SECTION 22 05 13
MOTORS

PART 1 - GENERAL

1.01 WORK INCLUDED

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

PART 2 - PRODUCTS

2.01 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. EC Motors:
    a. The motor shall be DC rated with permanent magnet rotor and automatically resetting integral overload protection.
    b. The unit shall meet the scheduled voltage, phase, control and other requirements indicated.
    c. Input Control: The unit shall have the following control features as a minimum:
        1) Packaged Unit Controls: DDC input to include start/stop/status/general trouble.

2) External Control: Minimum of Modbus and/or BACnet digital start/stop, digital trouble, 0-10VDC and 4-20mA speed control input.

d. Unit insulation shall be Class H.

e. Electrical termination lugs shall be suitable for the intended feed circuit.

f. Ratings shall be 90% minimum power factor and 10% maximum total harmonic distortion.

g. Speed control suitable for 100% to 10% operational capability.

h. Fully programmable and reviewable settings and parameters.

i. Suitable for operation at ambient conditions of 32 to 104 degrees F.

j. The power circuiting shall be separated from the low voltage control circuiting.

k. Output parameters where indicated:

1) Speed.

2) Trouble indication.

3) Overload indication.

4. 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	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
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

MINIMUM NOMINAL FULL-LOAD MOTOR EFFICIENCY						
HP	OPEN MOTORS (RPM)			CLOSED MOTORS (RPM)		
	1200	1800	3600	1200	1800	3600
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.)

5. 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

6. 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

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

PART 3 - EXECUTION

3.01 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

SECTION 22 05 23
VALVES

PART 1 - GENERAL

1.01 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.

1.02 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

2.01 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. Balance Valves: Armstrong, Bell & Gossett, Red White, Taco, Tour and Anderson.
2. Ball Valves: Apollo, Hammond, Milwaukee, Nibco, 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.

2.02 DOMESTIC WATER VALVES

A. Gate Valves:

1. 4 in. and Larger, Hot Water Service: IBBM, solid wedge disc, OS&Y, flanged ends, 125 SWP; Milwaukee F-2885.
2. 4 in. and Larger, Cold Water Service: Epoxy coated, resilient wedge, OS&Y, flanged ends, 175 wwp, UL/FM; Watts 408 RW.

3. 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: American-made, lead-free, bronze 2-piece body, chrome-plated lead-free brass ball, lead-free brass stem, full port, teflon seats and stem packing, separate packing and handle nut, blow out proof stem extended for insulation, vinyl insulator for handle, 600 WOG, 150 SWP: Watts #LFB-6080G2 (threaded ends) or Watts #LFB-6081G2 (sweat ends).

D. Balance Valves:

1. 2 in. and Smaller: Lead-free, brass body, chrome plated brass ball, glass and carbon filled PTFE seat rings, Viton packing, threaded or solder ends, differential readout ports, calibrated nameplate and memory stop indicator rated for 125 psi; and pre-formed insulation to permit access for balancing and readout; Watt Series LFCSM-61-S.
    a. Balance valve sizes shall be based upon gpm range rather than pipe size.

Balance Valve Size	GPM Range
1/2 in.	Up to 2.5
3/4 in.	2.5 - 4.5
1 in.	4.5 - 10
1-1/4 in.	10 - 15
1-1/2 in.	15 - 30
2 in.	30 - 60

F. Pressure Reducing Valves:

1. Direct Operated for Cold Water Service:

a. Bronze body construction, renewable stainless steel seat, reinforced Buna-N diaphragm and valve disc integral strainer, adjustable reduced pressure range, for dead end service.

b. Acceptable Manufacturers: Watts Series #223, Cash, Spence or approved equal.

2. Pilot Operated for Cold Water Service:

a. Globe or angle pattern, flanged ends, epoxy coated, ductile or cast iron body, bronze seat, stainless steel trim, hydraulically operated, diaphragm actuated, pilot controlled, adjustable pressure settings, pressure gauges, UL labeled, minimum 150 psi WWP for entire assembly.

b. Acceptable Manufacturers: Watts, Bermad, Spence or approved equal.

3. Direct Operated for Hot Water Service:

a. Water Wash Hoods: Same as cold water except with built-in by-pass option; outlet set at 40 psi, rated at 160°F.

b. Acceptable Manufacturers: Watts Series #223, Cash, Spence or approved equal.

