SECTION 220500 BASIC PLUMBING REQUIREMENTS

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 WORK INCLUDED

A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work, complete, and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications and standards called for in the specification sections and on the drawings mean, the latest edition, amendment and revision of such referenced standard in effect on the date of these contract documents. All materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.3 LICENSING

A. The Contractor shall hold a license to perform the work as issued by the authority having jurisdiction.

B. Plumbing contract work shall be performed by, or under, the direct supervision of a licensed master plumber.

C. Electrical contract work shall be performed by, or under, the direct supervision of a licensed electrician.

1.4 PERMITS

A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges. Provide certificate of approval from the Authorities Having Jurisdictionprior to request for final payment.

B. Provide electrical inspection certificate of approval from Middle Department Inspection Agency, Commonwealth Inspection Agency, or an Engineer approved Inspection Agency prior to request for final payment.

1.5 CODE COMPLIANCE

A. Provide work in compliance with the following:

1. 2020 Building Code of New York State.
2. 2020 Fire Code of New York State.
3. 2020 Plumbing Code of New York State.
4. 2020 Mechanical Code of New York State.
5. 2020 Fuel Gas Code of New York State.

6. 2020 Energy Conservation Code of New York State
7. Accessible and Usable Buildings and Facilities, ICC A117.1 (2009).
8. New York State Department of Labor Rules and Regulations.
9. New York State Department of Health.
10. 2017 National Electrical Code (NEC)
11. Occupational Safety and Health Administration (OSHA).
12. Local Codes and Ordinances.
13. Life Safety Code, NFPA 101.

1.6 GLOSSARY

ACI	American Concrete Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AFBMA	Anti-Friction Bearing Manufacturer's Association
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing Materials
AWSC	American Welding Society Code
AWWA	American Water Works Association
FM	Factory Mutual Insurance Company
IBR	Institute of Boiler & Radiation Manufacturers
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NYS/DEC	New York State Department of Environmental Conservation

SBI	Steel Boiler Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFPO	Underground Facilities Protective Organization
UL	Underwriter's Laboratories, Inc.
OSHA	Occupational Safety and Health Administration
XL - GAP	XL Global Asset Protection Services

1.7 DEFINITIONS

Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
As Specified	Materials, equipment including the execution specified/shown in the contract documents.
Basis of Design	Equipment, materials, installation, etc. on which the design is based. (Refer to the article, Equipment Arrangements, and the article, Substitutions.)
Code Requirements	Minimum requirements.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Coordination Drawings	Show the relationship and integration of different construction elements and trades that require careful coordination during fabrication or installation, to fit in the space provided or to function as intended.
Delegated-Design Services	Performance and Design criteria for Contractor provided professional services. Where professional design services or certifications by a design professional are specifically required of a Contractor, by the Contract Documents. Provide products and systems with the specific design criteria indicated. If criteria indicated is insufficient to perform services or certification required, submit a written request for additional information to the Engineer. Submit wet signed and sealed certification by the licensed design professional for each product and system specifically assigned to the Contractor to be designed or certified by a design professional. Examples: structural maintenance ladders, stairs and platforms, pipe anchors, seismic compliant system, wind, structural supports for material equipment, sprinkler hydraulic calculations.
Equal, Equivalent, Equal To, Equivalent To, As Directed and As Required	Shall all be interpreted and should be taken to mean "to the satisfaction of the Engineer".
Exposed	Work not identified as concealed.

Extract	Carefully dismantle and store where directed by Owner's Representative and/or reinstall as indicated on drawings or as described in specifications.
Furnish	Purchase and deliver to job site, location as directed by the Owner's Representative.
Inspection	Visual observations by Owner's site Representative.
Install	Store at job site if required, proper placement within building construction including miscellaneous items needed to affect placement as required and protect during construction. Take responsibility to mount, connect, start-up and make fully functional.
Labeled	Refers to classification by a standards agency.
Manufacturers	Refer to the article, Equipment Arrangements, and the article, Substitutions.
Prime Professional	Architect or Engineer having a contract directly with the Owner for professional services.
Product Data	Illustrations, standard schedules, performance charts, instructions, brochures, wiring diagrams, finishes, or other information furnished by the Contractor to illustrate materials or equipment for some portion of the work.
Provide (Furnish and Install)	Contractor shall furnish all labor, materials, equipment and supplies necessary to install and place in operating condition, unless otherwise specifically stated.
Relocate	Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.
Remove	Dismantle and take away from premises without added cost to Owner, and dispose of in a legal manner.
Review and Reviewed	Should be taken to mean to be followed by "for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents".
Roughing	Pipe, duct, conduit, equipment layout and installation.
Samples	Physical full scale examples which illustrate materials, finishes, coatings, equipment or workmanship, and establishes standards by which work will be judged.
Satisfactory	As specified in contract documents.
Shop Drawings	Fabrication drawings, diagrams, schedules and other instruments, specifically prepared for the work by the Contractor or a Sub-contractor, manufacturer, supplier or distributor to illustrate some portion of the work.
Site Representative	Owner's Inspector or "Clerk of Works" at the work site.
Submittals Defined (Technical)	Any item required to be delivered to the Engineer for review as requirement of the Contract Documents. The purpose of technical submittals is to demonstrate for those portions of the work for which a submittal is required, the manner in which the Contractor proposes to conform to the information given and design concepts expressed and required by the Contract Documents.

1.8 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

A. Provide submittals on all items of equipment and materials to be furnished and installed. Submittals shall be accompanied by a transmittal letter, stating name of project and contractor, name of vendor supplying equipment, number of drawings, titles, specification sections (name and number) and other pertinent data called for in individual sections.

B. Submittals shall have individual cover sheets that shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at under one cover sheet per specification section (e.g. lighting fixtures, valves, plumbing fixtures, etc.). Submittals shall include all required documentation for each product listed in the specification section at the same time as a complete package. Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Submittals will be given a general review only.

C. Corrections or comments made on the Submittals during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. If submittals are to be submitted electronically, all requirements in Item A apply. Submittals shall be emailed in PDF format to specific email address provided by the Construction Manager, General Contractor, Architect or Project Manager. Name of project shall be in subject line of email. Send emails to meBuff-RFI-Sub-Clerk@meengineering.com

D. Refer to Division 01 for additional requirements.

1.9 PROTECTION OF PERSONS AND PROPERTY

A. Contractor shall assume responsibility for construction safety at all times and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety railings, barriers, and other safety feature required to provide safe conditions for all workmen and site visitors.

1.10 EQUIPMENT ARRANGEMENTS

A. The contract documents are prepared using one manufacturer as the Basis of Design, even though other manufacturers' names are listed. If Contractor elects to use one of the listed manufacturers other than Basis of Design, submit detailed drawings, indicating proposed installation of equipment. Show maintenance clearances, service removal space required, and other pertinent revisions to the design arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other

miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace doorframes, access doors, walls, ceilings, or floors required to install other than Basis of Design. If revised arrangement submittal is rejected, revise and resubmit specified Basis of Design item which conforms to Contract Documents.

1.11 SUBSTITUTIONS

A. If Contractor desires to bid on any other kind, type, brand, or manufacture of material or equipment than those named in specifications, secure prior approval. To request such approval, Contractor shall submit complete information comparing (item-for-item) material or equipment offered with design material or equipment. Include sufficient information to permit quick and thorough comparison, and include performance curves on same basis, capacities, power requirements, controls, materials, metal gauges, finishes, dimensions, weights, etc., of major parts. If accepted, an addendum will be issued to this effect ahead of bid date. Unless such addendum is issued, substitution offered may not be used.

B. Refer to Division 01 for additional requirements.

1.12 UTILITY COMPANY SERVICES

A. Division 26 shall make arrangements with New York State Electric and Gas for electric service to the Owner's distribution equipment. Provide underground or overhead electric service as called for and transformers, meter sockets or meter compartments as required by the Utility Company. Coordinate all activities between the Owner and Utility Company. The installation of the electric service shall comply with the published Utility Company standards.

B. Division 22 shall make arrangements with New York State Electric and Gas for gas service to the Owner's distribution system. Provide service to the building as required by the Utility Company. Coordinate all activities between the Owner and Utility Company. The installation of the gas service shall comply with the published Utility Company standards.

1.13 ROUGHING

A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.

E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.
2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.14 COORDINATION DRAWINGS

A. Before construction work commences, Divisions for all trades shall submit coordination drawings in the form of CAD drawing files, drawn at not less than 1/4 in. scale. Such drawings will be required throughout all areas, for all Contracts. These drawings shall show resolutions of trade conflicts in congested areas. Mechanical Equipment Rooms shall be drawn early in coordination drawing process simultaneous with all other congested areas. Prepare Coordination Drawings as follows:

1. Division 23 shall prepare the base plan CAD coordination drawings showing all ductwork, all pertinent heating piping, and equipment. These drawings may be CAD files of the required Ductwork Shop Drawings. The drawings shall be coordinated with lighting fixtures, sprinklers, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner's Representative. Provide adjustments to exact size, location, and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of contract. Minor revisions need not be redrawn.

2. Division 23 shall provide CAD files and submit the base plan CAD Coordination Drawings to all Divisions.
3. Divisions 21 and 22 shall draw the location of piping and equipment on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolutions.
4. Divisions 26, 27 and 28 shall draw the location of lighting fixtures, cable trays, and feeders over 1-1/2 in. on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolution.
5. The General Construction Trade shall indicate areas of architectural/structural conflicts or obstacles on the CAD Coordination Drawings, and coordinate to suit the overall construction schedule.
6. The General Construction Trade shall expedite all Coordination Drawing work and coordinate to suit the overall construction schedule. In the case of unresolved interferences, he shall notify the Owner's Representative. The Owner's Representative will then direct the various trades as to how to revise their drawings as required to eliminate installation interferences.
7. If a given trade proceeds prior to resolving conflicts, then if necessary, that trade shall change its work at no extra cost in order to permit others to proceed with a coordinated installation. Coordination approval will be given by areas after special site meetings involving all Divisions.

B. The purpose of the coordination drawing process is to identify and resolve potential conflicts between trades, and between trades and existing or new building construction, before they occur in construction. Coordination drawings are intended for the respective trade's use during construction and shall not replace any Shop Drawings, or record drawings required elsewhere in these contract documents.

1.15 EQUIPMENT AND MATERIAL REQUIREMENTS

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.
2. All equipment and material for which there is a listing service shall bear a UL label.
3. Potable water systems and equipment shall be built according to AWWA Standards.
4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.
5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.
6. Fire protection equipment shall be UL listed and FM approved.

B. Exterior and wet locations shall utilize materials, equipment supports, mounting, etc. suitable for the intended locations. Metals shall be stainless steel, galvanized or with baked enamel finish as a minimum. Finishes and coatings shall be continuous and any

surface damaged or cut ends shall be field corrected in accordance with the manufacturer's recommendations. Hardware (screws, bolts, nuts, washers, supports, fasteners, etc.) shall be:

1. Stainless steel where the associated system or equipment material is stainless steel or aluminum.
2. Hot dipped galvanized or stainless steel where the associated system or equipment is steel, galvanized steel or other.

1.16 PAINTING

A. Paint all insulated and bare piping, pipe hangers and supports exposed to view in mechanical equipment rooms, penthouse, boiler rooms and similar spaces. Paint all bare piping, ductwork and supports exposed to the out-of-doors with rust inhibiting coatings. Paint all equipment that is not factory finish painted (i.e. expansion tanks, etc.).

B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. Review system color coding prior to painting with the Owner's Representative or Architect.

C. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contract must be touched up by the Contractor responsible for same.

D. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

E. Refer to Division 9 - Finishes, for additional information.

1.17 CONCEALMENT

A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.18 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.
2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.
4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.
5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.
6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

1.19 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.
2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.
3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.
4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.
5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.
6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.
7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.

B. Acceptable Manufacturers:

1. Dow Corning Fire-Stop System Foams and Sealants.
2. Nelson Electric Fire-Stop System Putty, CLK and WRP.
3. S-100 FS500/600, Thomas & Betts.
4. Carborundum Fyre Putty.
5. 3-M Fire Products.
6. Hilti Corporation.

1.20 NON-RATED WALL PENETRATIONS

A. Each trade shall be responsible for sealing wall penetrations related to their installed work, including but not limited to ductwork, piping, conduits, etc. See individual specification sections for requirements.

1.21 SUPPORTS

A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above.

B. For precast panels/planks and metal decks, support mechanical/electrical work as determined by manufacturer and the Engineer. Provide heavy gauge steel mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

C. For finished areas without a finished ceiling system such as classrooms, offices, conference rooms, etc., where decking and structure is exposed, and ductwork/piping/conduit is exposed: All mounting brackets, channel support systems and mounting hardware for ductwork, piping, lighting, etc. shall be concealed and approved by the Architect/Engineer prior to the installation. AirCraft cable style hanging for ductwork is required. It is recommended that room mockups be done and receive Architect/Engineer approval prior to proceeding with installation.

D. Equipment, piping, conduit, raceway, etc. supports shall be installed to minimize the generation and transmission of vibration.

E. Materials and equipment shall be solely supported by the building structure and connected framing. Gypboard, ceilings, other finishes, etc. shall not be used for support of materials and equipment.

1.22 ACCESS PANELS

A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.23 CONCRETE BASES

A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.24 HVAC EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.

C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Refer to manufacturer drawings and specifications for requirements of special equipment. Verify connection requirements before bidding.

1.25 PLUMBING EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide roughing and final water, waste, vent, gas, , and/or diesel connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.

C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.

D. Install controls and devices furnished by others.

E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

G. Refer to Manufacturer drawings and specifications for requirements of special equipment. Verify connection requirements before bidding.

1.26 ELECTRICAL EQUIPMENT CONNECTIONS

A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.

B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

C. Refer to Manufacturer's drawings/specifications for requirements of special equipment. Verify connection requirements before bidding.

1.27 STORAGE AND PROTECTION OF MATERIALS AND EQUIPMENT

A. Store Materials on dry base, at least 6 in. aboveground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.

B. Refer to Division 01 for additional information.

C. Division 23 shall provide airtight plastic covers over all supply and return air openings prior to the start of construction by any trade. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Owner's Representative.

1.28 FREEZING AND WATER DAMAGE

A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no change in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.29 LUBRICATION CHART

A. Provide lubrication chart, 8-1/2 in. x 11 in. minimum size, typed in capital letters, mounted under clear laminated plastic; secure to wall in area of equipment. List all motors and equipment in contract. Obtain and list necessary information by name/location of equipment, manufacturer recommended types of lubrication and schedule. Lubricate motors as soon as installed and perform lubrication maintenance until final acceptance. Divisions 22 and 26 shall add contract items to the chart provided by Division 23 or provide separate charts.

1.30 OWNER INSTRUCTIONS

A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.31 OPERATION AND MAINTENANCE MANUALS

A. Submit by email (preferred) or digital media, thru the normal project submittal process. Include a copy of each final approved Shop Drawing, wiring diagrams, piping diagrams, spare parts lists, final testing and balancing report, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of installing contractor and of supplier manufacturer Representative and service agency for all major equipment items. Provide a table of contents page and dividers based upon specification section numbers. Submit in a compiled and bookmarked PDF format as outlined below. Each item listed in the table of contents shall include a hyperlink to the associated section of the O&M Manual, in addition to the bookmarking.

B. Provide content for Operation and Maintenance Manuals as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Engineer will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

C. Submit Operation and Maintenance Manuals in the following format:

1. Submit by uploading to web-based project software site, or by email to Architect, as a formal project submittal in conformance with the project specific submittal procedures. Enable reviewer comments on draft submittals.
2. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
3. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in the table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

D. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing Owner training. Engineer will comment on whether general scope and content of manual are acceptable.

E. Final Manual Submittal: Submit O&M manual in final form prior to requesting inspection for Substantial Completion and at least 2 weeks before commencing Owner training. Engineer will return copy with review comments.

1. Correct or revise O&M manual to comply with Engineer's comments. Submit copies of each corrected manual within 2 weeks of receipt of Engineer's and Commissioning Agent's comments.

F. Refer to Division 01 for additional requirements.

1.32 RECORD DRAWINGS

A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings, (including non-reproduction black and white prints or electronic files) for the purpose of recording as-built conditions.

B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.

C. It shall be the responsibility of the Contractor to mark **EACH** sheet of the contract documents in red and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, the complete set of red marked contract documents, plus all approved field sketches and diagrams shall be submitted to the engineer and used in preparation of the record drawings.

D. A complete set of red marked contract drawings shall be submitted, at one time, as the "Record" set. If there are no changes to a specific drawing, the contractor shall indicate "NO CHANGES" on that drawing. ALL drawings shall be included in the "Record" set.

E. The complete set of red marked Contract Documents or electronic files shall be certified by the Contractor as reflecting record conditions and submitted to the engineer for review.

F. The Contractor shall have the marked up set scanned, if they are not already electronic files, and then submit them to the Engineer as the "Record Set".

1.33 FINAL INSPECTION

A. Upon completion of all Engineering Site Observation list items, the Contractor shall provide a copy of the Engineering Site Observation Report back to the Engineer with each items noted as completed or the current status of the item.

