA 1. Paint the following metal surfaces according to SSPC-PA 1 and SSPC-Paint 16:

1. Metal Interceptors: All surfaces except baskets, screens, and strainers.
2. Plastic Interceptors: All metal surfaces except baskets, screens, and strainers.
3. Metal Manhole Frames and Covers[**(Including Grates)**]: All surfaces.
4. Do not paint metal surfaces with factory-applied, corrosion-resistant coating.

J. Set [**metal**] [**metal and plastic**] [**plastic**] interceptors level and plumb.

K. Set tops of metal interceptor covers flush with finished surface in pavements. Set tops [**3 inches (75 mm)**] <**Insert other**> above finish surface elsewhere, unless otherwise indicated.

L. Prepare and paint metal components, to be field painted, according to SSPC-Paint 16.

M. Install piping and oil storage tanks according to Division 23 Section "Facility Fuel-Oil Piping."

N. Repair and restore protective coatings to original condition.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.4 IDENTIFICATION

A. Identification materials and installation are specified in Division 22 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 221323