G. Valves for Gauges and Instruments:

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

H. Hose Thread Drain Valves:

1. Ball valve, bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #LFFBV/FBVS-3C-CC.

2.03 GAS VALVES

A. Plug Valves:

1. 2-1/2 in. thru 6 in.: Semi-steel body and plug, short pattern, 100% pipe area rectangular port, lubricated plug, wrench operated with handle, sealing compound suitable with natural gas, flanged ends, 200 WOG, UL listed for natural gas; Homestead Figure 602.

2. 6 in. thru 12 in.: Semi-steel body and plug, short pattern, 100% pipe area round port, full bore lubricated plug, gear operated with handle, sealing compound suitable with natural gas, flanged ends, 200 WOG, UL listed for natural gas; Homestead Figure 652-G.

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 natural gas, Watts FBV-3C-UL.

2.04 UNDERGROUND VALVES AND ACCESSORIES

A. Gate Valves 3 in and Larger: IBBM, inside screw-in, wedge disc, resilient seat, "O" ring seals, 175 WWP, open counter-clockwise, 2 in. square wrench nut, mechanical joint ends, AWWA C509, UL listed, FM approved.

B. Curb Valves 2 in., and Smaller: Brass plug valve, one quarter turn with check, solid teehead "O" ring seal, flared copper ends, 175 WWP; Mueller #H-15201.

C. Curb Boxes: Cast iron with adjustable steel riser, stationary rod and cover extending from the valve to finish grade. Provide with each curb valve.

D. Valve Boxes: Cast iron adjustable screw type box and cover extending from the valve to finish grade. Cast arrow and lettering on cover of box denoting direction of valve opening and service. Provide with each curb valve.

E. Valve Key: Steel socket key for gate valve or curb valves.

F. Post Indicator Assembly: UL/FM for fire protection service only; sufficient shaft length for tope of valve to be approximately 36 in. above finished grade, case hardened brass padlock and keys.

2.05 SANITARY DRAINAGE VALVE

A. Gate Valves:

1. 2-1/2 in. and Larger: IBBM, solid wedge disc, OS&Y, flanged ends, 125 SWP; Milwaukee F-2885.

2. 2 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: Cast iron body, epoxy coated, sinking metal ball type check, access port for cleanout, flanged connections, stainless steel fasteners; Flomatic Model 408, or GA Industries.

2. 2-1/2 in. and Smaller: Cast iron body, epoxy coated, sinking ball type check, two bolt access cover for cleanout, replaceable Buna-N valve seat; Flomatic Model 508, or GA Industries.

C. Backwater Valves:

1. Type A, 2 in. through 8 in.: Flap type on hinge with revolving disc. Cast iron body with cleanout of sufficient size to permit removal of interior parts. Hinge, disc and seat shall be bronze. Set position of disc to be slightly opened. Threaded cover with countersunk plug; Jay R. Smith Figure 7022S.

2. Type B, 2 in. through 8 in.: Flap type on hinge with revolving disc. Cast iron body with cleanout of sufficient size to permit removal of interior parts. Hinge, disc and seat shall be bronze. Set position of disc to be slightly opened. Bolted cover with stainless steel bolts; Jay R. Smith Figure 7012S.

3. Type C, 2 in. through 6 in.: Drain outlet type, cast iron body with ball float, neoprene seat with removable bronze ring; Jay R. Smith Figure 7080.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 NATURAL GAS SYSTEM

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

END OF SECTION

(PAGE INTENTIONALLY LEFT BLANK)

SECTION 22 05 40
ELECTRIC WIRING

PART 1 - GENERAL

1.01 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".

1.02 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.

1.03 QUALIFICATIONS

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

1.04 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

2.01 PRODUCTS

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

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 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".

3.04 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

(PAGE INTENTIONALLY LEFT BLANK)

SECTION 22 05 53
PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.01 WORK INCLUDED

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

1.02 QUALIFICATIONS

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

1.03 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.

1.04 MAKES

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

PART 2 - PRODUCTS

2.01 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.

2.02 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
Hot Water Recirculating	DOMESTIC HOT WATER RECIRCULATING
Pump Discharge	PUMP DISCHARGE
Natural Gas	NATURAL GAS
Compressed Air	COMPRESSED AIR
Exhaust Air	EXHAUST AIR

2.03 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.

2.04 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.

2.05 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

3.01 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

(PAGE INTENTIONALLY LEFT BLANK)

SECTION 22 05 54
PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED

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

1.02 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.

1.03 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.

1.04 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

2.01 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.