1.34 COMMISSIONING

A. Refer to General Commissioning Requirements in Division 01 for additional requirements.

1.35 TEMPORARY HEATING AND COOLING

A. Refer to the General Conditions of the Contract for Construction and Supplemental General Conditions.

1.36 MAINTENANCE OF HVAC SYSTEMS DURING TEMPORARY USE PERIODS

A. Provide each air handling system with a set of prefilters in addition to the permanent filters. Furnish four sets of prefilters for each system for use when system is operated for temporary heating or cooling. During such use, change prefilters as often as directed by Owner's Representative. Provide MERV-8 filters in all open ended ducts, return grilles and registers to keep dust out of ductwork. Change as often as necessary. Remove all such temporary filters upon completion. Use supply fans only. Do not operate return fans.

B. Blank-off outside air intake opening during temporary heating period. Install first set of permanent filters and prefilters.

C. Adjust dampers on supply system.

D. Set all heating coil control valves for manual operation.

E. Do not install any grilles or diffusers at room terminal ends of ducts until permission is given.

F. Assume responsibility for systems and equipment at all times, even though used for temporary heat or ventilating. Repair or replace all dented, scratched or damaged parts of systems prior to final acceptance.

G. Remove concrete, rust, paint spots, other blemishes, then clean.

H. Just prior to final acceptance, remove used final filter and install new set. Deliver all unused sets of prefilters to the Owner and obtain written receipt. Properly lubricate system bearings before and during temporary use. Maintain thermostats, freeze stats, overload devices, and all other safety controls in operating condition.

1.37 TEMPORARY FACILITIES

A. Refer to the Division 01 Sections, General Conditions and Supplemental General Conditions.

1.38 TEMPORARY LIGHT AND POWER

A. Refer to the Division 01 Sections, General Conditions and Supplemental General Conditions.

1.39 CLEANING

A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Each trade shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:

1. Thoroughly clean entire installation, both exposed surfaces and interiors.
2. Remove all debris caused by work.
3. Remove tools, surplus, materials, when work is finally accepted.

1.40 SYSTEM START-UP AND TESTING

A. All new heating and ventilating systems shall be started up and operated at normal operating temperature for a period of 24 hours to "bake-off" the equipment. The associated ventilation system shall run on 100% outside air during the bake-off for an additional eight hours to purge the building. This work shall be completed prior to fall school occupancy or on a Saturday, with the Contractor responsible for being on site during the entire purge and bake-off operation.

1.41 TRANSFER OF ELECTRONIC FILES

A. M/E Engineering, P.C. will provide electronic files for the Contractor's use in the preparation of sheet metal shop drawings, coordination drawings, or record drawings related to the project, subject to a potential $50.00 charge per drawing file and the following terms and conditions:

1. The Contractor shall submit a formal request for electronic drawing files on the M/E Engineering, P.C. website, by utilizing the following website link: http://www.meengineering.com/contact-pages/contractor-request
2. M/E Engineering, P.C. makes no representation as to the compatibility of these files with the Contractor's hardware or the Contractor's software beyond the specific release of the referenced specifications.
3. M/E Engineering can only provide CAD files of M/E/P/FP drawing levels for which we are the Engineer of Record. CAD files of Architectural backgrounds, reflected ceiling plans, structural plans, etc. must be obtained separately from the Architect of Record.

4. Data contained on these electronic files is part of M/E Engineering, P.C.'s instruments of service shall not be used by the Contractor or anyone else receiving data through or from the Contractor for any purpose other than as convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by the Contractor or by others will be at the Contractor's sole risk and without liability or legal exposure to M/E Engineering, P.C. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against M/E Engineering, P.C., its officers, directors, employees, agents or sub-consultants which may arise out of or in connection with the Contractor's use of the electronic files.
5. Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless, M/E Engineering, P.C. from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from the Contractor's use of these electronic files.
6. These electronic files are not contract documents. Significant difference may arise between these electronic files and corresponding hard copy contract documents due to addenda, change orders or other revisions. M/E Engineering, P.C. makes no representation regarding the accuracy or completeness of the electronic files the Contractor receives. In the event that a conflict arises between the signed contract documents prepared by M/E Engineering, P.C. and electronic files, the signed contract documents shall govern. The Contractor is responsible for determining if any conflicts exist. By the Contractor's use of these electronic files the Contractor is not relieved of the Contractor's duty to comply with the contract documents, including and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, field verify conditions and coordinate the Contractor's work with that of other contractors for the project.

1.42 VIDEO RECORDING OF TRAINING SESSIONS

A. The contractor shall video record all training sessions required by their discipline. Video shall be in Windows Media Player video format saved on flash drives. Two (2) copies on flash drives are to be provided as a formal submittal. . Flash drives are to be tagged with project name, training session name(s), installing Contractor and date of training. The flash drive shall include a scanned version of the training session sign in list(s), including the presenter and the owner's participants.

1.43 ENERGY INCENTIVES

A. The Contractor, his Subcontractors and Suppliers shall provide to the Owner all paperwork necessary to support the Owners pursuit of incentives related to energy conservation as offered by the utility company or state sponsored incentive programs. This shall include at a minimum, receipts, and quantities and data sheets for energy efficient equipment such as: lighting, motors, variable frequency drives, etc.

1.44 INFECTION CONTROL

A. Construction procedures, temporary partitions, negative air systems, cleaning procedures, HVAC system isolation, dust control, etc. shall be in accordance with the infection control standards set forth by the Facility. A copy of the facilities standards are available from the Owner upon request.

END OF SECTION 220500

SECTION 220513 MOTORS

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 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

PART 2 - PRODUCTS

2.1 MOTORS

A. General Requirements:

1. Motors built for 60 Hz operation, three phase for 1/2 HP and larger; single phase for 1/3 HP and smaller. In compliance with NEMA Standards, wound specifically for nameplate voltage, and selected for appropriate duty and environment. 1.15 minimum service factor at rated voltage and frequency. Bearings rated 20,000 life hours. V-belt connected motors with adjustable slide rail bases and pulleys. Motors shall have Class F insulation system, with Class B temperature rise. Maximum allowable motor temperature rise for open drip-proof or totally enclosed fan cooled (TEFC) type at 1.15 service factor shall be 80°C above 40°C ambient up to 300 HP. NEMA locked rotor kVA code as required to match unit equipment torque characteristics. Single-phase motors shall be capacitor start, induction run, or split phase type. Polyphase motors shall be constant speed, squirrel cage, unless otherwise called for. Nameplates shall have as a minimum, all information as described in NEMA Standard MG-1-20.60.
2. Motors for use with variable speed drive applications shall be inverter duty rated in accordance with NEMA. These motors shall meet NEMA corona inception voltage requirements, withstanding peak voltages up to 1600 volts, and be manufactured in accordance with NEMA MG-1 Part 31.
3. Three phase motors rated 1 HP and greater shall be special design, copper winding, relubable ball bearings, 1.15 service factor, premium efficiency, energy-saver type with a guaranteed NEMA nominal full-load efficiency, by IEEE Standard 112 Test Method "B". Motors to have three-year warranty. Efficiency rating shall appear on nameplate, and shall be not less than as follows:

MINIMUM NOMINAL FULL-LOAD MOTOR EFFICIENCY						
HP	**OPEN MOTORS (RPM)**			**CLOSED MOTORS (RPM)**		
	1200	**1800**	**3600**	**1200**	**1800**	**3600**
1.0	82.5	85.5	77	82.5	85.5	77.0

MINIMUM NOMINAL FULL-LOAD MOTOR EFFICIENCY						
HP	**OPEN MOTORS (RPM)**			**CLOSED MOTORS (RPM)**		
	1200	**1800**	**3600**	**1200**	**1800**	**3600**
1.5	86.5	86.5	84	87.5	86.5	84
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1
125	95.0	95.4	94.1	95.0	95.4	95.0

(The above efficiency levels are in compliance with the NYSERDA Smart Equipment Choices Program PON 912, which expires 12/31/05.)

4. Nominal Motor Voltage Table:

Nominal System Voltage	Motor Nameplate
480V - 3 phase	460 volt
277V - 1 phase	265 volt
240V - 1 phase and 3 phase	230 volt
208V - 1 phase and 3 phase	200 volt
120V - 1 phase	115 volt

5. Motor Application:

Environment/location	Motor Enclosure Type
General Purpose	Open Drip-proof, TEFC or encapsulated
Outdoors, below grade or high humidity areas, pool filter rooms	TEFC
Hazardous	Explosion-proof

6. Make: Need not be all of same make, but one of the following: General Electric, Gould, Reliance, Westinghouse.

PART 3 - EXECUTION

3.1 MOTORS

A. Furnished by equipment manufacturer and especially manufactured and/or selected, mounted, and installed for intended use. Install motors accessible for maintenance and belt adjustment.

END OF SECTION 220513

SECTION 220523 VALVES

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 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.3 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical and Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL

A. Valves shall have following requirements:

1. Working pressure stamped or cast on bodies.
2. Stem packing serviceable without removing valve from line.
3. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

B. Acceptable Manufacturers:

1. Ball Valves: Apollo, Hammond, Milwaukee, Nibco, Red White, Watts.
2. Butterfly Valves: Bray, Jamesbury, Keystone, Milwaukee, Red White, Watts.
3. Gate and Check Valves: Hammond, Milwaukee, Nibco, Red White, Stockham, Watts.
4. To establish a standard of quality and identify features, certain manufacturer's numbers are given in the following paragraphs.

2.2 DOMESTIC WATER VALVES

A. Gate Valves:

1. 4 in. and Larger, Cold Water Service: Epoxy coated, resilient wedge, OS&Y, flanged ends, 175 wwp, UL/FM; Watts 408 RW.

2. 3 in. and Smaller: Bronze, solid wedge disc, rising stem, 125 SWP; Milwaukee 1152 (threaded ends, union bonnet) or Milwaukee 149 (sweat ends, threaded bonnet.)

B. Check Valves:

1. 3 in. and Larger: IBBM, renewable seat and disc, bolted flange cap, flanged ends, 125 SWP; Milwaukee F-2974.
2. 2 in. and Smaller: Lead-free swing check with silicone bronze body, bonnet and trim, PTFE disc seat and stainless steel seat disc washer, 200 psi working pressure, Nibco T-413-Y-LF (threaded) or Nibco's S-413-Y-LF (solder).
3. Silent Type: Lead-free spring check with silicone bronze body, stainless steel trim and PTFE disc: 250 psi working pressure; Nibco T-480-4-LF (threaded) or Nibco S-480-Y-LF (solder).

C. Ball Valves:

1. 2-1/2 in. and Larger: Lead-free, forged copper silicon 2-piece body, chrome plated brass ball, full port, teflon seats and stem packing, separate packing and handle nut, blowout proof stem extended for insulation, vinyl insulator for handle, 600 WOG, 125 WSP; Watts LF-FBV-3C Series (threaded ends) or Watts LF-FBVS-3C series (sweat ends).
2. 2 in. and Smaller: Lead-free, forged copper silicon 2-piece body, chrome plated brass ball, full port, teflon seats and stem packing, separate packing and handle nut, blowout proof stem extended for insulation, vinyl insulator for handle, 600 WOG, 125 WSP; Watts LF-FBV-3C Series (threaded ends) or Watts LF-FBVS-3C series (sweat ends).

D. Butterfly Valves:

1. 2-1/2 in. and Larger: Cast or ductile iron body, 175 WWP, lug type, bronze disc, 17-4 stainless steel stem, replaceable EPDM seat for water temperatures up to 250°F at 140 psi, bubbletight shutoff, suitable for dead end service, Buna-N O-ring stem seals, lever operator up to 6 in. size, gear operator for 8 in. and larger, capable of bi-directional flow, extended neck to accommodate 2 in. of pipe insulation; Milwaukee "C" Series.

E. Valves for Gauges and Instruments:

1. 1/2 in. Size: Brass bar stock for 1000 psi and 300°F; Trerice No. 735 needle valve.

F. Hose Thread Drain Valves:

1. Ball valve, bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #B6001CC (sweat connection), Watts #B6000CC (threaded connection).

2.3 GAS VALVES

A. Plug Valves:

1. 2 in. and Smaller: Semi-steel body and plug, short pattern, 100% pipe area round port, full bore lubricated plug, wrench operated with handle, sealing compound suitable with liquefied petroleum gas, threaded ends, 200 WOG, UL Listed for liquefied petroleum gas; Homestead Figure 651.

B. Ball Valves:

1. 2 in. and Smaller: Ball type, two-piece, full port, brass body with chrome plated brass ball, teflon seats, threaded ends, 600 psi WOG, UL listed for liquefied petroleum gas, Watts FBV-3C-UL.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all shutoff, check, balancing and other type valves as indicated, as required by Code and as required for proper system maintenance, isolation and safety. Provide at major building and systems sections. Provide shutoff valves on all branch lines serving two fixtures or more, at all equipment, fixtures, before and after automatic control valves, and at future connections.

B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.

C. Provide drain valves with hose thread connections on all equipment. Provide hose thread drain valves at all low points to enable complete drainage of all piping systems including, water mains, branches, at base of vertical risers and at strainers.

D. Provide shutoff valve and wye-strainer before all automatic control valves and pressure reducing valves.

E. Inspect valves for proper operation before installation. Install underground valve boxes vertically over each valve. Adjust top of box to proper grade. Immediately backfill with crushed stone and carefully tamp into place. Unless otherwise noted, leave in the open position.

3.2 DOMESTIC WATER SYSTEM

A. The main water service shutoff valve inside the building and valves for a 3 in. and larger water meter assembly shall be OS&Y gate valves in accordance with the local water authority requirements.

B. Install balance valves in each hot water circulation branch and where noted.

3.3 LIQUEFIED PETROLEUM GAS SYSTEM

A. Ball valves shall be UL listed for use in liquefied petroleum gas systems, or certified by another acceptable third-party testing agency.

END OF SECTION 220523

SECTION 220540 ELECTRIC WIRING

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 WORK INCLUDED

A. Provide labor, materials, equipment and services for the complete installation of motor control wiring and instrumentation control wiring as required in Contract Documents. Provide wiring and conduit, required to connect devices furnished as part of or adjunctive to the system and for motor control regardless of the source of supply. Control wiring includes 120 volt and lower voltage wiring for control signals directing equipment operation. Control circuits shall be 120 volt maximum. Provide wiring in accordance with requirements specified in Division 26, "Electrical" and the National Electrical Code. Provide devices required for proper system operation, including special electrical switches, transformers, disconnect switches, relays, and circuit breaker protection.

B. Coordinate all work with Division 26, "Electrical".

1.3 WORK NOT INCLUDED

A. Power wiring for motors, motor starters and associated starting and control equipment, as well as the motor starters (except in the case of equipment specified to have packaged controls/starters), are included in Division 26, "Electrical", unless otherwise called for.

1.4 QUALIFICATIONS

A. Wiring installed in compliance with all requirements of Division 26, "Electrical".

1.5 SUBMITTALS

A. Provide complete wiring diagrams for equipment and systems. Deliver wiring diagrams to proper trades in time for roughing of conduit, equipment connections, and avoid delay in construction schedule. Wiring diagrams and roughing information to be wired as part of the Work of Division 26, "Electrical", shall be clearly indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Refer to Division 26 specifications for required wiring materials.

PART 3 - EXECUTION

3.1 GENERAL

A. Check electrical wiring pertaining to equipment for completeness and correctness of connections. Correct any misapplied motor and/or motor starter, improper thermal overload device, or device which fails to function and resultant damage, whether due to incorrect connections or improper information on wiring diagrams.

3.2 WIRING FOR CONTROL SYSTEMS

A. Provide motor control and instrumentation wiring for equipment. All wiring shall be in conduit, unless otherwise noted. Refer to Section 260501 for type of conduit to be used in specific applications. Provide 18 in. length flexible conduit at motors and devices subject to vibration. Conduit supported on 5 ft. centers. Do not attach directly to hot surfaces, piping, or ductwork. Control wiring shall be in separate conduit from all other wiring. Provide green grounding wire circuited from starter, and run ground wire through conduit to each remote auxiliary relay, pushbutton station, remote panel heating device, thermostat, or device with potentials in excess of 50 volts. Size ground wire as required by NEC.

B. Provide pushbutton stations, pilot lights, selector switches, auxiliary starter contacts, and other devices required to provide specified functions.

C. Where allowable by Code and contract documents, control wiring may be installed without conduit. Installation and wire insulation types shall be as described by NEC, Article 725. All low voltage wiring circuits 50V and under shall:

1. Be adequately supported using bridle rings or other approved method when installed horizontally above accessible ceilings or run exposed in unfinished areas.
2. Be run in wall cavity or surface metal raceway where no access is available to wall cavity, in finished areas.
3. Be installed in conduit when installed vertically in Mechanical Rooms from panels and devices up to ceiling.
4. Be installed in conduit in all cases not specifically covered by the above cases, or where subject to physical damage.
5. Have the proper insulation and meet the requirements of NEC Article 300-22 when installed in plenums or other spaces used for environmental air.

3.3 EQUIPMENT WIRING

A. Provide power and control wiring between shipping splits, and between remote panels, thermostats, disconnect switches, and their respective units. Provide control wiring from the package control system, to each respective motor or device. Properly mount control package. Power wiring to and including disconnect switch shall be by Division 26, "Electrical".

3.4 FIELD WIRING IN STARTERS, CONTROLLERS, AND PANELS

A. Wiring within starters, controllers, and panels, shall be routed neatly in gutter space, away from moving and/or heat producing parts. Provide 30 ampere, 600 volt rated terminal blocks. Do not place more than two wire connections on pilot device or relay terminal. Where more than two circuit connections are required, use terminal blocks. Provide nylon self-insulated, locking type spade lugs for all control wires. Cables and wires shall be neatly bundled and lashed with nylon cable straps.

END OF SECTION 220540

SECTION 220553 PLUMBING IDENTIFICATION

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 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.3 QUALIFICATIONS

A. All identification devices shall comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles.

1.4 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each identification material and device. Submit valve schedule for each piping system typewritten on an 8-1/2 in. x 11 in. paper (minimum), indicating valve number, location and valve function. Submit schedule of pipe, equipment and name identification for review before stenciling or labeling.

1.5 MAKES

A. Allen Systems, Inc., Brady (W.H.) Co.; Signmark Div., Industrial Safety Supply Co., Inc., Seton Name Plate Corp.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide manufacturer's standard products of categories and types required for each application. In cases where there is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.

B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.2 PIPING IDENTIFICATION

A. Identification Types:

1. Pressure Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.

B. Lettering:

1. Piping labeling shall conform to the following list:

PIPE FUNCTION	IDENTIFICATION
Cold Water	DOMESTIC COLD WATER
Hot Water	DOMESTIC HOT WATER
140 Degree Hot Water	DOMESTIC HOT WATER - 140°F
Sanitary Waste	SANITARY WASTE
Indirect Waste	INDIRECT WASTE
Vent	VENT
Non-Potable Water	NON-POTABLE WATER
Propane	PROPANE GAS

2.3 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high black-filled numerals. Attach to valve with brass jack chain and "S" hook. Identify between heating and plumbing services with 1/4 in. letters above the valve number.
2. Acceptable Manufacturers: Seton Style No. M4507, or approved equal.

B. Valve Chart:

1. Provide valve chart for all valves provided as a part of this project. Frame and place under clear glass. Mount in Mechanical Room.

2.4 EQUIPMENT IDENTIFICATION

A. General:

1. Provide engraved vinyl nameplates for each major piece of mechanical equipment provided, 2-1/2 in. x 3/4 in. size.
2. Acceptable Manufacturers: Seton Style No. M4562, or approved equal.

2.5 ABOVE CEILING EQUIPMENT LOCATOR

A. 3/4 in. diameter adhesive stickers placed on ceiling grid and color-coded.

B. The color for all plumbing valves shall be BLUE.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide valve tags for all valves provided on project.

B. Provide equipment tags for all equipment provided on project.

C. Provide piping identification with directional flow arrows for all piping on project, maximum intervals of 20'-0". For piping installed through rooms, provide at least one (1) pipe label in each room, for each pipe function.

END OF SECTION 220553

SECTION 220554 PAINTING

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 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical data sheets for each coating.

1. Material analysis including vehicle type and percentage by weight and by volume of vehicle, resin, and pigment.
2. Application instructions including mixing, surface preparation, compatible primers and topcoats, recommended wet and dry film thickness, recommended application methods.

1.4 QUALITY ASSURANCE

A. Materials:

1. All coating materials required by this section shall be provided by a single manufacturer, unless otherwise required or approved.

a. Contractor: Firm with successful experience in painting work similar in scope of work of this project.
b. Maintain throughout duration of the work a crew of painters who are fully qualified to satisfy requirements of the specifications.

1.5 GENERAL

A. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design Make:

1. Sherwin Williams Company.

B. Acceptable Makes:

1. Devoe & Raynolds Company
2. The Glidden Company
3. Benjamin Moore & Company
4. PPG Industries, Inc./Pittsburgh Paints
5. Pratt & Lambert, Inc.
6. Sherwin Williams Company

2.2 PRODUCTS

A. Colors:

1. As selected by Owner.

B. Lead Content:

1. Not more than 0.009 percent lead by weight (calculated as lead metal) in the total nonvolatile content of the paint or the equivalent measure of the lead in the dried film.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that surfaces and conditions are ready for work in accordance with coating manufacturer's recommendations.

B. Prior to commencement of work, examine surfaces scheduled to be finished.

C. Report any unsatisfactory conditions in writing.

D. Do not apply coatings to unsatisfactory substrates.

E. Beginning painting work on an area will be deemed construed acceptance of surfaces in that area.

3.2 SCOPE

A. Plumbing components shall be painted by the Plumbing Contractor.

B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. See schedule for color code.

C. Paint all hangers, rods and any other bare iron work in all exposed areas.

D. Paint all exterior metal or iron including all piping, supporting metals, etc, unless furnished with a factory finish. This shall include galvanized steel. Paint with galvanized primer and finish with epoxy of color selected by Architect. Exterior metal painting shall include all exposed plumbing piping, fittings, valves, etc.

E. Paint bare metal and touch up damaged finish on all plumbing equipment. Use heat resistant paint on all hot surfaces.

F. Paint all insulated and bare piping exposed to view in all areas.

G. Paint all uninsulated water pump casings and piping connections.

H. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contact must be touched up by Contractor responsible for same.

3.3 SURFACE PREPARATION

A. Apply coatings to surfaces that are clean and properly prepared in accordance with manufacturer's instructions and as herein specified. Remove dirt, dust, grease, oils and foreign matter. Prepare surface for proper texture necessary to optimum coating adhesion and intended finished appearance. Plan cleaning, preparation, and coating operations to avoid contamination of freshly coated surfaces.

B. Provide protection for non-removable items not called for coating. After application of coatings, installed removed items. Use only skilled workmen for removal and replacement of such items.

C. Protect surfaces not called for coating. Clean, repair, or replace to the satisfaction of the Engineer/Owner's Representative any surfaces inadvertently spattered or coated.

D. Metal Work:

1. Remove all oil and grease with non-flammable solvent. Remove all rust with steel wool.
2. Patched Areas, Touch-up Areas. Clean and prepare all surfaces as required to provide a smooth, even substrate for proper application of finish.
3. Contractor must examine areas and conditions under which paint is to be applied and notify Engineer in writing if conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.4 APPLICATION

A. General:

1. Apply coatings in accordance with coating manufacturer's instructions and using application method best suited for obtaining full, uniform coverage of surfaces to be coated.

2. Apply successive coats after adequate cure of the preceding coat and within the recommended recoating time.
3. Complete coatings shall be free of defects such as runs, sags, variations in color, lap or brush marks, holidays, and skips.

B. Remove coatings not in compliance with this specification, reclean and re-prepare surfaces as specified, and apply coatings to comply with the Contract Documents.

3.5 SCHEDULE OF COATINGS FOR METAL SURFACES

A. Porous Surface:

1. The coating shall be Tough-Coat as manufactured by VAC Systems Industries, Foster 40-10, 40-20, or 40-23 as manufactured by Foster Products Corporation, or approved equal. Coating shall meet NFPA Standard 90A and 90B and contain an anti-microbial agent.

B. Non-Porous Surface:

1. The paint shall be Porta-Sept as manufactured by Porter Paints, Inc., Foster 40-26 as manufactured by Foster Products Corporation or approved equal. Paint shall contain an EPA registered anti-microbial, Intercept, which inhibits the growth of bacteria, mold, mildew and fungi.

3.6 COLOR CODING

A. Pipe coloring shall conform to the following schedule:

PIPING SYSTEM	SAFETY COLOR
Domestic Cold Water	GREEN
Domestic Hot Water	YELLOW
Propane	YELLOW
Sanitary	GREEN
Storm	GREEN

END OF SECTION 220554

SECTION 220580 EXCAVATION AND BACKFILL

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 WORK INCLUDED

A. Provide labor, materials, equipment, and services to perform operations required for the complete installation and related work as required in the Contract Documents.

1.3 SUBMITTALS

A. Backfill Materials:

1. Cushion sand, identify source.
2. Crushed stone, identify source.
3. Gravel fill, identify source.
4. Ordinary fill, identify source.

1.4 CODES

A. Comply with local, state, and federal codes, regulations, and laws affecting work of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cushion Sand: Clean, coarse, and free of organic matter, conforming to New York State DOT Item No. 703.06.

B. Crushed Stone: Crushed stone, graded, free of organic materials, No. 1 to No. 4 size. Conforming to New York State DOT Item No. 703-0201.

C. Gravel Fill: Well-graded natural inorganic sand and gravel conforming to New York State DOT Item No. 703-0202.

D. Ordinary Fill: Well-graded, natural soil, meeting the following requirements:

1. Free of organic and other compressible materials, debris and frozen materials, and of stones larger than 4 in. maximum dimension.
2. Be of such nature and character that it can be compacted to the specified densities.
3. Free of highly plastic clays, of materials subject to decay, decomposition, or dissolution, and of cinders, ash and other corrosive materials.

4. Maximum dry density of not less than 115 lbs. per cu. ft.
5. Material from excavation on the site may be used as ordinary fill if it meets the above requirements.

E. Backfill Materials: Provide backfill materials in accordance with applicable sections of Division 31.

F. Concrete: Provide concrete in accordance with applicable sections of Division 3.

PART 3 - EXECUTION

3.1 PREPARATORY WORK, SCHEDULING SHUTDOWNS, AND TEMPORARY WORK

A. Build lines to grade and elevations shown. Provide stakes, grade boards, cleats, nails, and instruments. Locate and stake each new run for its entire length. Verify elevations given. Start excavation at low point. Notify Engineer of elevation discrepancies. Protect marks and stations. Before starting excavation work, coordinate with and furnish schedule of work to Owner's Representative and other trades. Provide and maintain temporary walks and bridges over excavations where underground utility lines, sewers, water lines, etc., cross access roads, walks, and streets. Make necessary arrangement with authorities having jurisdiction.

3.2 PROTECTION

A. Provide bracing, shoring, sheathing and other work for protection of personnel, the contract work, excavations, trees, shrubs, existing structures, and surrounding properties. Provide and maintain barricades, warning signs, flags, and lights for the protection of work, workmen, public, and property. Plank walks, pavements, and curbs to be crossed by equipment. Protect adjacent property, fences, trees, shrubs, roads, curbs, sidewalks, manholes, hydrants, and other items.

1. Restore, repair or replace any items damaged or destroyed to a condition equal to that existing before such damage occurred.
2. Establish conditions, before starting work, by taking photographs to determine state to which existing conditions must be restored. Submit such photographs notarized, identified and dated for record.

B. The use of equipment with metal tracks over paved areas is not permitted unless the pavement is protected with methods as approved by the Owner's Representative.

3.3 INVESTIGATION AND PROTECTION OF EXISTING UTILITIES

A. Every attempt has been made to indicate existing utilities as accurately as possible from existing drawings, surveys, and data. Immediately report other utility lines encountered, but not shown on the drawings. Notify Underground Facilities Protection Organization (UFPO) before starting work. Phone (800)-962-7962 for information and location of nearest organization address and telephone number. Verify exact location of existing utility lines where work crosses existing utilities and where connections are to be made by test hole before starting work. Notify utility companies, municipalities, and other

involved jurisdictions when excavating occurs within vicinity of existing underground service such as sewers, water, electric, gas, telephone, including such services owned by Owner. If existing service lines, utilities and utility structures which are to remain in service are uncovered or encountered during this excavation, they shall be protected from damage, and securely supported as directed and approved by the involved jurisdiction. Comply with all local, state and federal regulations when working in vicinity of combustible gas piping. Immediately report damage to utility lines to Owner's Representative and involved jurisdiction. Repair or replace utility lines damaged or destroyed as directed and approved by the involved jurisdiction. Excavate by hand in proximity to existing underground utility lines; take extreme care when excavating around ductbanks carrying energized cable. Remove, plug or cap inactive or abandoned utilities encountered during construction operations. The location of such utilities shall be noted on the record drawings. Verify inactivity of services with involved jurisdiction before start of work.

B. Saw cut floor slabs perpendicular to surface and parallel with/perpendicular to walls. Replace slabs and adjacent surfaces damaged by excavation operations with materials equal to adjacent existing materials.

3.4 CUTTING AND PATCHING

A. Prior to starting work, obtain necessary permits and pay all costs and fees. Cut paved areas, perpendicular to surface and in straight saw-cut lines. Replace pavements, roadways, streets, blacktop areas and walks damaged by excavating operations with materials equal to adjacent pavements.

3.5 EXCAVATION

A. Provide for buried work in contract both inside and outside of building. Excavate to proper depth and width for installation work and comply with rules set forth by New York State Department of Labor. Remove materials including masonry work, rubble, earth, brickwork, concrete, sand, debris, abandoned pipe lines, drains, sewers, rocks, boulders, and concrete, all of which is considered "earth excavation". Provide for legal disposition of excess excavated materials. Make allowance for gravel fill, sand bases, form work, floor slabs, manholes, anchor and thrust blocks, sheet piling, drainage pumps, and work space. Start excavation at rough grade and provide form work and sheet piling where required.

B. Trench Excavation:

1. By open cut, to proper depth and grade no wider than required for placement of work and not more than 100 ft. in advance of utility being installed.
2. Should trench bottom be wet, unstable or otherwise incapable of supporting the contract work, immediately report the condition to the Owner's Representative. Should it be deemed unsuitable, excavate to depth as directed and backfill with gravel to trench depth, or provide concrete cradling.
3. Should rock be encountered, excavate 6 in. deeper and fill space between trench bottom and pipe with coarse sand, well compacted to form a firm pipe bed.

C. Shoring, Bracing, Sheathing:

1. In addition to governing codes, protect sides of excavations with shoring, bracing and sheathing to prevent sliding or caving of banks and to protect adjacent structures. Remove as backfill is placed.
2. Provide at locations adjacent to existing manholes, hydrants, and similar items.

D. General Excavation:

1. As required for all buried work. This shall include, but not be limited to, piping, tanks, ductbanks, conduits, footings, manholes, anchors, concrete pads, thrust blocks, fixture bases, and other work in contract.

3.6 BACKFILL

A. Bedding:

1. Around piping with cushion sand from 6 in. below to 8 in. above. Apply by hand and compact under and at sides by mechanical means.
2. Piping, jackets and sand bed must be inspected and tested prior to backfill of any nature. Provide necessary anchors, thrust blocks, for testing.

B. Remainder of Trench:

1. Backfill remainder of trench in accordance with applicable sections of Division 31.

C. Under Roadways, Manholes, Drives, Parking Areas, Walks, Slabs on Grade and at Utility Entrance to Building:

1. Backfill in accordance with applicable sections of Division 31.

D. Compaction Requirements:

1. Compaction in accordance with applicable sections of Division 31.

E. Field Testing:

1. Test compaction in accordance with applicable sections of Division 31.

3.7 REMOVAL OF WATER

A. Provide pumps, hoses, pipe, labor and fuel, necessary to keep excavations free of water accumulation. Maintain and operate equipment. Discharge water in manner not to interfere with any trade's work, undermine or disturb adjacent structures or properties. Grade to prevent surface water from flowing into all excavations and trenches. Do not discharge dirt, backfill or debris into sanitary or storm drainage systems.

3.8 ROUGH GRADING

A. Trim and grade areas to receive fill material or topsoil specified.

B. Set grade stakes where spot elevations are shown, at breaks in grade, along drainage "swales" and as otherwise required to correctly grade the area to existing conditions.

C. On completion of rough grading, obtain Owner's Representative's approval before spreading topsoil or preparing pavement subgrade.

D. Compact fill as specified.

3.9 FINAL GRADING

A. Spread topsoil conforming to New York State DOT Item No. 713-01 over entire area disturbed by work of this project unless otherwise noted.

B. Spread, compact and manipulate topsoil to a minimum of six (6) inches thickness after compaction to smooth draining grades true to original elevations. Remove all excess topsoil remaining after all needs of this contract are met.

C. Repair to proper grade any settlement of slab, pavement, utility, structure, or lawn adversely affected by settlement within one year after final acceptance at no expense to the Owner.

D. Protect all disturbed areas during and after earthwork operation to prevent gullying, erosion, and subsequent deposition on or off site. Repair/remove all erosion and deposition that occurs at no expense to the Owner.

3.10 FLOOR SLABS

A. Upon completion of backfilling, drill and grout steel dowels into existing slab, place steel rebar and pour concrete slab the same thickness as the existing slab. All work shall be performed by workmen skilled in the appropriate trade in accordance with the requirements of the Architect.

B. New slab shall be finished smooth and flush with existing slab.

3.11 RESTORATION

A. On completion of the work, clean the entire site, remove surplus earth, large stones and debris and legally dispose to an off-site location. Remove tools and equipment and leave the entire area in a neat condition.

END OF SECTION 220580

SECTION 220700 INSULATION

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 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.3 SUBMITTAL

A. Shall include product description, manufacturer's installation instructions, types and recommended thicknesses for each application, and location of materials.

PART 2 - PRODUCTS

2.1 GENERAL

A. Insulation, jackets, adhesive, and coatings shall comply with the following:

1. Treatment of jackets or facing for flame and smoke safety must be permanent. Water-soluble treatments not permitted.
2. Insulation, including finishes and adhesives on the exterior surfaces of pipes and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
3. Asbestos or asbestos bearing materials are prohibited.
4. 2020 Energy Conservation Code of New York State All adhesives and sealants used for insulation in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ E4.1 and EQ E4.2.
5. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Provide insulation systems in accordance with the approved MICA or NAIMA Insulation Standards.
6. Insulation shall be clearly marked with manufacturer's name, identification of installed thermal resistance (R) value, out-of-package R value, flame spread and smoke developed indexes in accordance with Energy Code requirements.