2.02 PRODUCTS

A. Colors:

1. As selected by Owner.

B. Lead Content:

1. Not more than 0.06 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

3.01 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.

3.02 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.

3.03 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.

3.04 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.

3.05 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.

3.06 COLOR CODING

A. Pipe coloring shall conform to the following schedule:

PIPING SYSTEM	SAFETY COLOR
Air, Compressed	YELLOW
Domestic Cold Water	GREEN
Fire Protection	RED
Natural Gas	YELLOW

END OF SECTION

SECTION 22 05 93
ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 WORK INCLUDED

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

1.02 SUBMITTALS

A. Provide information in report form listing items required by specifications. Report shall be typed and three copies submitted for review. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner's Representative.

B. Report format shall consist of the following:

1. Title sheet with job name, contractor, engineer, date, balance contractor's name, address, telephone number and contact person's name and the balancing technician's name.

1.03 QUALIFICATIONS

A. Follow procedures and methods published by one or more of the following:

1. Individual manufacturer requirements and recommendations.

B. Maintain qualified person at project for system operation, trouble shooting and perform mechanical adjustments in conjunction with balancing procedure.

C. Balancing contractor shall be current member of AABC or NEBB.

1.04 GENERAL REQUIREMENTS

A. Before concealment of systems visit the job site to verify and advise on type and location of balancing devices and test points. Make changes as required to balancing facilities.

B. Place systems in satisfactory operating condition.

1. Adjusting and balancing shall be accomplished as soon as the systems are complete and before Owner takes possession.

2. Prior to balancing adjust balancing devices for full flow; fill, vent and clean hydronic systems, replace temporary strainers.

3. Initial adjustment and balancing to quantities as called for or as directed by the engineer, to satisfy job conditions.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers and tachometers required. Instruments used shall be accurately calibrated as per AABC or NEBB requirements.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine Bid Documents and notify Owner's Representative of any questions regarding balancing, within thirty (30) days after receipt of bid and prior to starting work.

3.02 WATER SIDE

A. Test, adjust and record the following:
   1. Hot Water Recirculating Pump:
      a. Check rotation
      b. GPM
      c. Running suction pressure
      d. Running discharge pressure
      e. Running load amps
      f. RPM - motor
      g. Complete nameplate motor and pump
   2. Recirculation Balancing Valves:
      a. Balance every valve to 0.5 GPM, unless otherwise noted.

END OF SECTION

SECTION 22 07 00
INSULATION

PART 1 - GENERAL

1.01 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.

1.02 SUBMITTAL

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

PART 2 - PRODUCTS

2.01 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 jackets, 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**.**
5. 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.
6. 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.
7. 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.

2.02 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.

F. Heat Tracing: Raychem, Thermon.

2.03 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.

2.04 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".

2.05 FIELD-APPLIED JACKETS

A. Piping:

1. PVC Pipe Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; 25 or less flame spread rating/50 or less smoke developed rating, 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. Alumaguard Jacketing: Self adhesive, 60 mil thick, rubberized bitumen, foil faced membrane. Polyguard Products, Inc. Alumaguard 60, or equal.

2.06 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.

2.07 HEAT TRACING

A. Output Rating:

1. Outdoor Water Piping: 8 watts/foot.
2. Voltage: 120/1/60.

B. The self-regulating heating cable shall consist of two (2) 16 AWG nickel-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heating cable to be cut to length in the field. The heating cable shall be covered by a radiation-cross-linked, modified polyolefin dielectric jacket. To provide a ground path and to enhance the heating cable's ruggedness, the heating cable shall have a braid of tinned copper and an outer jacket per section 427-23 of the NEC.

C. All heating-cable components shall be UL Listed for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that use crimps or terminal blocks, shall not be acceptable. All components that make an electrical connection shall be re-enterable for servicing. No component shall use silicone to seal the electrical connections. An exception will be made in areas where a conduit transition is required.

D. Design Equipment: Raychem XL Trace.

2.08 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.

2.09 MATERIALS AND SCHEDULES

A. See Exhibits at the end of this section.

PART 3 - EXECUTION

3.01 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.

3.02 PIPE INSULATION

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

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 jacketing.

H. For piping exposed to the elements, jacketing shall be aluminum 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 a continuous 30 mil thick white PVC 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.

3.03 INSTALLATION OF HEAT TRACING

A. System must be installed per manufacturer's recommendations.

B. Provide coverage for ALL pipes, valves, fittings, etc. exposed to freezing temperatures.

C. Apply the heating cable linearly on the pipe after piping has been successfully pressure-tested. Secure the heating cable to piping with cable ties or fiberglass tape.

D. Apply "Electric Traced" labels to the outside of the thermal insulation.

E. After installation and before and after installing the thermal insulation, subject heating cable to testing using a 2500 VDC Megger, minimum insulation resistance shall be 20 megohms or greater.

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
Domestic hot, tempered and circulation 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	Flexible	All sizes: 1/2 in.	Not required for exposed PVC drains SEE NOTE 2

NOTES FOR EXHIBIT I:

NOTE 1: Exposed insulation subject to damage shall be covered with PVC jacket.

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

NOTE 3: 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

SECTION 22 08 00
COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Commissioning is a systematic process of verifying that all building systems perform interactively according to the Owner's operational needs, the design documents, manufacturer's recommendations, good engineering and workmanship practices. This is achieved by beginning in the design phase and documenting the Owner's requirements and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

B. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify that applicable equipment and systems are installed according to the contract documents, manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that O&M documentation provided for the project is complete, accurate and represents the actual installed equipment.
4. Verify that the Owner's operating personnel are adequately trained.

C. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

D. Abbreviations: The following are common abbreviations used in the Specifications. Definitions are found in Article 1.2.

A/E - Architects and Design Engineers	EC - Electrical Representative
CxA - Commissioning Authority	FT - Functional Performance Test
CC - Controls Representative	GC - General Contractor
CTR - Contractors Technical Representative	MC - Mechanical Representative
Cx - Commissioning	PFI - Pre-Functional Inspection
Cx Plan - Commissioning Plan Document	PM - Project Manager (of the Owner)

PC - Plumbing Representative TAB - Test and Balance Contractor

1.02 STANDARD AND CORE COMPLIANCE

A. Commissioning will be accomplished to comply with, and in accordance with the requirements of the following:

1. 2020 Energy Conservation Construction Code of New York State, Section C408 System Commissioning.

1.03 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this section. Additional specific responsibilities, when required, of the mechanical representative, TAB, controls representative, plumbing representative and those of the electrical representative are described in their particular contract specifications and documents. It is noted that the commissioning responsibilities of the Owner's Project Manager, Architect, HVAC Mechanical and Electrical Designers/Engineers and Commissioning Authority are not provided for in this contract. That is, the Contractor is not responsible for providing their services, and those responsibilities are listed here only for clarification of the commissioning process.

B. All Parties:

1. Follow the Commissioning Plan.

2. Attend the commissioning scoping meeting and additional meetings as necessary.

C. Commissioning Authority (CxA):

1. The CxA is not responsible for design concept, design criteria, compliance with codes, design or construction scheduling, cost estimating, or construction management. The CxA may assist with problem solving non-conformance or deficiencies, but ultimately that responsibility resides with the GC and A/E. The primary role of the CxA is to develop and coordinate the execution of the Commissioning Plan, observe and document system performance. Specifically, that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractor will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied by the CxA.

2. Construction and Acceptance Phase:

a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular

communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

b. Coordinate the commissioning work and, with the GC and CTRs, verify that commissioning activities are being scheduled into the master schedule.

c. Revise the Commissioning Plan as necessary.

d. Plan and conduct a commissioning scoping meeting.

e. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.

f. Before startup, gather and review the current control sequences and interlocks and work with installers and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

g. Review equipment submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.

h. Write and distribute prefunctional inspections. The CxA will provide the GC and installers a list of the required submittals. The Contractor bears all costs associated with providing the requested submittals to the CxA without any additional cost to the Owner, CxA or others.

i. Develop prefunctional checklists for completion by Contractor.

j. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

k. Witness all or part of the plumbing piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify Owner's Project Manager of any deficiencies in results or procedures.

l. With necessary assistance and review from the Contractor and installers, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.

m. Confirm completion of prefunctional checklists by site observation and spot-checking.

n. Evaluate systems startup procedures by reviewing start-up reports and by selected site observation.

o. Analyze any functional performance trend logs and monitoring data to verify performance.

p. Maintain a master deficiency and resolution log and a separate testing record. Provide the GC, PM and installers with written progress reports and test results with recommended actions.

q. Review equipment warranties to verify that the Owner's responsibilities are clearly defined.

r. Oversee and approve the training of the Owner's operating personnel.

s. Compile and maintain a commissioning record and Systems Energy Manual.

t. Review the preparation of O&M manuals.

u. Provide a final commissioning report.

v. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

w. Return to the site at ten (10) months into the twelve (12) month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

x. Identify any warranty phase deficiencies and provide detailed documentation to the Contractor.