2.2 ACCEPTABLE MANUFACTURERS

A. Fiberglass: Knauf, Johns Manville, Owen-Corning, Certainteed

B. Polyisocyanurate: Dow Trymer 2000XP, HyTherm.

C. Calcium Silicate: Industrial Insulation Group (ILG).

D. Flexible Elastomeric: Armacell, K-Flex.

E. Adhesives: Childers Products, Foster.

2.3 PIPE INSULATION (RIGID FIBERGLASS TYPE)

A. Product meeting ASTM C 547, ASTM C 585, and ASTM C 795; rigid, molded, noncombustible.

B. 'K' Value: ASTM C 335, 0.23 at 75°F mean temperature. Maximum Service Temperature: 1000°F.

C. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.

D. Field-Applied PVC Fitting Covers with Flexible Fiberglass Insulation: Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system shall consist of pre-molded, high-impact PVC materials with blanket type fiberglass wrap inserts. Blanket fiberglass wrap inserts shall have a thermal conductivity ('K') of 0.26 at 75°F mean temperature. Closures shall be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

E. Field-Applied PVC Fitting Covers with Molded Fiberglass Inserts: Hamfab Products, Division of ICA Inc., UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system consists of pre-molded, high-impact PVC materials with rigid molded fiberglass inserts. Closures to be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

F. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in pre-forming insulation to cover valves, elbows, tees, and flanges.

2.4 PIPE INSULATION (RIGID POLYISOCYANURATE TYPE)

A. Preformed Rigid Polyisocyanurate Insulation: Cellular foam complying with ASTM C591, rigid molded, non-combustible. 2-lb./ft^3 nominal density. Maximum thermal conductivity (k) shall be 0.19 BTU-in/ft^2 hr. °F at 75°F mean temperature.

2.5 PIPE INSULATION (FLEXIBLE TYPE)

A. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Adhesive: As recommended by insulation material manufacturer.

B. Insulation (1 in. thickness and smaller) shall have a flame-spread index of less than 25 and a smoke-developed index of less than 50 as tested by ASTM E 84 and CAN/ULC S-102, "Method of Test for Surface Burning Characteristics of Building Materials".

2.6 CALCIUM SILICATE

A. Flat-, curved- and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I, rated for a maximum temperature of 1700 degree F.

2.7 FIRE RATED INSULATION

A. Wrap shall be fully tested against external fires (ASTM E 119/UL263), through penetration insulated piping fires (ASTM 814/UL1479), wall fires (ASTM E 119), and surface burning (ASTM E 84/UL723). Wrap for engine exhaust applications shall use two layers of 1-1/2 in. wrap. The interior layer shall be applied with a butt joint. The second layer shall be offset a minimum of six inches from the initial layer, with an overlap of three inches and the insulated pipe is banded with stainless steel straps.

B. Acceptable Manufacturers: John Mansville Firetemp Wrap, Certainteed FlameChek or approved equal.

2.8 FIELD-APPLIED JACKETS

A. Piping:

1. PVC Pipe Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming. Adhesive: As recommended by insulation material manufacturer. PVC Jacket Color: White.
2. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003-alloy, and H-14 temper. Finish and Thickness: Corrugated finish, 0.010 inch thick. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.
3. Stainless-Steel Jacket: ASTM A 666, Type 304 or 316; 0.010 inch thick; and factory cut and rolled to indicated sizes. Moisture Barrier: 3-mil- thick, heat-bonded polyethylene and kraft paper. Elbows: Gore type, for 45- and 90-degree elbows in same material, finish, and thickness as jacket. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.
4. Alumaguard Jacketing: Self adhesive, 60 mil thick, rubberized bitumen, foil faced membrane. Polyguard Products, Inc. Alumaguard 60, or equal.
5. Venture Guard Jacketing: 26.6 mil thick, Hypalon self adhesive membrane. Venture Tape Corp. Venture Guard, or equal.

2.9 COATINGS, MASTICS, ADHESIVES AND SEALANTS

A. Vapor Barrier Coatings: Used in conjunction with reinforcing mesh to coat insulation on below ambient services temperatures. Permeance shall be no greater than 0.08 perms at 45 mils dry as tested by ASTM F1249. Foster 30-65 Vapor Fas; Childers CP-34, or approved equal.

B. Lagging Adhesives: Used in conjunction with canvas or glass lagging cloth to protect equipment/piping indoors. Foster 30-36 Sealfas; Childers CP-50AMV1 Chil Seal, or approved equal.

C. Weather Barrier Mastic: Used outdoors to protect above ambient insulation from weather. Foster 46-50 Weatherite; Childers CP-10 Vi Cryl, or approved equal.

D. Fiberglass Adhesive: Used bond low density fibrous insulation to metal surfaces. Shall meet ASTM C916 Type II. Foster 85-60; Childers CP-127, or approved equal.

E. Elastomeric Insulation Adhesive: Used to bond elastomeric insulation. Foster 85-75; Childers CP-82, or approved equal.

F. Elastomeric Insulation Coating: Water based coating used to protect outside of elastomeric insulation. Foster 30-65, Childers CP-34 or approved equal.

G. Insulation Joint Sealant: Used as a vapor sealant on below ambient piping with polyisocyanurate and cellular glass insulation. Foster 95-50; Childers CP-76, or approved equal.

H. Metal Jacketing Sealant: Used as a sealant on metal jacketing seams to prevent water entry. Foster 95-44; Childers CP-76, or approved equal.

I. Reinforcing Mesh: Used in conjunction with coatings/mastics to reinforce. Foster Mast A Fab; Childers Chil Glass #10, or approved equal.

2.10 PIPE SUPPORT INSULATION INSERTS

A. 20 lbs./cu. ft. molded fiberglass, for -120°F to +450°F service temperature, non-combustible, 0.30 thermal conductivity (k), same thickness as pipe insulation.

B. Acceptable Manufacturers: Hamfab "H" Block, or approved equal.

2.11 MATERIALS AND SCHEDULES

A. See Exhibits at the end of this section.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation. No glass fibers shall be exposed to the air.

C. All pipe insulation shall be continuous through hangers, sleeves, walls, ceiling, floor, or roof openings, unless not allowed by fire stop system. Refer to Sections 220500, "Basic Plumbing Requirements" and 221010, "Piping Systems and Accessories" for firestop systems.

D. Provide thermal insulation on clean, dry surfaces and after piping and equipment (as applicable) have been tested. Do not cover pipe joints with insulation until required tests are completed.

E. All cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained; insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation. Cover valves, fittings and similar items in each piping system with insulation as applied to adjoining pipe run. Extra care must be taken on piping appurtenances to insure a tight fit to the piping system. For piping systems with fluid temperatures below ambient, all vapor retarder jacket (ASJ) seams must be coated with vapor barrier coating. All associated elbows, fittings, valves, etc. must be coated with vapor barrier coating and reinforcing mesh to prevent moisture ingress. Valve extension stems require Elastomeric insulation that is tight fitting to the adjoining fiberglass system insulation. Pumps, strainers, drain valves, etc. must be totally encapsulated with Elastomeric insulation.

F. Items such as manholes, handholds, clean-outs, plugged connections, pet cocks, air vents, ASME stamp, and manufacturers' nameplates, may be left un-insulated unless omitting insulation would cause a condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.

G. Provide protective insulation as required to prevent personal injury.

H. All pipes shall be individually insulated.

I. If any insulation material becomes wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site.

J. All exposed surfaces shall be white, unless noted otherwise.

3.2 PIPE INSULATION

A. Insulate piping systems including fittings, valves, flanges, unions, strainers, and other attachments installed in piping system, whether exposed or.

B. Insulation installed on piping operating below ambient temperatures must have a continuous vapor retarder. All joints, seams and fittings must be sealed. Insulation shall be continuous through hangers on all water piping and storm water piping.

C. Hanger Shields: Refer to Section 221010 "Piping Systems and Accessories".

D. Hanger shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required.

1. Pre-Insulated Type: Butt insulation to hanger shields and apply a wet coat of vapor barrier cement to the joints and seal with 3 in. wide vapor barrier tape.
2. Field Insulated Type: Provide Hamfab Co. "H" blocks per manufacturers recommended spacing between pipe and shield.
3. Tape shields to insulation.

E. Joints in section pipe covering made as follows:

1. All ends must be firmly butted and secured with appropriate butt-strip material. On high-temperature piping, double layering with staggered joints may be appropriate. When double layering, the inner layer should not be jacketed.
2. Standard: Longitudinal laps and butt joint sealing strips cemented with white vapor barrier coating, or factory supplied pressure sensitive adhesive lap seal.
3. Vapor Barrier: For cold services, Longitudinal laps and 4 in. vapor barrier strip at butt joints shall be sealed with white vapor barrier coating. Seal ends of pipe insulation at valves, flanges, and fittings with white vapor barrier coating.

F. Fittings, Valves and Flanges:

1. Domestic Hot and Cold Water: Premolded fitting insulation of the same material and thickness as the adjacent pipe insulation. Vapor seal domestic cold water with two (2) coats of white vapor barrier coating
2. White PVC jacketing, with continuous solvent weld of all seams. Tape all fittings.

G. Flexible Pipe Insulation:

1. Split longitudinal joint and seal with adhesive.
2. Fittings made from miter-cut pieces properly sealed with adhesive, or elbows may be continuous.
3. Where exposed outdoors, provide with Alumaguard or Venture Guard jacketing.

H. For piping exposed to the elements, jacketing shall be aluminum or stainless steel with a factory applied moisture barrier. Fitting covers shall be of similar materials. The insulation and jacketing shall be held firmly in place with a friction type Z lock or a minimum 2 in. overlap joint. All joints shall be sealed completely along the longitudinal seam and installed so as to shed water. All circumferential joints shall be sealed by use of preformed butt strips; minimum 2 in. wide or a minimum 2 in. overlap. Butt strips shall overlap the adjacent jacketing a minimum 1/2 in. and be completely weather sealed. Jacket at elbows and tees shall be mitered, or pre-manufactured fitting jackets shall be provided, with additional aluminum holding bands, as required. All joints shall be sealed watertight using specified metal jacketing sealant as recommended by the manufacturer.

I. Apply PVC jacket where indicated, with 1 in. overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.

J. Apply either aluminum or PVC jacketing to exposed insulated pipe, valves, fittings, and specialties, at an elevation of 8 feet or less above finished floor in mechanical/electrical rooms, penthouses, and services aisles/pipe chases. Fittings of aluminum-jacketed piping may be either aluminum or standard PVC fitting covers. Jacketing for piping in existing areas shall match existing jacketing.

K. All exposed piping less than 8'-0" above finished floor in occupied spaces shall be insulated with polyisocyanurate insulation (for cold services) or calcium silicate (for hot services) and rigid fiberglass fittings. All exposed piping shall have a continuous 30 mil thick white PVC or aluminum jacketing.

L. Piping in exterior walls, spaces, overhangs, attics, or where subject to freezing: Insulate pipe with double the thickness called for. Piping in wall chases: In addition to the above, pack chase with loose glass fiber insulation.

M. Provide insulation on exposed hot and cold plumbing piping to within 18 in. of fixture or equipment connection.

N. Insulate exposed domestic water and waste piping for plumbing fixtures designated for use by the handicapped.

EXHIBIT "I" - PIPE INSULATION MATERIALS
(Notes at end of Exhibit "I")

SERVICE	INSULATION MATERIAL	THICKNESS	REMARKS
Domestic cold water	Glass fiber	1-1/2 in. and larger: 1 in. 1-1/4 in. and smaller: 1/2 in.	SEE NOTES 1, 2
Non potable cold water	Glass fiber	1-1/2 in. and larger: 1 in. 1-1/4 in. and smaller: 1/2 in.	SEE NOTE 2
Domestic hot and tempered water (105°F - 140°F)	Glass fiber	1-1/2 in. and larger: 1-1/2 in. 1-1/4 in. and smaller: 1 in.	SEE NOTES 1, 2
AC unit drains, overflows and indirect waste piping associated with any HVAC equipment	Glass fiber or **Flexible**	All sizes: 1/2 in.	Not required for exposed PVC drains SEE NOTE 2
Sanitary and waste	Glass fiber	All sizes: 1/2 in.	SEE NOTE 3, 4

NOTES FOR EXHIBIT I:

NOTE 1: Exposed insulation at equipment shall be covered with aluminum or PVC jacket.

NOTE 2: Flexible allowed in 1/2 in. thickness only.

NOTE 3: Insulation on sanitary and waste piping located within plumbing chases and crawl spaces are not required.

NOTE 4: When PVC piping is installed for storm, sanitary and vent piping within return air plenums, the piping shall be insulated and enclosed in materials listed and labeled for installation within a plenum.

END OF SECTION 220700

SECTION 221010 PIPING SYSTEMS AND ACCESSORIES

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 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.3 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

B. All items here-in used to convey water for potable use shall be lead free in accordance with NSF, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

2.2 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 or Schedule 80 weight; black or galvanized finish as called for; ends chamfered for welding or grooved for grooved mechanical connections.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Welded fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sockolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.

2. Threaded fittings: Cast or malleable iron, black or galvanized, as called for; drainage type where called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.

C. Flanges, Unions, and Couplings:

1. Threaded Connections:

   a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.
   b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.
   c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.

2. Welded Connections:

   a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.

3. Grooved Mechanical Connections:

   a. Couplings: Ductile iron, ASTM A536, with painted coating, designed for rolled grooved piping, hot dipped galvanized finish were called for.
   b. Gaskets: Grade "E" EPDM synthetic rubber, -30°F to 230°F temperature range, suitable for water service.
   c. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated.
   d. Fittings: Elbows, tees, laterals, reducers, adapters as required. Same construction as couplings.
   e. Design Equipment: Victaulic, rigid system, Style 07 couplings.
   f. Acceptable Manufacturers: Grinnell, Gruvlok, Victaulic.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

E. Base Elbows:

1. Cast iron or steel type, flange connections; Crane 500 or equivalent made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

Elbow Size	Support Size	Base Plate
Up to 3 in.	1-1/4 in.	6 in. x 6 in. x 1/4 in.
4 in. to 6 in.	2-1/2 in.	8 in. x 8 in. x 1/4 in.
8 in. and larger	6 in.	14 in. x 14 in. x 5/16 in.

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.3 COPPER TUBE AND FITTINGS

A. Pipe: ASTM B88; Type K or L, hard temper. Soft temper only as called for. Plans show copper tube sizes.

B. Fittings: Wrought copper and copper alloy, ASME B16.22 or cast copper alloy, ASME B16.18; solder end connections.

C. Unions and Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp: 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.

D. Flux Materials: Flux shall comply with ASTM B813 and the provisions of the New York State Plumbing Code.

E. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel. Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe" or approved equal.

F. Brazing Materials: Class BcuP-5 for brazing copper to brass, bronze to copper. Harris, Inc. "Stay-Silv 15" or approved equal.

2.4 COPPER TUBE AND FITTINGS - PRESS FITTINGS

A. Tubing Standard: Copper tubing shall conform to ASTM B75 or ASTM B88.

B. Fitting Standard: Copper fittings shall conform to ASME B16.18, ASME B16.22, or ASME B16.26.

C. Press Fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.

D. Acceptable Manufacturers: Apollo, Mueller, Nibco, Viega.

2.5 COPPER TUBE AND FITTINGS - GROOVED MECHANICAL CONNECTIONS

A. Pipe: ASTM B88, Type K or L, hard temper.

B. Fittings: Wrought copper, roll grooved mechanical connections, ASTM B-75, ANSI B16.22 for 4 in. size. Cast bronze, rolled grooved mechanical connections, ASTM B-584, ANSI B16.18 for sizes 5 in. - 8 in.

C. Couplings: Ductile iron, ASTM A-536, with copper colored alkyd enamel finish, designed for rolled grooved piping.

D. Gaskets: Grade "E" EPDM synthetic rubber, copper color coded, -30°F to 230°F temperature range, suitable for water service.

E. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated finish.

F. Design Equipment: Victaulic Style 606 couplings.

G. Acceptable Manufacturers: Grinnell, Gruvlok, Victaulic.

2.6 COPPER DRAINAGE TUBE AND FITTINGS

A. Pipe: ASTM B306, Type DWV, hard temper.

1. Copper not allowed for urinal waste.

B. Fittings: Wrought copper, ANSI B16.29 or cast bronze, ANSI B16.23; solder end connections.

C. Flux Materials: Flux shall comply with ASTM B813 and the provisions of the New York State Plumbing Code.

D. Solder Materials: No lead solder, using alloys made from tin, copper, silver and nickel.

E. Acceptable Manufacturers: Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe", or approved equal.

2.7 BRASS PIPE AND FITTINGS

A. Piping: ASTM B43, semi-annealed, red brass containing not less than 85% copper; chrome plated where called for.

B. Fittings: Cast brass, sps, malleable iron pattern, reinforced corresponding to weight of pipe; chrome plated with high polished finish where called for.

2.8 HUB AND SPIGOT CAST IRON SOIL PIPE AND FITTINGS

A. Pipe: ASTM A74 service weight cast iron, bitumen coated.

B. Fittings: Cast iron, service weight, hub and spigot, drainage pattern, bitumen coated.

C. Connections: ASTM C564 neoprene gaskets and lubricant.

D. 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.

2.9 NO-HUB CAST IRON SOIL PIPE AND FITTINGS

A. Pipe: ASTM A888, CISPI Standard 301, no-hub cast iron, bitumen coated.

1. For above grade only.

B. Fittings: Cast iron, no-hub drainage pattern, bitumen coated.

C. Couplings:

1. 1-1/2 in. to 2 in.: CISPI standard 310 with 300 series stainless steel corrugated shield and clamp assembly with ASTM C564 neoprene sealing sleeve (or) same as specified for 3 in. and larger.
2. 3 in. and Larger: 24 gauge, Type 304 stainless steel housing clamp assembly with ASTM C564 neoprene sealing sleeve, 60 in. lbs. minimum torque rating, shall meet requirements of pipe manufacturer and shall be compatible with specified pipe. Acceptable Manufacturers: Clamp-All Coupling System, Tyler "Wide Body", Husky "Series 2000", Mission "Heavy Weight" or approved equal.