D. General Contractor (GC):

1. Construction and Acceptance Phase:

a. Include the cost of supporting commissioning in the contract price.

b. Attend a commissioning scoping meeting and other commissioning team meetings.

c. Furnish a copy of all construction documents, addenda, change orders and submittals and shop drawings related to commissioned equipment to the CxA. The CxA will forward a request to the GC for copies of the submittals that the CxA is required to review concurrently with the Engineer as required by the LEED guidelines. The Contractor bears all costs associated with providing the requested submittals to the CxA without any additional cost to the Owner, CxA or others.

d. Provide the requisite readiness notification to the CxA for equipment prefunctional inspections and functional testing utilizing forms provided by the CxA.

e. Participate in pre-functional inspections, startup and functional testing of all equipment, as directed by the CxA.

f. Review the functional performance test procedures submitted by the CxA, prior to testing, and provide comments.

g. Review commissioning progress and deficiency reports.

h. Coordinate the resolution of deficiencies identified by the CxA.

i. Document the completion and/or action taken for the resolution of deficiencies as directed by the CxA and described in the Cx Plan utilizing forms provided by the CxA.

j. Coordinate and perform the training of Owner personnel. Notify the CxA when training will be taking place.

k. Ensure that all installers execute their commissioning responsibilities according to the Contract Documents and schedule.

l. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

m. Assist the CxA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

n. Ensure that installers execute seasonal or deferred functional performance testing, witnessed by the CxA, according to the specifications.

o. Ensure that installers correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

E. Installers (CTRs):

1. Construction and Acceptance Phase:

a. Attend all commissioning scoping meetings and other commissioning team meetings.

b. Provide the requisite readiness notification to the GC for equipment prefunctional inspections and functional testing.

c. Complete prefunctional checklists developed by the CxA.

d. Review the functional performance test procedures submitted by the CxA, prior to testing.

e. Review commissioning progress and deficiency reports.

f. Coordinate the resolution of deficiencies identified by the CxA.

g. Document the completion and/or action taken for the resolution of deficiencies as directed by the CxA and described in the Cx Plan.

h. Coordinate and perform the training of Owner personnel.

i. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

j. Assist the CxA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

k. Ensure that seasonal or deferred functional performance testing, is executed and witnessed by the CxA, according to the specifications.

l. Ensure deficiencies are corrected and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

F. Equipment Suppliers:

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.

2. Assist in equipment commissioning with CTRs as per the Contract Documents.

3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor.

4. Provide the information requested by the CxA regarding equipment sequences of operation and testing procedures.

5. Review test procedures for equipment installed by factory representatives.

1.04 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning record:

1. Plan for delivery and review of submittals, systems manuals and other documents and reports.

2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for plumbing systems, assemblies, equipment and components to be verified and tested.

4. Certificate of completion certifying that installation, prestart checks and startup procedures have been completed.

5. Certificate of readiness certifying that plumbing systems, subsystems, equipment and associated controls are ready for testing.

6. Test and inspection reports and certificates.

7. Corrective action documents.

8. Verification of testing, adjusting and balancing reports.

1.05 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning record:

1. Plan for delivery and review of submittals, systems manuals and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks and startup procedures have been completed.
5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting and balancing reports.

1.06 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned in this project. The Owner and the CxA reserves the right to amend this list at anytime during the construction and acceptance process.

B. Plumbing:

1. Domestic water heaters
2. Domestic Hot Water Recirculation System
3. Compressed Air system

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division Contractor for the equipment being tested.

B. Special equipment, tools, instruments, (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents, shall be included in the base bid price to the Contractor and left on site, except for stand-alone datalogging equipment that may be used by the CxA.

C. Datalogging equipment and software required to test equipment will be provided by the CxA, but shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

PART 3 - EXECUTION

3.01 MEETINGS

A. Scoping Meeting: The CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CxA. Information gathered from this meeting will allow the CxA to revise the Commissioning Plan to its final version, which will also be distributed to all parties.

B. Prefunctional Inspection (PFI) Meeting: The CxA will schedule, plan and conduct a PFI meeting with the entire commissioning team in attendance to kickoff the PFI phase.

C. Functional Performance Testing Meeting: The CxA will schedule, plan and conduct a functional performance test meeting with the entire commissioning team in attendance to kickoff the FT phase. The Controls Representative (CC) will play a critical role in the Functional Performance Testing. The CC's Project Manager will be required to attend this meeting.

D. Miscellaneous Meetings: Progress meetings will be scheduled and conducted by the CxA, as necessary. Other meetings will be planned and conducted by the CxA as the construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular CTRs. The CxA will plan these meetings and will minimize unnecessary time being spent by CTRs.

3.02 REPORTING

A. The CxA will provide regular reports to the Owner, PM, GC and A/E depending on the management structure, with increasing frequency as construction and commissioning progresses.

B. The CxA will regularly communicate with all members of the commissioning team, keeping them apprised for commissioning progress, and scheduling changes through memos, progress reports, etc.

C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

D. A final summary report by the CxA will be provided to the Owner. The report will include:

1. A brief summary report that includes a list of participants and roles, brief building description, overview of commissioning and testing scope, and a

general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the CxA regarding the adequacy of the equipment, documentation, and training as it relates to the Contract Documents in the following areas:

a. Equipment meeting the equipment specifications.

b. Equipment installation.

c. Functional performance and efficiency.

d. Equipment documentation.

e. Operator training.

2. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment and operations, future actions, recommended commissioning process changes, etc. shall also be listed.

3. Also included in the Commissioning Record shall be the issues log, commissioning plan, progress reports, submittal and O&M manual reviews, training record, test schedules, construction checklists, start-up reports, functional tests and trend log analysis.

E. The CxA will compile a Systems Manual that consists of the following:

1. Space and use descriptions.

2. Single line drawings and schematics for major systems (to be provided by the Design Engineer).

3. Control drawings and sequences of control (to be provided by the Controls Contractor).

4. Table of all setpoints and implications when changing them.

5. Schedules.

6. Instructions for operation of each piece of equipment for emergencies, seasonal adjustment, startup and shutdown.

7. Instructions for energy savings operations and descriptions of the energy savings strategies in the facility.

8. Recommendation for recommissioning the facility.

9. Energy tracking recommendations.

3.03 SUBMITTALS

A. The CxA will provide the Contractor with a specific request for the type of submittal documentation the CxA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At a minimum the request will include the manufacturer and model number, the manufacturer's printed installation and detailed startup procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of Owner contracted tests. In addition, the installation and checkout materials that are actually shipped

inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CxA. All documentation requested by the CxA will be included by the CTRs in their O&M manual contributions.

B. The CxA will review submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The CxA will notify the Owner, PM, GC or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission. The CxA does not have approval responsibility, but is required to review the submittals concurrently with the Engineer as required by LEED guidelines.

C. The CxA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review them.

3.04 SYSTEM START-UP AND TESTING

A. General Requirement:

1. All systems and system components shall be tested by the CTRs and in the presence of the Owner and Design Consultants if desired by the Owner and Design Consultants to demonstrate compliance with specified requirements. To minimize the time of commissioning, contracting, and Design Consultant team members, testing shall be done in seasonal single blocks of time insofar as possible.
2. The Contractor shall notify the CxA fourteen (14) days prior to scheduled functional performance tests, of the scheduled completion date of the installation verification and prefunctional inspections.
3. All testing shall be conducted under specified design operating conditions as approved by the CxA and Design Consultants.
4. All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on a hierarchical basis. Each piece of equipment shall be tested for proper operation, and functionality of safety devices, followed by each system's subsystem, followed by the entire system, followed by any interlocks to other major systems.
5. All special testing materials and equipment shall be provided by the CTR. This includes, but is not limited to, proprietary equipment, hand-held

control parameter/setpoint adjustment tools, water/air flow balancing readout and adjustment tools.

6. One (1) copy of all factory test reports and records as well as all start-up documentation shall be provided to the CxA.

B. Test Procedure Development and Test Documentation:

1. At least fourteen (14) days prior to startup of the plumbing system, the CTR shall inform the CxA, the Owner's Representative and Design Consultants of the intention to start up the system.