D. 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.

2.10 PVC SOLID WALL PIPE AND FITTINGS - DWV SYSTEM

A. Pipe: PVC Schedule 40 solid wall pipe, iron pipe size conforming to ASTM D1785 and ASTM D2665. Pipe shall be manufactured from PVC compounds as identified in ASTM D1784. Both pipe and fittings shall conform to National Sanitation Foundation Standard 14.

B. Fittings: Type DWV, socket type conforming to ASTM D2665. Fittings shall be manufactured from PVC compounds as identified in ASTM D1784. Solvent cement joints shall be made utilizing a two-step process with primer manufactured for thermoplastic piping and solvent cement conforming to ASTM D2564.

2.11 SPECIAL FITTINGS

A. Cast Iron to Lead Pipe: Red brass ferrules and wiped joints. Caulk ferrule into cast iron hub.

B. Copper to Cast Iron: Cast bronze, cast iron to sweat adapter.

C. Copper to Steel Piping:

1. Cast bronze copper to iron male or female adapter with shoulder for drainage piping only.
2. Dielectric pipefittings.

D. Steel to Cast Iron: Cast iron soil pipe connector with spigot and IPS male thread end (Manhoff fittings).

E. No-Hub, Cast Iron, Glass, Polypropylene or High Silicon Cast Iron: Proper adapter to piping being connected.

F. Cast Iron and PVC Sovent: Aerators and deaerators as manufactured by Conine Manufacturing Co., Inc.

2.12 DIELECTRIC PIPE FITTINGS

A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

B. Unions: Factory fabricated, for 250 psi minimum working pressure at 180°F, threaded or solder ends, insulating material suitable for system fluid, pressure and temperature.

C. Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.

D. Acceptable Manufacturers: EPCO, Capitol Manufacturing, Watts or approved equal.

2.13 HANGERS, INSERTS AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. PVC coated where in contact with copper piping.
2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
3. Adjustable steel clevis type for piping 4 in. and larger.
4. Nuts, washers and rods with electroplated zinc or cadmium finish.
5. Provide hot dipped galvanized finish for hangers and accessories installed in exterior locations and interior areas with moist environment conditions such as pools, pool filter rooms, areaways, garages and similar areas.

C. Spacing Schedule:

Pipe Size	Steel	Copper	Plastic	Cast Iron	Rod Size
3/4 in. to 1 in.	8 ft.	6 ft.	3 ft.	Each	3/8 in.
1-1/4 in. to 2 in.	10 ft.	6 ft.	3 ft.	Horizontal	3/8 in.
2-1/2 in. to 4 in.	12 ft.	10 ft.	4 ft.	Joint 5 ft.	1/2 in.
5 in. and over	12 ft.	10 ft.	4 ft.	Maximum	5/8 in.
8 in.	12 ft.	10 ft.	4 ft.	O.C.	3/4 in.
Over 8 in.	To suit loading conditions.				

D. Cast Iron No-Hub Supports:

1. In accordance with manufacturer's recommendations.
2. Vertical piping supported at each stack base, at each floor and 15 ft. on center, maximum. Freestanding vertical pipe should be adequately staked or braced during construction to maintain alignment. Bases of stacks shall be supported on concrete, brick laid in cement mortar, metal brackets attached to the building construction or by other methods approved by the Owner's Representative.

3. Horizontal piping supported within 24 in. each side of the coupling joint at 10 ft. intervals for 10 ft. pipe lengths and at 5 ft. intervals for 5 ft. pipe lengths. Supports or hangers placed to maintain alignment and grade with provision made to prevent shear. Greater than 3 in. diameter pipe braced at changes of direction to prevent horizontal movement.

E. Beam Attachments:

1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller.
2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.

F. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal.

G. Supports:

1. Provide intermediate structural steel members where required for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.
2. For Weights Under 1000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.
3. For Weights Above 1000 lbs.: Drill through floor slabs and provide flat flush plate welded to top of rod or provide additional "Drill-In" inserts and hangers to reduce load per hanger below 1000 lbs.
4. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.
5. For Wood Construction: Provide hangers and supports designed for attachment to wood construction.
6. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

H. Trapeze Hangers:

1. For plumbing systems only.
2. Hangers shall be supported with rod sized with a safety factor of four.
3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.
4. Securely fasten piping to trapeze with "U" bolt or pipe clamps, dissimilar metals shall not touch, use isolation gaskets. Fasten piping to trapeze at every third support.
5. Acceptable Manufacturers: B-Line, Kindorf, Unistrut or approved equal.

I. Cabinet Pipe Space Supports:

1. Piping below casework countertops within space behind cabinet shall be supported using continuous slot metal channels with pipe clamps.
2. Acceptable Manufacturers: B-Line, Kindorf, Unistrut or approved equal.

J. Hanger Insulation Shields:

1. Hanger insulation shields shall be provided for all water and storm water piping. Hangers shall attach directly to pipe for all remaining services.
2. Piping 2 in. and Smaller: Pipe insulated with glass fiber insulation shall be protected at point of support by a sheet metal shield. Shield shall be #18 gauge, galvanized steel, minimum 120 degree arc, formed to fit insulation thickness and 12 in. long. Tape shields to pipe insulation.
3. Piping 3 in. and Larger: Pipe insulated with glass fiber insulation shall be protected at point of support by a sheet metal shield and pipe support insulation insert(s) between pipe and hanger. Shield shall be #18 gauge, galvanized steel, minimum 120 degree arc, formed to fit insulation thickness and 12 in. long. Tape shields to pipe insulation. Provide temporary blocking to maintain proper spacing for insulation.

K. Piping systems with material not listed above shall be supported and protected in accordance with manufacturer's recommendations.

2.14 PIPING ACCESSORIES

A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas and at plumbing fixtures.

B. All cleanout plugs, bushings and nipples, required for instruments and gauges shall be brass.

2.15 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.
2. Schedule 40 PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing.

2.16 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.17 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.18 STACK SLEEVE

A. Cast iron body with caulking recess, flashing clamp and under deck clamp.

B. Acceptable Manufacturers: Jay R. Smith Series 1720, Zurn, Wade.

2.19 STRAINERS

A. Description: Y-Pattern, self-cleaning, except where otherwise indicated, full size of connecting piping, Type 304 stainless steel screens, 125 lb. SWP, unless otherwise indicated.

B. Copper Piping 2-1/2 in. and Smaller: Lead free, cast bronze body, threaded ends, tapped retainer cap with closure plug, 20 mesh screen, Watts #LF777S.

C. Steel Piping 2-1/2 in. and Smaller: Iron body, threaded ends, tapped retainer cap with closure plug, 20 mesh screen, Watts #77S

D. Piping 3 in. and Larger, Cold Water Applications: Lead free, cast iron body, flanged ends, standard screen openings, FDA approved epoxy coating, tapped retainer cap and gasket with closure plug; Watts #77F-DI-FDA-125.

2.20 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (Plumbing) piping.

B. See Exhibit "B", "Testing" at end of this Section.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

A. Install equipment and systems in accordance with provisions of each applicable Section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in sizes shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.3 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beams clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers where insulation/supports must pass between pipe and hanger. Provide continuous support or extra supports for plastic piping per manufacturer's requirements. Hangers, when attached to joists, shall only be placed at the top or bottom

chord panel point. Only concentric type hangers are permissible on piping larger that 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor. Use trapeze hangers where a group of piping can be installed.

B. Provide a pipe hanger within 12 inches of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.4 PIPE CONNECTIONS

A. No-Lead Solder Connections: Nonacid flux and clean off excess flux and solder.

B. Press Connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

C. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat.

D. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.

E. Flanged Joints: Select appropriate gasket material, size, type and thickness for service applications. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

F. Dielectric Pipe Fittings: Provide dielectric unions at ALL equipment connections where dissimilar metals meet. In addition, provide dielectric unions in all open type piping systems (condensing water, domestic water, etc.) where dissimilar metals are to be joined.

G. Grooved Mechanical Joints: Pipe to be prepared in accordance with the latest manufacturer's grooving specification. Use manufacturer's recommended grooving tools. Pipe shall be checked to be sure it is free of indentations, projections; weld seams or roll marks on the exterior of the pipe over the entire gasket seating area. Pipe ends are to be square cut. Lubricant shall be applied to gasket and/or pipe ends and housing interiors to eliminate pinching the gasket.

H. Solvent-Cement Plastic Piping Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. PVC Piping: Join according to ASTM D 2855.

3.5 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

B. When welding galvanized pipe, apply cold galvanizing on joint following welding.

3.6 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed.

B. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains, use steel pipe sleeves 2 in. above floor.

C. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for.

D. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating.

E. Fill abandoned sleeves with concrete.

F. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.7 SLEEVE PACKING

A. Seal void space at sleeves as follows:

1. Interior Locations: Firmly pack with fiberglass and caulk.
2. Exterior Walls and Below Grade Cored Holes: Use sealing element.
3. Cored Holes: Use sealing element.
4. Fire Rated, Partitions and Floor Slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
5. Waterproofed Walls/Floors: Use waterproof sealing element, device or compound.

3.8 ESCUTCHEON PLATES

A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.9 TESTS

A. Refer to Exhibit "B" at the end of this section for testing of Plumbing Systems.

B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

C. Domestic Water:

1. Do not cover joints with insulation until required tests are completed and the Owner's Representative accepts the system.
2. Make leaks tight; no caulking permitted. Replace defective fittings, pipe or connections. Piping shall be tight and show no loss of pressure.
3. Air test not acceptable as final test.
4. Confirm in writing that tests and flushing have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

D. Sanitary:

1. There shall be no loss of water when testing interior piping.
2. Air test not acceptable as final test.
3. Should any leaks, defective joints or defective construction be detected in sewers and/or floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fitting or accessories be discovered they shall be removed and replaced at the Contractor's expense.
4. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

3.10 DOMESTIC WATER PIPING CLEANING AND DISINFECTION

A. Cleaning and disinfecting shall be in accordance with requirements of New York State Department of Health and authority having jurisdiction. Prior to disinfecting, flush piping to remove any sediment and debris.

B. Clean and disinfect water distribution piping systems and parts of existing potable water systems that have been altered, extended or repaired.

C. After disinfection procedures, submit water samples in sterile bottles to an approved Department of Health Laboratory. Samples shall be proven equal to the water quality served to the public from the existing water supply system and acceptable to the Department of Health. Flush and disinfect all sections of pipe that fail the laboratory tests. Submit test results indicating water is potable.

3.11 CONNECTIONS TO SPECIAL EQUIPMENT

A. Special Equipment:

1. Special Equipment shall be furnished by others and set in place by others.
2. Provide all piping, stops, valves, traps and fittings.
3. Where exposed, provide chrome plated brass piping, valves, hangers, brackets and accessories.
4. Pipe relief valves to floor. Size and arrangement of pipe, traps, valves and fittings, as recommended by manufacturer of equipment.

3.12 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS (PLUMBING)
(Notes at end of Exhibit "A")

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Water, Fireservice	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Domestic water interior/hot and cold 3 in. and smaller	Type L copper	Wrought or cast copper	No-lead solder
	Type L copper	Wrought or cast copper	Press fit
Domestic water interior/hot and cold 4 in. and larger	Schedule 40 galvanized steel	Galvanized ductile iron	Roll grooved mechanical type couplings (SEE NOTE 1)
	Schedule 40 galvanized steel	Galvanized cast or malleable iron	Flanged
	Type L copper	Wrought copper	Brazed
	Type L copper	Wrought or cast copper	Roll grooved mechanical type couplings
Non-potable water	Type L copper	Wrought or cast copper	No-lead solder
	Type L copper	Wrought or cast copper	Press fit

SERVICE	**PIPE MATERIALS**	**FITTINGS**	**CONNECTIONS**
Sanitary and sanitary vent (buried)	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Sanitary and sanitary vent	Service weight cast iron soil pipe	Cast iron hub and spigot	Neoprene compression type gasket
	Service weight cast iron soil pipe	No hub	No hub neoprene gasket and stainless steel clamp assembly
	Type DWV copper	Wrought copper	No-lead solder (SEE NOTE 4)
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 3)
Indirect waste	Type DWV copper	Wrought copper	No-lead solder
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 3)
LP Gas (Propane) (buried)	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
LP Gas (Propane) (exterior above grade)	Schedule 40, black steel	Butt welded steel, 2-1/2 in. and larger	Welded (SEE NOTE 2)
	Schedule 40, black steel	Malleable iron, 2 in. and smaller	Threaded (SEE NOTE 2)
LP Gas (Propane) (interior)	Schedule 40, black steel	Butt welded steel, 2-1/2 in. and larger	Welded (SEE NOTE 2)
	Schedule 40, black steel	Malleable iron, 2 in. and smaller	Threaded (SEE NOTE 2)
Compressed air (shop and industrial)	Schedule 40, black steel	Malleable iron, 3 in. and smaller	Threaded

NOTES FOR EXHIBIT A:

NOTE 1: Provide ductile iron, double thickness cement - lined pipe and fittings up to the water meter inlet valve in accordance with the New York State Plumbing Code and Municipal Water Bureau Requirements. Pipe and fittings shall be flanged.

NOTE 2: Provide one coat of alkyd primer and two coats of exterior acrylic latex gloss enamel on exposed exterior and interior piping. Color as selected.

NOTE 3: PVC piping shall not be installed within return air plenums.

NOTE 4: Copper piping shall not be used for urinal waste piping.

EXHIBIT "B" - TESTING

SERVICE	TEST REQUIREMENTS
Domestic water	Test hydrostatically at 150 PSI for two (2) hours or at 1.5 times the working pressure when working pressure exceeds 100 PSI
Sanitary, sanitary vent,	Maintain 10 ft. head of water for two (2) hours.
Indirect waste	Maintain 10 ft. head of water for two (2) hours.
LP gas (propane)	Refer to Section 227011 - "LP Gas System".
Compressed air (house, shop and industrial)	Test with clean air or nitrogen at a pressure of 175 PSI for 24 hours.

END OF SECTION 221010

SECTION 221020 UNDERGROUND PIPING AND ACCESSORIES

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 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents

1.3 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings new and marked with manufacturer's name, complying with applicable ASTM and ANSI Standards.

2.2 CAST IRON SOIL PIPE AND FITTINGS

A. Pipe: ASTM A74 service weight cast iron, bitumen coated, hub and spigot.

B. Fittings: Service weight cast iron, bitumen coated, hub and spigot, ASTM C564 service weight neoprene gasket of same manufacturer as piping.

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

2.3 COPPER PIPE AND FITTINGS

A. Pipe: ASTM B88, Type K, Soft Temper

B. Fittings: ANSI B16.22 wrought copper; ANSI B16.26 and ASTM B62 cast bronze; flared end connections.

2.4 DUCTILE IRON PIPE AND FITTINGS

A. Pipe: AWWA C151/ANSI A21.51, Class 51, ductile iron, mechanical type joints for short runs, otherwise use push-on type joints.

B. Fittings: AWWA C110/ANSI A21.51, ductile iron, 250-psi pressure rating (or) AWWA C153/ANSI A21.53 ductile iron compact fitting, 350 psi pressure rating. Joints shall be restrained, mechanical type for short runs, otherwise use push-on type.

C. Lining: Pipe and fittings shall have double thickness cement mortar lining with seal per AWWA C104/ANSI A21.4 on interior and asphaltic coating on outside.

D. Glands and Gaskets: AWWA C111/ANSI A21.11, ductile iron gland, rubber gasket joints, provide two bronze wedges for each joint of pipe.

E. Encasement: AWWA C105/ANSI A21.5, tubular polyethylene, minimum 8 mils thick.

2.5 PVC SOLID WALL PIPE AND FITTINGS - DWV SYSTEM

A. Pipe: PVC Schedule 40 solid wall pipe, iron pipe size conforming to ASTM D1785 and ASTM D2665. Pipe shall be manufactured from PVC compounds as identified in ASTM D1784. Both pipe and fittings shall conform to National Sanitation Foundation Standard 14.

B. Fittings: Type DWV, socket type conforming to ASTM D2665. Fittings shall be manufactured from PVC compounds as identified in ASTM D1784. Solvent cement joints shall be made utilizing a two-step process with primer manufactured for thermoplastic piping and solvent cement conforming to ASTM D2564.

2.6 POLYETHYLENE PIPE, TUBING, AND FITTINGS - LP GAS (PROPANE)

A. Pipe: High density polyethylene pipe and tubing, shall meet the requirements of ASTM D2513, and shall be recommended by the manufacturer for use with LP Gas systems.

B. Fittings: High density polyethylene fittings, shall meet the requirements of ASTM D2513, and shall be recommended by the manufacturer for use with LP Gas systems. Heat fusion joints, socket-type ASTM D2683, Heat fusion joints, butt-type, ASTM D3261 or Electrofusion joints, ASTM F1055.

2.7 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53 or ASTM A106 seamless, Schedule 40 or 80 weight; black or galvanized finish, factory coated.

B. Fittings: Same material and pressure class as adjoining pipe, black or galvanized finish, field coated and wrapped.

1. Welded Fittings: Factory forged, seamless construction, butt weld type, chamfered ends.
2. Threaded Fittings: Malleable iron.