C. Installation Verification Requirements:

1. All systems and system components shall be checked and verified by the CTR that they have been installed according to the drawings, specifications, and manufacturer's written instructions, and that all connections have been made correctly. Discrepancies shall be corrected and resolved to the satisfaction of the Engineer and CxA prior to proceeding any further with prefunctional inspections.
2. Each system of interlocked system components shall be observed and verified by the CTR that it is ready to function as specified.
3. Verification of complete and proper installation shall be completed prior to the CxA authorizing functional performance testing.
4. The installation verification shall be documented by the CTR in a written format for each system/piece of equipment as designated by the CxA. Each certificate of readiness shall be dated and initialed by the Contractor and clearly stating any items that are deficient or have not been completed. The protocols for this will be further clarified in the Commissioning Plan.
5. Certify that plumbing systems, subsystems and equipment have been installed and started and are operating according to the Contract Documents.
6. Certify that testing, adjusting and balancing procedures have been completed and that testing, adjusting and balancing reports have been submitted, discrepancies corrected and corrective work approved.
7. Inspect and verify the position of each device and interlock identified on checklists.
8. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
9. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

D. Prefunctional Inspection Requirements:

1. The CxA will provide the inspection forms for each system and equipment.
2. Verification of completion of the prefunctional checklists is the responsibility of the CxA.

3. Prior to the CxA performing the prefunctional inspection, the CTRs shall check the equipment for proper installation, adjustments, and shall calibrate the equipment to verify that it is ready to perform as specified.

4. Verification of complete and proper installation shall be completed prior to performing functional performance tests.

E. Functional Performance Testing Requirements:

1. A functional performance test shall be performed on each complete system. Each function shall be demonstrated to the satisfaction of the CxA based on the written test procedure developed by the CxA to demonstrate conformance to the requirements of the Contract Documents.

2. Each functional performance test shall be performed, witnessed and signed off by the CxA. The CxA and the CTRs will perform the functional testing together. Any exceptions to this will be made clear to the Owner as to the reason and justification.

3. The functional performance testing shall be conducted in accordance with prior approved procedures and documented as required.

4. The Contractor shall notify the contracting team, the CxA, and Design Consultants, at least two weeks prior to the date of schedule functional performance tests. The seasonal functional performance test periods shall be scheduled over a single block of days. The schedule of functional performance tests shall be based on the construction completion schedule.

3.05 FUNCTIONAL TESTING SUPPORT REQUIREMENTS

A. General Requirements:

1. This section provides brief descriptions of the testing and support the Contractor and installers will be required to provide to perform the functional testing of the equipment for the project.

B. Domestic Hot Water Systems:

1. The installer(s) will be required to demonstrate all safeties, local device operation, any local controls and any integrated 3rd party Building Management System controls INCLUDING ALL RELATED DEVICES AND SEQUENCE OF OPERATIONS.

2. The installer(s) will be required to manually operate all hand valves, and the controls contractor will be required to demonstrate their systems' integrated performance. Any local controls will require the representative who was responsible for the programming and setting up of the equipment to document the set points and demonstrate the performance of their equipment.

C. Pumping Systems:

1. The installer(s) will be required to demonstrate in writing (TAB Report) that the pumps are balanced to achieve the specified design flows,

including motor performance data as specified in the specifications. The Controls Contractor will be required to demonstrate that the pumps can start, stop, modulate speed (if required) and the lead/lag sequence performs as per the sequence of operations. In addition, a representative will be required to manually operate all hand valves.

D. Pipe system cleaning, flushing, hydrostatic tests and chemical treatment requirements are specified in plumbing piping sections. Plumbing Contractor shall prepare a pipe system cleaning, flushing and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested and chemically treated.

3.06 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation - The CxA shall witness and document the results of all functional performance tests using the specific forms developed by the CxA for that purpose.

B. Non-Conformance:

1. The CxA will record the results of the PFIs and functional tests utilizing the appropriate documentation. All deficiencies or non-conformance issues shall be noted and reported to the Owner, PM, GC and CTRs.
2. Reports of the deficiencies identified will be provided to the project team by the CxA. Individual forms identifying the deficiencies for each trade will also be provided. These forms are utilized for the contractor to inform the CxA of the action taken to address the deficiency items and these forms must be returned in a timely manner to the CxA.
3. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases, the deficiency and resolution will be documented by the CxA.
4. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or compromising acceptance criteria to satisfy scheduling

or cost issues, unless there is an overriding reason to do so at the request of the Owner.