2.8 CATHODIC PROTECTION FOR UNDERGROUND STEEL PIPING

A. Provide cathodic protection for underground steel piping and systems. The cathodic protection system shall provide a flow of direct current from sacrificial anodes to the outer surface of the piping.

B. Anodes shall be cast zinc or magnesium alloy anodes with 10 ft. long No. 12 Type TW lead wires silver soldered to a galvanized steel core. Anodes shall have sufficient number of lead wires to allow electrical connection form anode to each pipe. Anodes shall come packaged in a permeable cloth bag with prepared backfill consisting of 75% Gypsum, 20% Bentanite and 5% Sodium Sulphate. Wright of anode: 17 lbs. each.

C. Coating shall be Scotchkote or Scotchwrap.

D. Portable copper-sulfate reference electrode for testing effectiveness of cathodic protection system.

E. Test station shall be cast iron manhold, 12 in. diameter; OPW #104A-12.

F. Acceptable Manufacturers: Harco Corporation, International Metals, Corrco.

G. Provide the services of a Corrosion Engineer certified by the National Association of Corrosion Engineers. Submit their name and qualifications.

2.9 DETECTABLE TAPE

A. Detectable underground warning tape, 5 mil. polyethylene, 6 in. wide, aluminum backing, APWA approved background colors within permanent black lettering identifying service below.

B. Schedule:

1. Sanitary: Green color, "Caution Buried Sewer Line Below".
2. Storm: Green color, "Caution Buried Sewer Line Below".
3. Water: Blue color, "Caution Buried Water Line Below".
4. Gas: Yellow color, "Caution Buried Gas Line Below".
5. Electric: Red color, "Caution Buried Electric Line Below".

C. Acceptable Manufacturers: Seton, Terra Tape, Pro-Line Safety Products, Inc.

2.10 SCHEDULE OF PIPING MATERIALS

A. See Exhibit "A", Schedule of Piping Materials at end of this section for piping.

PART 3 - EXECUTION

3.1 TESTING

A. Sanitary:

1. Do not backfill over piping until required tests are completed and the Owner's Representative accepts the system.
2. There shall be no loss of water when testing interior piping inside the building foundation.
3. Air test not acceptable as final test.
4. Should any leaks, defective joints or defective construction be detected in sewers, floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fitting or accessories be discovered they shall be removed and replaced at the Contractor's expense.
5. Test exterior piping outside the building foundation in 100 ft. sections. The allowable rate of leakage per 24 hours per in. of diameter per 1,000 ft. of sewer tested shall not exceed 25 gallons. Piping shall be inspected and tested prior to backfill.
6. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test reports to Owner's Representative.

B. Domestic Water:

1. Do not backfill over piping until required tests are completed and the Owner's Representative accepts the system.
2. Make leaks tight; no caulking permitted. Replace defective fittings, pipe or connections. Piping shall be tight and show no loss of pressure.
3. Air test not acceptable as final test.
4. Confirm in writing that tests and flushing have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

C. Test exterior water and fire service piping outside the building foundation hydrostatically at 200 psi for two (2) hours. The amount of leakage shall not exceed two (2) quarts per hour per 100 gaskets or joints. Conform to NFPA 24.

3.2 DETECTABLE TAPE

A. Provide detectable tape directly over the buried pipe lines at a depth of 1 ft. - 0 in. below finished grade. Install tape over the continuous length of the pipe.

3.3 GAS PIPING

A. Refer to Section 227011, "LP Gas System".

3.4 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded piping fabricated by a certified welder. Use full length pipe where possible; minimum distance between welds, 18 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds shall be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

3.5 CATHODIC PROTECTION

A. Provide all electrical work, wiring fittings, anodes, bonding, thermite brazing and all other work and items required for a complete cathodic protection system.

B. Anodes shall be installed and backfilled in wet native soil, a minimum of 3 ft. from the pipe and below the center line of the pipe. Anode lead wires shall terminate on a test station lug with a lead wire thermite brazed to the pipe.

C. Wiring shall be buried 2 ft. below grade, with 6 in. minimum separation from other underground structures. Wiring shall be backfilled with material free from rocks and debris.

D. Splices and electrical connections shall be made with copper compression bolts and shall be made moistureproof. Electrical connections to the piping shall be made using the thermite weld process.

E. Thermite brazing techniques shall comply with the manufacturer's recommendations. Only proper size cartridges and welders will be permitted. Clean pipe to bright metal 3 sq. in. in area to be brazed. The brazed connection and pipe shall be coated with a cold applied coal tar compound.

F. Test leads shall be #12 AWG solid copper conductors with TW insulation and installed with thermite brazing. Terminate within test station at grade.

G. Electrical Isolation Fittings: Provide electrical isolating fittings at tank connection at building wall penetration.

H. Testing:

1. Testing shall be performed in accordance with accepted practices as recommended by National Association of Corrosion Engineers (NACE).
2. Test insulating fittings for electrical isolation.
3. Measure structure-to-soil potential at representative locations throughout the system.
4. Record anode current outputs at test stations.
5. Adjust the cathodic protection system to comply with the criteria for protection as given in NACE RP-01-69.

I. Corrosion Engineer's Duties:

1. Prior to construction, arrange for a Corrosion Engineer to perform soil resistively tests and determine list of materials for which shop drawings shall be submitted.
2. During construction to arrange for the Corrosion Engineer to supervise the installation.
3. After completion of construction, arrange for the Corrosion Engineer to make all adjustments of the system as required to assure proper operation. Test the system and submit a written report that includes all test data, analysis of the data, and instructions for operation, testing and maintenance of the system.

EXHIBIT "A" - PIPING MATERIALS (PLUMBING)
(Notes are at end of Exhibit "A")

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Water, Fire service	Ductile iron water main with cement lining	Ductile iron	Mechanical or push-on type
Sanitary	Service weight cast iron soil pipe	Cast iron, hub and spigot	Neoprene gasket compression type
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 4)
Sanitary vent	Service weight cast iron soil pipe	Cast iron, hub and spigot	Neoprene gasket compression type
LP Gas (Propane)	Schedule 40 steel, factory applied, corrosion protective coating	Butt welded steel	Welded (SEE NOTE 1)
	Polyethylene	Polyethylene	Heat fusion (socket, butt)

NOTES FOR EXHIBIT A:

NOTE 1: On buried coated steel pipe, tape all joints with Scotchwrap #50, 2 in. wide, 50% overlap. Provide cathodic protection system.

NOTE 2: Above ground vent piping shall be galvanized steel, Schedule 40; galvanized malleable iron fittings with threaded connections.

NOTE 3: Provide ductile iron, double thickness cement - lined pipe and fittings up to the water meter inlet valve in accordance with the New York State Plumbing Code and Municipal Water Bureau Requirements. Pipe and fittings shall be flanged.

NOTE 4: Schedule 40 PVC pipe may not be used when the temperature of the waste can exceed 140°F.

EXHIBIT "B" - TESTING

SERVICE	TEST REQUIREMENTS
Water service	Test hydrostatically at 150 PSI for two (2) hours.
Sanitary, sanitary vent	Maintain 10 ft. head of water for two (2) hours.
LG gas (propane)	Refer to Section 227011 - "LP Gas System".
Fire service	Test hydrostatically at 200 PSI or 50 PSI in excess of the system working pressure, whichever is greater for two (2) hours.

END OF SECTION 221020

SECTION 221100 WATER SUPPLY

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 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.3 QUALITY ASSURANCE

A. Follow all requirements, recommendations and appendices to comply with the following publications, codes, standards, and listings/approvals:

1. ANSI/AWWA C600: AWWA Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.
2. NFPA 24: Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
3. New York State Health Department.
4. Local municipality and fire department requirements and standards.
5. All items here-in used to convey water for potable use shall be lead free in accordance with NSF 61, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

1.4 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this Section.

PART 2 - PRODUCTS

2.1 WATER PIPING

A. Piping Materials: Refer to Specification Section 221010, "Piping Systems and Accessories" and Section 221020, "Underground Piping and Accessories".

2.2 BACKFLOW PREVENTERS AND ACCESSORIES

A. Reduced Pressure Type (Domestic Water - 2 in. and Smaller):

1. All bronze body construction, stainless steel bolts and internal parts, stainless steel check seats.
2. Four (4) test cocks, bronze strainer and full port ball valve shutoffs.
3. Design Equipment: Watts Series 009

4. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

B. Reduced Pressure Type (Domestic Water - 2-1/2 in. and Larger):

1. Stainless steel body, stainless steel bolts and internal parts, removable bronze seats, epoxy coated, bronze relief valve.
2. Four (4) test cocks, epoxy-coated strainer, OS&Y resilient wedge gate valves.
3. Design Equipment: Watts Series 957.
4. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

C. Reduced Pressure Detector Assembly Type (Fire Service):

1. Stainless steel body, stainless steel bolts and internal parts, removable bronze seats, epoxy coated, bronze relief valve.
2. Four (4) test cocks, OS&Y resilient wedge gate valves.
3. UL/FM listed and approved.
4. Same size as fire service.
5. Detector assembly consisting of an approved reduced pressure zone backflow preventer, approved water meter and shutoffs.
6. Design Equipment: Watts Series 957 RPDA.
7. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

D. Double Check Valve Type (Water/Fire Service - 3 in. and Larger):

1. Stainless steel body, stainless steel bolts and internal parts, removable bronze seats, epoxy coated.
2. Four (4) test cocks, OS&Y resilient wedge gate valves.
3. UL/FM listed and approved.
4. Same size as fire service.
5. Design Equipment: Watts Series LF757.
6. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

E. Double Check Detector Assembly Type (Fire Service - 3 in. and Larger):

1. Cast iron body, stainless steel bolts and internal parts, removable bronze seats, epoxy coated.
2. Four (4) test cocks, OS&Y resilient wedge gate valves.
3. UL/FM listed and approved.
4. Same size as fire service.
5. Detector assembly consisting of an approved double check valve backflow preventer, approved water meter and shutoffs.
6. Design Equipment: Watts Series LF757 DCDA.
7. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

F. Dual Check Type with Intermediate Atmospheric Vent (Coffee and Ice Machines):

1. Conforms to NSF Standard No. 25, stainless steel body, threaded end connections, rubber diaphragm, ball check, vent extended to drain.
2. Design Equipment: Watts #9BD.

3. Acceptable Manufacturers: Conbraco, Febco, Watts, Zurn.

G. Dual Check with Atmospheric Vent (Beverage Machines):

1. Conforms to ASSE 1022, stainless steel body, ANSI (NSF Standard 18 certified), wye pattern strainer, stainless steel springs, for continuous pressure, vent extended to drain.
2. Design Equipment: Watts #SD3.
3. Acceptable Manufacturers: Conbraco, Febco, Watts, Zurn.

H. Dual Check Type (Residential Domestic Water - 1 in. and smaller):

1. Conforms to ASSE Standard 1024, copper body with union ends, plastic check modules, silicone discs and BUNA-N seals, stainless steel springs, straight line flow.
2. Design Equipment: Watts Series #Cu7.
3. Acceptable Manufacturers: Conbraco, Febco, Watts, Zurn.

I. Detector Check Valve:

1. Weighted lever type, galvanized cast iron casing, trim kit with approved bypass meter, rising stem shutoff and check valve, UL listed, FM approved, and the entire assembly in accordance with the local Water Authority requirements.
2. Design Equipment: Hersey Products Model EDC III.

J. Terminal Valve:

1. Cast iron body with flapper valve, coated galvanized finish.
2. Design Equipment: J.R. Smith, Figure #7070.
3. Acceptable Manufacturers: J.R. Smith, Waterman.

2.3 VACUUM BREAKERS

A. Atmospheric Type:

1. Lead free brass body, silicone disc, ASSE 1001, threaded inlet and outlet connections, polished chrome for finished areas.
2. Design Equipment: Watts Series #LF288-A
3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

B. Hose Connection Type:

1. Brass body, stainless steel working parts, rubber diaphragm and disc, drainable, non removable feature, polished chrome for finished areas.
2. Design Equipment: Watts #8A.
3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

C. Pressure Type - Exterior use (Irrigation Systems):

1. Lead free bronze body, anti-siphon and pressure vacuum type, silicone rubber seat disc, replaceable seats, ball valve shutoffs on inlet and outlet, test connections.
2. Design Equipment: Watts #LF800M4QT.
3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

D. Pressure Type and Spill Resistant Type - Interior use:

1. Lead free bronze body, anti-siphon and spill resistant type, one-piece thermoplastic modular check and float assembly, stainless steel springs, ball valve shutoffs on inlet and outlet, test connection.
2. Design Equipment: Watts #LF008PCQT.
3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate work with all other trades and utility company.

B. Inspect pipe, fittings and equipment prior to installation. Remove all defective materials from the site.

C. Do not backfill until inspection by Owner's Representative.

D. Install pipe and equipment in accordance with manufacturer's recommendations and in a workmanlike manner as determined by the Owner's Representative.

3.2 WATER SERVICE

A. Install all piping on firm bed, using caution where piping passes over excavation. Provide concrete thrust blocks to support hydrant and prevent movement at all changes in direction of piping. Thrust blocks not required for Type K copper piping installation. Provide rods, clamps and retainer glands on all elbows and fittings in accordance with manufacturer's recommendations to prevent fitting from blowing off under line pressure. Coat all clamps, rods, nuts with two coats of bitumastic.

B. Minimum earth cover shall be 5 ft. - 0 in. unless otherwise noted.

C. Water mains crossing sanitary or storm sewers shall be installed to provide a minimum vertical distance of 1 ft. - 6 inches between the outside of the pipes where the water main is above or below the sewer. Locate the water pipe so that the crossing of the sewer occurs at the mid-section of a full length of pipe. The minimum horizontal separation between water mains and sewer mains shall be 10 ft. - 0 in. measured from the outside of the pipes. If separation or distance of joints from pipe crossing cannot be established, encase water piping in 6 in. concrete for a distance 10 ft. - 0 in. each side of crossing.

3.3 BACKFLOW PREVENTERS

A. The backflow preventer installation shall be installed in accordance to the Health Department approved drawings.

B. Prior to installation of backflow preventers, obtain the approved drawings from the Engineer.

C. Provide hub style drain for emergency relief drain with a pipe separation of at least two (2) pipe diameters from backflow preventer relief outlet.

3.4 PIPING

A. Run slightly off level to low points; provide drain valves at low points. Provide shock absorbers where shown, or specified. Branch headers serving flush valves shall be full size as shown. Exposed water piping in Kitchen shall be chrome plated brass (from insulation to fixture or equipment connection.). Provide dielectric pipe fittings when connecting to piping systems of dissimilar metals. All supply piping to fixtures, faucets, hydrants and flush valves shall be anchored to prevent movement.

B. Provide shock absorbers where flush valves and quick closing valves are used as specified in Section 223010.

3.5 CLEANING AND DISINFECTING

A. Refer to Specification Section 221010, "Piping Systems and Accessories" for domestic water piping cleaning and disinfecting requirements.

3.6 TESTS

A. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner.

B. Upon completion of construction, all backflow prevention devices provided under this contract shall be tested. Tests shall be performed by a certified backflow preventer tester registered by the New York State Department of Health. Provide three (3) copies of Form DOH-1013 for each device with Part A completed by the tester. Submit forms to Engineer. Pay all costs required for testing devices, including administrative costs associated with satisfying the requirements and regulations of Water Authority and Health Department. Repair or replace any device failing the test and repeat the test.

C. Test each vacuum breaker according to authorities having jurisdiction and the device's reference standard.

D. Refer to Specification Section 221010, "Piping Systems and Accessories" for pipe testing requirements.

END OF SECTION 221100

SECTION 221300 SANITARY, WASTE AND STORM DRAINAGE SYSTEMS

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 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.3 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 PLUMBING DRAINAGE SYSTEM

A. Piping Materials: Refer to Section 221010, "Piping Systems and Accessories" and 221020, "Underground Piping and Accessories" for piping materials.

2.2 HYDROFLUSHING

A. The hydroflushing equipment used for sewer cleaning shall be designed and constructed for sewer cleaning and be capable of removing sludge, grease, dirt and other foreign materials. It shall consist of, but not be limited to, booster pump, high pressure hose, water spray jet, cutting nozzles and all accessories required to complete the work.

2.3 TELEVISION INSPECTION

A. The television camera used for inspection shall be designed and constructed for sewer inspection and shall be sufficient to allow a clear, visible picture. It shall consist of, but not be limited to, camera, TV monitor, videotape equipment and all accessories required to complete the work.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to commencing work, the Contractor shall verify inverts and locations. Any discrepancy between plans and field conditions shall be reported to the Owner or Engineer. No work shall start until discrepancies have been resolved. All costs related to Contractor's failure to verify and report discrepancies will be borne by the Contractor.

B. Install pipe and equipment in accordance with manufacturer's recommendations and in a workmanlike manner as determined by the Owner's Representative.

3.2 PIPE INSTALLATION

A. Minimum Pitch: 2-1/2 in. and under - 1/4 in. per ft.; 3 in. to 6 in. - 1/8 in. per ft; 8 in. and larger - 1/16 in. per ft.

B. All underground sanitary piping shall be a minimum of 3 inch size.

C. Urinal Waste: Copper is not allowed.

D. In all finished spaces, paint exposed waste piping 2 in. and over with chromium paint.

E. Slope piping as indicated on drawing; verify inverts given. Inspect piping before installation to detect apparent defects. Remove defective piping from site. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert. Install piping and gaskets in accordance with manufacturer's recommendations and other special installation requirements. Clean interior of piping of dirt and other foreign material as work progresses. Place plugs in ends of pipe at end of day or whenever work stops. Flush lines if required to remove collected debris.

F. Inspect piping to determine whether line displacement or other damage has occurred. Make inspections after lines have been installed and approximately 2 ft. of backfill is in place, and again at completion of project. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects, and reinspect.

3.3 HYDROFLUSHING

A. Upon completion of the project, mechanically auger and hydroflush clean all new buried sanitary, waste and storm drainage piping 4 in. and larger. Use cutting nozzles when applicable. Do not mechanically auger or use cutting nozzles when piping is clay tile or plastic piping.

B. Hydroflush piping utilizing full length of jet hose. Thoroughly flush all piping for 30 minutes upon completion of hydroflushing. Piping shall be clean.

C. Field check existing piping layout prior to commencement of cleaning operations. Take all precautions to prevent water leaks within the buildings.

D. Determine the existing sewer materials prior to cleaning. Should pipe be any material other than cast iron, do not proceed. Notify Owner's Representative.

E. All hydroflushing of drain lines shall be performed against the direction of flow of the waste water, unless otherwise noted.

F. Restore all areas disturbed to match existing.

G. The cleaning and flushing services shall be performed by one approved service firm.

3.4 TELEVISION INSPECTION

A. After completion of hydroflushing, furnish all labor, materials and equipment necessary to provide television inspection of all hydroflushed piping.

B. Provide a digital video copy accompanied with a written report and drawings locating all sources of infiltration, blockages and obstructions, broken pipe, collapsed pipe, misalignments, pipe sags and unusual conditions observed. The digital video copy and report shall be cross-referenced. Provide a copy of each to the Owner's Representative.

3.5 TESTING

A. Refer to Specification Section 221010, "Piping Systems and Accessories" for pipe testing requirements.

END OF SECTION 221300

SECTION 223010 EQUIPMENT

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 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.3 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

A. Drain Description: All Floor Drains Type A unless otherwise noted.

1. Type A: Cast iron body, flashing collar with weepholes, nickel bronze, 7 in. diameter adjustable strainer; Jay R. Smith Figure #2010-A.

2. Type B: Cast iron body, flashing collar with weepholes, nickel bronze 7 in. diameter adjustable strainer with separate oval funnel; Jay R. Smith Figure #2010-A with #3590 funnel.

3. Type E: Cast iron body, flashing collar with weepholes, 8 in. diameter cast iron grate medium duty, removable sediment bucket; Jay R. Smith Figure #2110.

B. Where floor drains are not installed in slabs on grade, provide flashing collar and flash with 24 in. square four (4) pound lead flashing or equal.

C. Make: Josam, Jay R. Smith, Wade, Watts or Zurn.

2.2 CLEANOUTS

A. Floors: Cast iron body, nickel-bronze top with adjustable feature, bronze plug and flashing clamp where required, carpet marker and tile cover where applicable; Jay R. Smith Series #4028.

B. Walls: Cast iron ferrule, with bronze plug and stainless steel smooth access cover.

1. Horizontal: Jay R. Smith Figure #4402.
2. Vertical: Jay R. Smith Figure #4531.

C. Yard Cleanout:

1. Cast iron body, adjustable round heavy duty top, with tractor cover, vandal proof screws and bronze plug; Jay R. Smith Figure #4246.

D. Make: Josam, Jay R. Smith, Wade, Watts or Zurn.

2.3 WALL HYDRANTS

A. Exposed type hose connection, lead-free, solder connection, nickel bronze face, quarter turn valve, nonfreeze type, 3/4 in. hose connection, self draining, integral vacuum breaker with vandal resistant cap, loose key control and wall clamp; Jay R. Smith Figure #5609QT.

B. Recessed box type hose connection, quarter turn valve, nonfreeze type, 3/4 in. hose connection, self draining, integral vacuum breaker with vandal resistant cap, loose key control, wall clamp and stainless steel box with nickel bronze face; Jay R. Smith Figure #5509QT.

C. Make: Jay R. Smith, Prier, Watts, Woodford or Zurn.

2.4 HOSE BIBBS (INTERIOR)

A. Inside sill faucet, vacuum breaker, lead-free, solder connection, 3/4 in. hose thread outlet, lock shield cap, loose key control, flanged female inlet, polished chrome plate finish for finished rooms, rough chromium for unfinished rooms.

B. Make: Woodford Model 84, Prier, Chicago Faucets or Acorn in finished room; Chicago Faucets #998 in Mechanical Rooms, Boiler Room, Penthouse, or other unfinished rooms.

2.5 SHOCK ABSORBERS

A. Hydropneumatically controlled with permanently sealed expansion chamber pre-charged with non-combustible gas; lead-free, threaded connection, meets or exceeds Plumbing and Drainage Institute Standard PDI WH-201 and ASSE Standard 1010.

1. Bellows Type: Stainless steel construction with stainless steel bellows.
2. Piston Type: Hard drawn copper body with brass piston, cap and adapter, and elastomer seals.

B. Elastomer or rubber compound type bellows not allowed.

C. Make: Watts #LF15M2, Precision Plumbing Products, Jay R. Smith, or Zurn.

2.6 TRAP PRIMERS

A. Fully automatic, bronze body with vacuum breaker, actuated by drop in system water pressure, UPC listed, ASSE Standard No. 1018.

B. Trap primer and distribution piping (1/2 in. Type L Copper) shall be provided for each new floor drain unless otherwise noted.

C. Make: Precision Plumbing Products, Inc. Model P-1, Jay R. Smith, Watts or Zurn.

2.7 TRAP GUARDS

A. Elastomeric, normally closed seal to prevent evaporation of P-traps. Inserts into throat of floor drain. Provide for each new floor drain.

B. Make: ProVent Systems, Inc. "ProSet Trap Guard".

2.8 WATER PRESSURE GAUGES

A. Construction to be Bourdon tube type; 4-1/2 in. diameter, minimum dial face, stamped stainless steel, replaceable glass lens, with snap-on rings. Phosphor bronze tube, bronze bushed rotary movement, silver brazed or soldered to brass socket and brass tip, 1/4 in. bottom connection. Accuracy, on (1.0) percent of included scale range. White dial face with black numerals, graduated in pounds; equipped with bronze pulsation dampener or snubber and needle valve.

B. Make: Trerice, Weiss, Weksler, Winters.

2.9 PIPING SYSTEM THERMOMETERS

A. Industrial type, plastic, aluminum or steel case, glass or plastic front, non-toxic organic liquid filled, red reading column, white or silver V-shaped scale, black numerals. Union flange mounted, separable socket with thermowell, extension necks were required; range as called for service. Universal adjustable type, 9 in. scale. For installation in water systems where the maximum temperature is less than 120°F, graduations of 1°F, accurate to within 1/2°F. For installation greater than 120°F, graduations of 2°F, accurate to within 1°F.

B. Make: Trerice, Weiss, Weksler, Winters.

2.10 TEMPERATURE MIXING VALVE ASSE 1017

A. Valve shall mix 140°F hot water with 40°F cold water to obtain a water outlet temperature of 120°F. The valve shall consist of the following:

1. Single thermostatic mixing valve with 1 in. inlets and 1 in. outlet. Flow capacity of 2.5 gpm at 5 psi pressure drop, and 16 gpm at 20 psi pressure drop.
2. Combination strainer check stops with union at each inlet, union on outlet, tamper resistant temperature adjustment control.
3. Provide valves on hot, cold and tempered water piping with fittings, nipples, trim piping and escutcheon plates. Horizontal stem dial thermometers on hot, cold and tempered water piping.
4. Rough bronze lead free mixing valve and trim exposed on wall.

B. Make: Watts Series LF1170, Powers, Leonard, or Symmons.

PART 3 - EXECUTION

3.1 EQUIPMENT CONNECTIONS

A. Plumbing Contractor shall:

1. Provide all roughing and final water, waste, vent, gas, and/or air connections to all equipment requiring same as called for on Contract Documents.
2. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
3. Provide loose key stops, "P" traps, tailpieces, adapters, gas or air cocks and all necessary piping and fittings from roughing point to equipment.
4. Provide for installation of sinks, faucets, traps, tailpieces provided by an Equipment Contractor. These items to be delivered, in easily identified cartons, to the proper room for Contractor's installation.
5. Install controls and devices furnished by others.
6. Provide cold water line with gate valve and backflow prevention device at locations called for. Continuation and connection to equipment by others.
7. Install relief valve discharge piping from equipment relief valves.
8. Provide for Owner furnished equipment:

    a. Connect complete and ready for use, including all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, etc., as required by Owner.
    b. Refer to manufacturer Drawings and Specifications for requirements of special equipment. Verify connection requirements before bidding.

3.2 CLEANOUTS

A. Install cleanouts out of traffic patterns and flush to floor. Provide offset from sanitary line served. Do not locate under doors or under lockers. Maintain distance between cleanouts on piping 4 in. and smaller, 50 ft.; over 4 in., 100 ft. At changes in direction greater than 45°. Install at base of soil, waste, vent, stacks and roof conductors and where called for.

B. Cleanouts: Same nominal size as pipe, but not larger than 4 in.

3.3 WALL HYDRANTS

A. Install minimum 24 in. above grade.

3.4 HOSE BIBBS

A. Install at low points of piping system.

3.5 SHOCK ABSORBERS

A. Install in vertical position.

3.6 THERMOMETERS

A. Provide on piping system where called for and shown, with thermometer well at each location, mounted in oversize tee or elbow to provide as little restriction as possible to fluid flow, stems or proper length to allow accurate reading. Arrange to be easily read from floor.

B. Select range such that the maximum system working temperature is in the middle one-third of the scale.

3.7 PRESSURE GAUGES

A. Provide in piping system where called for and shown, with needle valve and pulsation damper or snubber at each location. Arrange to be easily read from the floor.

B. Select range such that the maximum system working temperature is in the middle one-third of the scale.

3.8 TEMPERATURE MIXING VALVE

A. Provide where called for. Provide 2 ft. - 0 in. deep heat trap on hot water supply line ahead of connection to mixing valve.

B. Provide factory-trained technician to start up, adjust and inspect the mixing valve and piping for correct installation and temperature adjustment.

3.9 TRAP PRIMER

A. Install in nearest cold water supply line that contains a flush valve.

B. Provide 1/2 in. piping from trap primer to floor drain. Make final connection.

END OF SECTION 223010

SECTION 223400 WATER HEATERS

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 SCOPE OF WORK

A. Work of this section shall be performed in accordance with the requirements of the Contract Documents, including but not limited to Instructions to Bidders, Agreement and General Conditions, General Requirements and Basic Mechanical/Electrical Requirements.

B. Provide labor, materials, equipment and services to perform work and related work required by Contract Documents for a complete operating system.

1.3 SUBMITTALS

A. Submit manufacturer's data for approval in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all products to be installed including, but not limited to:

1. Water Heater.
2. Tank Protective Valves.
3. Expansion Tank.
4. All Heater and Tank Accessories.
5. All System Wiring Diagrams.
6. Tank Lining.

1.4 SPECIAL COORDINATION

A. Coordinate all work of other trades.

B. Furnish Division 26 "Electric" with dimensional drawings showing location of electrical connections, location of equipment mounted on walls, and of other equipment requiring electrical connections, removals or replacements.

PART 2 - PRODUCTS

2.1 WATER HEATER - ELECTRIC, TANK TYPE

A. 20 gallon, glass lined 150 PSI Non-ASME certified and stamped storage tank with individually fused elements per NEC. Total kW to be 3 at 208 volts, single phase with recovery of 12 gph at 100°F rise. Three (3) year commercial warranty.

B. Provide high temperature limit, operating temperature control and magnesium anode rods, insulation to meet current energy codes.

C. Provide temperature and pressure relief valve, ASME stamped and rated for full heating capacity. Pipe relief to drain.

D. Provide low water cut off.

E. Design Equipment: Lochinvar Model EJJ020GS.

F. Acceptable Manufacturers: A.O. Smith, State or approved equal.

G. Provide Holdrite #30-SWHP-WM galvanized steel wall mounted equipment platform including all necessary brackets and supports for mounting of each water heater.

2.2 THERMAL EXPANSION TANK

A. Vertical steel expansion tank constructed and designed per ASME Code Section VIII, 150 PSI working pressure, steel outer shell, rigid polypropylene liner, heavy duty butyl rubber diaphragm and non-ferrous system connection tapping, suitable for potable hot water, factory pre-charged at 55 PSI. Tank will have a 8 in. diameter and a height of 14 in. with a 2.0 gallon total volume and 0.80 maximum acceptance factors. The manufacturer will be similar to Model ST-5C-DD by Amtrol, Wessel or approved equal.

B. Design Equipment: Watts.

C. Acceptable Manufacturers: Amtrol, Watts, Wessel or approved equal.

2.3 TANK PROTECTIVE VALVES

A. Pressure Relief Valves:

1. ASME stamped and rated.
2. Open at 125 lbs. pressure sized for full heating capacity.
3. Make: Bell & Gossett, Kunkle, Watts or approved equal.

B. Temperature and Pressure Relief Valve:

1. ASME stamped and rated (for steam or hot water).
2. Size for full heat input.
3. Complying with Federal Spec. MIL-V-13612C.

4. Valve shall be sized and selected by manufacturer for tank and heater installed.
5. Make: Camco, Cash-Acme, Watts, or approved equal.

PART 3 - EXECUTION

3.1 WATER HEATERS

A. Install each heater on wall mounted steel platform.

B. Pipe pressure and temperature relief valve drain to discharge to nearest floor drain.

C. Provide all electric wiring and equipment in accordance with manufacturer's wiring diagrams and instructions. Make all final connections.

D. Provide all piping, valves and fittings in accordance with manufacturer's piping instructions. Make all final connections.

E. Provide equipment in accordance with contract drawings and all local codes.

F. Provide start-up services of a factory trained technician to inspect the installation based on factory recommendations. Items include but are not limited to:

1. Verification of proper piping arrangement.
2. Verification of proper temperature rise across heater(s).
3. Operating and safety controls.
4. Proper operation of equipment.
5. Verification of piping arrangement.
6. All control settings.

G. Submit three (3) copies of startup reports in writing with all factory checkout data signed by the factory authorized service agent to the Owner's Representative.

H. Place equipment in operation.

I. The installation of water heaters shall be based on the details shown on the drawings and specified in this Section. Approved water heaters provided other than type shown or specified shall be installed in accordance with manufacturer's recommended installation instructions and piping diagrams.

END OF SECTION 223400

SECTION 224000 PLUMBING FIXTURES AND TRIM

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 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.3 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 - Products of this section.

1.4 DESCRIPTION OF FIXTURES

A. Fixtures and trim shall be of those manufacturers listed, unless otherwise indicated. Fixtures for this project shall be of same manufacturer.

1. Fixtures: American Standard, Kohler, Mansfield, Sloan, Toto, Watts or Zurn.
2. Faucets: Chicago Faucets, Delta, Moen, Symmons, T&S Brass or Zurn. All faucets shall be lead-free in accordance with NSF 61 and NSF 372.
3. Flushometers: Sloan "Regal XL" or Zurn.
4. Closet Seats: Bemis, Beneke, Church or Olsonite.
5. Fixture Carriers: Jay R. Smith, Watts, Wade, Josam or Zurn.
6. Sinks: Elkay, Just or Kohler.
7. Water Coolers: Elkay, Halsey Taylor or Haws.
8. Supplies, Stops and Traps: Brasscraft, EBC, McGuire or Sanitary Dash.

B. Exposed parts of trim shall have polished chrome plated finish.

C. Tubular drainage products ("P" traps, nipples, etc.) shall be 17 gauge brass.

1.5 QUALITY ASSURANCE

A. Comply with requirements of the Plumbing Fixture Law of the New York State Department of Environmental Conservation.

B. Comply with the American Disabilities Act Guidelines and ANSI A117.1 "Accessible and Usable Buildings and Facilities".

C. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard 61, Section 9 Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third-party testing and certification.

D. All fixture trim used to convey water for potable use shall be lead free.

PART 2 - PRODUCTS

2.1 WATER CLOSETS

A. WC-A:

1. American Standard #2257.103 Afwall, wall hung, vitreous china, siphon jet, elongated bowl, 1.6 GPF, fully glazed 2 in. ball pass trapway, with 1-1/2 in. top spud, fitted with following:

   a. FV-A flush valve as specified herein.
   b. Church #9500SSC, extra heavy weight, white elongated solid plastic, open front closet seat with combination self-sustaining check hinges, less cover.
   c. Jay R. Smith Series 200 closet fittings and carrier.

B. WC-B (HDCP):

1. American Standard #2257.103 Afwall, wall hung, vitreous china, siphon jet, elongated bowl, 1.6 GPF, fully glazed 2 in. ball pass trapway, with 1-1/2 in. top spud, fitted with following:

   a. FV-A flush valve as specified herein.
   b. Church #9500SSC, extra heavy weight, white elongated solid plastic, open front closet seat with combination self-sustaining check hinges, less cover.
   c. Jay R. Smith Series 200 closet fittings and carrier.
   d. Mount at ADA required height and location or as shown on Architectural drawings.

2.2 URINALS

A. UR-A:

1. American Standard #6590.125 Washbrook 0.125 GPF, wall hung, vitreous china, washout urinal with extended shields, stainless steel strainer, outlet connection threaded 2 in. female, 3/4 in. top spud, fitted with following:

   a. FV-F flush valve as specified herein.
   b. Jay R. Smith Series 637 carrier with rectangular uprights, bearing and base plates.

B. UR-B (HDCP):

1. American Standard #6590.125 Washbrook 0.125 GPFwall hung, vitreous china, washout urinal with extended shields, stainless steel strainer, outlet connection threaded 2 in. female, 3/4 in. top spud, fitted with following:

   a. FV-F flush valve as specified herein.
   b. Jay R. Smith Series 637 carrier with rectangular uprights, bearing and base plates.
   c. Mount at ADA required height and location or as shown on Architectural drawings.

2.3 FLUSH VALVES

A. FV-A: Sloan Regal #111-1.28 GPF manually operated, closet flushometer, exposed diaphragm type, 1 in. screwdriver angle stop with vandal resistant cap, bumper on stop, vacuum breaker, adjustable tailpiece, sweat solder adaptor kit, cast wall flange with set screw and ADA compliant handle.

B. FV-F: Sloan #186-0.125 GPF manually operated, urinal flushometer, exposed diaphragm type, 3/4 in. screwdriver angle stop with vandal resistant cap, vacuum breaker, adjustable tailpiece, sweat-solder adaptor kit, cast wall flange with set screw and ADA compliant handle.

2.4 LAVATORIES

A. LAV-A:

1. American Standard #0497.221, 21-1/2 in. x 17 in. oval, undermount, vitreous china lavatory with front overflow fitted with the following:

   a. F-A faucet as specified herein.
   b. McGuire #155-A chrome plated PO plug with open grid strainer and 1-1/4 in., 17 gauge tailpiece.
   c. McGuire #8902 chrome plated, 17 gauge, 1-1/4 in. x 1-1/2 in. "P" trap with cleanout plug and cast brass escutcheon with set screw.
   d. McGuire # LF165LKF, lead-free, 3/8 in. chrome plated wall supplies with loose key angle stops. 12 in. long flexible risers, and cast brass escutcheon with set screws.

B. LAV-B (HDCP):

1. American Standard #0497.221, 21-1/2 in. x 17 in. oval, undermount, vitreous china lavatory with front overflow, fitted with the following:

   a. F-A faucet as specified herein.
   b. McGuire #155WC offset chrome plated P.O. plug with open grid strainer and 1-1/4 in., 17 gauge offset tailpiece.

c. McGuire #8902 chrome plated, 17 gauge, 1-1/4 in. x 1-1/2 in. "P" trap with cleanout plug and cast brass escutcheon with set screw.
d. McGuire # LF165LKF, lead-free, 3/8 in. chrome plated wall supplies with loose key angle stops, 12 in. long flexible risers and cast brass escutcheons with set screws.
e. Cover exposed waste, stops and supply piping with ADA conforming pipe covers, Truebro, Inc. "Lav-Guard".

2.5 SINKS

A. SK-A (HDCP):

1. Elkay Crosstown ECTSRAD25226TBG0, 25 in. x 22 in. x 6 in. deep, type 304 stainless steel single bowl sink, ADA compliant, 18 gauge, undermount, fitted with the following:

a. F-O faucet as specified herein.
b. Elkay #LKAD35 strainer with removable cup, LKADOS 1-1/2 in. O.D. offset tailpiece.
c. McGuire #8912 semi-cast brass adjustable "P" trap, 1-1/2 in. x 1-1/2 in., with cleanout plug and cast brass escutcheon with set screw.
d. McGuire #LF2167LKF, lead-free, 1/2 in. copper sweat supplies with 1/2 in. OD flexible risers, loose key stops and cast brass escutcheons with set screws.

2.6 FAUCETS

A. F-A:

1. American Standard Monterrey #6114.111.002 single control centerset faucet, cast brass body, deck mounted, 4 in. centers, 1.5 GPM pressure compensating aerator, lead-free, and fitted with the following:

a. Powers #LFe480, lead-free, tempering valve, 3/8 in. rough chrome finish.

B. F-O:

1. Chicago #431ABCP, single lever washerless sink faucet, integral 9-1/2 in. cast brass swing spout, temperature limiter, deck mounted, 8 in. centers, lead-free, ADA compliant and fitted with the following:

a. 2.0 GPM aerator.
b. ADA compliant.

2.7 SERVICE SINK

A. SS-A:

1. Elkay Dependabuilt #1C18X18-0X, 23 in. x 23-13/16 in. x 44-3/4 in., 16 gauge one compartment sink with 12 in. deep compartment, 300 series stainless steel, 12 in. high backsplash punched for one (1) set of 8 in. on center faucet holes, 3/4" radius coved corners, four stainless steel tubular legs with adjustable bullet shaped feet and fitted with the following.

    a. T&S Brass #B-0230/B-0407-03 back mounted, chrome plated 8 in. centerset faucet with 8-5/8 in. swivel vacuum breaker gooseneck spout, 4 in wrist blade handles and outlet with stream regulator.
    b. Elkay No. LK-25-RT stainless steel grid strainer for 3-1/2 in. opening with 3 in. perforated grid strainer and stainless steel 2 in. tailpiece with lever handle.
    c. McGuire No. 8904, 2 in. x 2 in. chrome plated cast brass, adjustable 17 gauge "P" trap with cleanout plug, tubing outlet and cast brass setscrew escutcheon.
    d. McGuire #LF2167LK, lead free, 1/2 in. chrome plated angle supplies with 1/2 in. flexible risers, loose key stops and cast brass setscrew escutcheons.

2.8 MOP BASINS

A. MB-A:

1. Fiat Model TSBC6011, terrazzo, corner shaped 32 in. x 32 in. x 12 in. deep, stainless steel flat strainer, 3 in. outlet, stainless steel cap on all sides, color as selected by the Architect, with the following:

    a. T&S Brass #B-0665-BSTP, lead-free, exposed wall mounted faucet with integral stops, rough chrome finish, lever handles, top-brace spout with bucket hook, hose end and vacuum breaker.
    b. Fiat # 832AA Hose and Hose Bracket.
    c. Fiat #889CC Mop Hanger.
    d. Fiat # E77AA Vinyl Bumper guard on exposed sides.
    e. Fiat #MSG 3232 Stainless Steel Wall Guard.
    f. Provide silicone sealant between wall, floor and mop basin.

2.9 ELECTRIC WATER COOLER

A. EWC-A:

1. Elkay #EZSTL8C two level wheelchair access model, wall mounted, ADA compliant, lead-free construction, type 304 stainless steel cabinet, one piece stainless steel basin, flexible bubbler, self-closing front and side push bar control on each side with in-line stream regulator, adjustable temperature control, permanently sealed and lubricated fan motor, hermetically sealed compressor and

motor, 1/5 hp, 120V, capacity of 8.0 GPH at 80°F inlet water, 50°F outlet water with room temperature of 90°F, with optional #LKAPREZL apron, fitted with the following:

a. McGuire #LF165LKE, lead-free, 3/8 in. lavatory wall supply with loose key angle stop, 3/8 in. flexible tube riser, cast brass escutcheon with set screw.
b. McGuire #8902, 1-1/4 in. x 1-1/2 in. semi-cast brass "P" trap with cleanout and cast brass escutcheon with set screw.
c. Jay R. Smith floor mounted carrier with rectangular uprights.
d. Acceptable Manufacturers: Elkay, Halsey Taylor.

PART 3 - EXECUTION

3.1 FIXTURES, EQUIPMENT AND SYSTEMS

A. Install fixtures, equipment and systems as shown on Drawings or specified herein in accordance with provisions of each applicable Specification Section and all local and state codes having jurisdiction.

3.2 INSTALLATION OF PLUMBING FIXTURES

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers written installation instructions.

B. Carefully drill holes for through bolts to avoid chipping blocks or plaster.

C. Except where carriers are specified, attach hangers or brackets to walls as follows:

1. Masonry Construction: Secure fixture hangers to partition by thru-bolts extending through a steel plate on opposite side of partition. Obtain Owner's Representative's approval prior to work.
2. Metal Stud Construction: Anchor backing for fixtures or equipment to 1/8 in. x 12 in. steel plate bolted or riveted to at least three studs. Obtain Owner's Representative's approval prior to work.

D. Anchor carriers to concrete floor with 1/2 in. x 3 in. anchor or thru-bolts and washers. Provide for drilling of floor and installation of expansion shields. Quantity of anchors:

1. Water Closets - Four (4).
2. Lavatories - Eight (8).
3. Urinals - Eight (8).

E. Seal fixtures in contact with walls, floors and counters using a sanitary-type, one-part, mildew-resistant, silicone caulk. Match color to fixture color.

F. Set self-rimming lavatories and sinks in a bed of silicone caulk.

G. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.

H. Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gage.

I. Install wall-hanging, back-outlet urinals with gasket seals.

J. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified and to building wall construction where no support is indicated.

K. Fasten counter-mounting-type plumbing fixtures to casework.

L. Metering faucets shall be adjusted for minimum ten (10) second run time, but not more than 0.25 gallons per cycle.

M. Immediately after installation, provide protective covering over fixtures and trim.

3.3 MOUNTING HEIGHT AND LOCATION

A. Mount fixtures at height and location as indicated on Architectural plans and elevations.

B. Mount accessible fixtures in conformance with the requirements of ANSI A117.1.

3.4 CONNECTIONS

A. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 22.

3.5 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings and controls.

B. Adjust water pressure at electric water coolers, faucets and flush valves to provide proper flow and stream.

C. Replace washers of leaking and dripping faucets and stops.

D. Clean fixtures, fittings, spout and drain strainers with manufacturers' recommended cleaning methods and materials.

E. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components and retest. Repeat procedure until all units operate properly.

END OF SECTION 224000

SECTION 227011 LP GAS SYSTEM

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 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related work as required in Contract Documents.

B. The Owner shall provide the propane tank and tank accessories.

1.3 SUBMITTALS

A. Submit manufacturer's data for approval in accordance with Basic Mechanical/Electrical Requirements and Division 01. Obtain approval prior to ordering material.

B. Provide submittals for all products specified under Part 2 of this section. Additionally, provide the following:

1. Sieve analysis of backfill.
2. Tank calibration charts.
3. Tank manufacturer's training certificate.
4. Tank and pipe manufacturer's installation checklist.
5. Tank warranty.
6. Piping.
7. Valves.
8. Flexible connectors.
9. Locator tape.
10. Record photographs.
11. Record drawings.
12. Test results.

1.4 QUALITY ASSURANCE

A. Follow all requirements, recommended and appendices to comply with the latest edition of the following publications, codes, standards and listings/approvals:

1. New York State code referenced edition of NFPA Standard 58: Liquefied Petroleum Gas Code.
2. 2020 Fuel Gas Code of New York State.
3. 2020 Fire Code of New York State.
4. Tank shall comply with ASME, U.S. Department of Transportation, and local authority.

5. This contractor, including the installation foreman shall have not less than four (4) years continuous experience in the installation of fuel storage systems. They shall be fully qualified for fuel tank installations by the tank manufacturer and shall have attended the manufacturer's training seminar within the past two (2) years. Contractors shall be certified for propane installations.

1.5 SYSTEM PRESSURE

A. The propane service shall distribute at a pressure of 11 in. w.c.

PART 2 - PRODUCTS

2.1 PIPING

A. Piping Materials: Refer to Specification Section 221010 "Piping Systems and Accessories" and Section 221020 "Underground Piping".

2.2 VALVES

A. Refer to Specification Section 220523 "Valves".

2.3 LOCATOR TAPE

A. Yellow plastic tape, intended for direct-burial service, not less than 6 in. wide x 4 mils thick with #12 AWG coated stranded copper wire tracer. Lettering on the tape shall state gas main is below.

B. Make: Calpico, Griffolyn, Terra Tape or approved equal.

2.4 FUEL TANK - ABOVEGROUND

A. Tank shall be capable of storing liquid petroleum gas.

B. Tank shall be ASME stamped or stamped in accordance with the U.S. Department of Transportation. Tanks shall be primed and painted.

C. The maximum service pressure of ASME tanks shall be in accordance with NFPA 58.

D. Service openings shall be provided in the tank or through a manhole cover.

E. Aboveground tanks shall be permanently mounted to a concrete pad with steel supports.

F. Tank shall be marked with the following:

1. Water capacity in pounds.
2. Aboveground or underground.
3. Name and address of tank supplier.
4. Design pressure in psi.
5. Year of manufacture.

6. Outside surface area in square feet.
7. Shell and head thickness.
8. Manufacturer's serial number.
9. ASME code symbol.

G. Tank Accessories:

1. Shall be provided in accordance with manufacturer's recommendations.
2. Shall have a rated working pressure of at least 250 psig.
3. Pressure relief valves.
4. Container shutoff valves.
5. Backflow check valves.
6. Internal valves.
7. Excess flow check valves.
8. Liquid level gauges.
9. Plugs.
10. Regulators.

2.5 FLEXIBLE PIPING CONNECTORS

A. LP Gas: UL listed for above and below ground use, all stainless steel construction, Type 321 stainless steel corrugated metal hose with a Type 304 stainless steel wire braid, maximum rated working pressure of 350 psi, 30 inch length; Amnet, Inc. "Flexpipe" or approved equal.

2.6 EARTHWORK

A. Refer to specification Section 220580 - Excavation and Backfill.

B. Excavation and backfill part of Division 2 work.

2.7 CONCRETE

A. Concrete work part of Division 31 contract.

PART 3 - EXECUTION

3.1 GENERAL

A. Tanks shall be located with respect to buildings, public ways, and lot lines in accordance with the 2020 Fire Code of New York State.

B. Maintain a minimum of 10 ft clear from tank to combustible materials, weeds, grass, and trash.

3.2 ABOVEGROUND FUEL TANK INSTALLATION

A. Installation shall be in accordance with manufacturer's written instructions and as noted.

B. Provide all strapping, concrete and masonry work, cutting and patching for complete installation, in accordance with this section.

C. Steel straps shall be anchored to concrete pad. Steel supports shall be provided in accordance with NFPA 58. Paint straps, rods and other exposed metal surfaces.

3.3 IDENTIFICATION

A. Install continuous plastic underground warning tape identification during backfilling of excavations for fuel storage tanks and trenches for fuel piping and electrical conduit. Locate tape 6 in. to 8 in. below finished grade, directly over piping, conduit and edges of each storage tank.

3.4 INSTALLATION CHECKLISTS AND WARRANTY CARDS

A. Provide Owner's Representative with the tank and piping manufacturer's installation checklist and warranty cards.

B. Fill out and sign upon completion of tank installation.

3.5 PIPING AND ACCESSORIES

A. Provide piping from fuel tank to building appliances and equipment.

B. Provide a minimum of 18 in. of cover above underground piping.

C. Provide valves, mains, risers, drops, drip legs as required.

D. Provide shut-off at building and at tank.

E. Furnish sleeve and sealing element for above ground entry through outside wall. Make entry gas and watertight.

F. Install gas piping at a uniform grade of 1/4 in. in 15 feet to prevent traps. Horizontal lines shall slope upward to risers or to the equipment.

G. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down. Connect branch piping from top or side of horizontal piping.

H. Install unions in pipes 2 in. and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

I. Install valve and strainer on the supply side of each gas pressure regulator.

J. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing elbow fittings with corrosion-resistant insect screens in large end.

K. Install containment conduits for buried gas piping within building in gas-tight conduits extending 12 in. minimum outside building and vented to atmosphere. Terminate vents with turned-down, reducing elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal tar epoxy.

L. Install gas piping next to gas-utilizing equipment and appliances to allow servicing and maintenance. Connect gas piping to gas-utilizing equipment and appliances with shutoff valves and unions. Make connections to equipment downstream of valves and unions with flexible connectors where indicated. Valves, unions and flexible connectors shall be same size as the gas supply piping to the equipment.

M. Install a gas valve upstream and within 6 ft. of each gas-utilizing appliance. Install a union connection downstream from the valve to permit removal of controls.

N. Sediment Traps: Install full size tee fittings forming dirt legs, as close as practical to gas appliance inlets. Cap or plug bottom outlet.

O. Provide a two-stage regulator system (first stage and high pressure regulator), or an integral two-stage regulator. Single stage regulators are not permitted.

3.6 TESTING

A. General:

1. Tank and piping tightness and the satisfactory operation of the cathodic protection system shall be proven before the system is placed in operation.

B. Tank:

1. Air pressure test the tank in accordance with the tank manufacturer's recommendations. In addition to the pressure test, cover the entire tank surface, manways and all fittings with soap solution and inspect for leaks.
2. There shall be no drop in pressure.

C. Piping:

1. Before backfilling and after assembly, but before connection to equipment, test metallic piping at 50 psig air pressure for not less than two hours. Soap all joints. Hydrostatic test all plastic piping at 50 psig for not less than two hours.
2. There shall be no drop in pressure.

D. Final Test:

1. Operationally test all equipment, including all existing systems, such as boilers and heaters affected by the shutdown of the fuel system. Coordinate testing with the Owner.

E. Test Results:

1. Provide written certification of all test results to the Owner's Representative.

3.7 RECORD DRAWINGS

A. Provide two sets of as-built plans on mylar drawings that show the size and locations of the tank and piping system.

3.8 LP GAS SERVICE

A. Arrange for LP gas service from local supplier. Coordinate with Owner's Representative.

B. Tank shall be filled at completion of project. Owner to furnish initial fill.

END OF SECTION 227011