5. Cost of Retesting:
   a. The cost for the Installer to repeat a prefunctional inspection or functional test, if they are responsible for the deficiency, shall be theirs.
   b. The time for the CxA to direct any retesting required because a specific prefunctional inspection of start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the appropriate CTR.
6. The Contractor shall respond in writing to the CxA at least as often as commissioning meetings are scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

C. Failure Due to Manufacturer Defect or Improper Installation - If 10%, or three (3), whichever is greater, of identical pieces of equipment (size alone does not constitute a difference) fail to perform to the Contract Documents (either mechanically or substantively) due to manufacturing defect or improper installation, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CxA, PM, A/E or Owner. In such case, the Contractor shall provide the Owner with the following:

1. Within one (1) week of notification from the A/E (via the CxA), the installer or Manufacturer's Representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CxA or PM within two (2) weeks of the original notice.
2. Within two (2) weeks of the original notification, the installer or manufacturer shall provide a signed and dated written explanation of the problem, cause of failures, etc., and all proposed solutions, which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. The CxA, G/C and PM will determine whether a replacement of all identical units or a repair is acceptable.
4. Two (2) examples of the proposed solution will be installed by the Contractor and the CxA will be allowed to test the installations for up to one (1) week, upon which the CxA or PM will decide whether to accept the solution.
5. Upon acceptance, the installer and/or manufacturer shall replace or repair all identical items, at their expense, and extend warranty accordingly, if the original equipment warranty had begun. The replacement/repair work

shall proceed with reasonable speed beginning within one (1) week from when parts can be obtained.

D. Approval: The CxA documents each satisfactorily demonstrated functional test.

3.07 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals:

1. The specific content and format requirements for the standard O&M manuals are detailed in the contract documents. Special requirements for the controls representative and TAB are detailed in the contract documents.

2. Prior to substantial completion, the CxA shall review the O&M manuals, documentation and redline as-builts for systems that were commissioned to verify compliance with the specifications. The CxA will communicate deficiencies in the manuals to the CTRs, PM, GC, A/E or Owner as requested. Upon successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the PM, GC, A/E and Owner. The CxA also reviews each commissioned equipment's warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E contract.

3.08 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and for ultimately ensuring that training is completed. The GC shall inform the CxA when training will be scheduled.

B. The CxA shall be responsible for overseeing and approving the content and adequacy of the training of the Owner personnel for commissioned equipment.

C. The CxA shall interview the facility manager and lead engineer to determine the special needs and areas where training would be most valuable. The Owner and CxA shall decide how rigorous the training should be for each piece of commissioned equipment.

D. In addition to these general requirements, the specific training requirements of Owner's personnel by CTRs, as detailed in the specifications, shall be provided.

E. Each CTR and vendor responsible for training will submit a written training plan to the CxA, for review and approval prior to training. The plan will cover the following elements:

1. Equipment (included in training).
2. Intended audience.
3. Location of training.
4. Objectives.

5. Subjects covered (description, duration of discussion, special methods, etc.).
6. Duration of training on each subject.
7. Instructor for each subject and qualifications.
8. Methods (classroom lecture, video, site walk thru, actual demonstrations, etc.).

F. The CxA develops criteria for determining that the training was satisfactorily completed, including attending some of the training.

3.09 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any inspection or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of inspections and functional testing may be delayed upon approval of the PM or Owner. These tests will be conducted in the same manner as the seasonal test as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate CTRs, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

3.10 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the specifications. The Commissioning Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, and, who receives and approves them and the location of the specification to create them. In summary the written products are:

	Product	**Developed By**
1.	Final Commissioning Plan	CxA
2.	Commissioning Schedules	CxA, GC and CTRs
3.	Equipment Documentation Submittals	CTRs
4.	Sequence Clarifications	A/E and CTRs as needed
5.	Pre-Functional Inspection Forms	CxA
6.	Pre-Functional Inspections	CxA
7.	Startup and Initial Checkout Plans	CTRs

	Product	Developed By
8.	Final TAB Report	TAB CTR
9.	Commissioning Progress Record	CxA
10.	Issue and Resolution Log	CxA
11.	Functional Test Procedures	CxA
12.	O&M Manuals	CTRs
13.	Commissioning Record	CxA
14.	Overall Training Plans	GC and CTRs
15.	Specific Training Syllabus	CxA
16.	Final Commissioning Report	CxA

END OF SECTION

(PAGE INTENTIONALLY LEFT BLANK)

SECTION 22 10 10
PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.01 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.

1.02 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

2.01 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.

2.02 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.

2.03 STEEL PIPING AND FITTINGS - PRESS CONNECT FITTINGS

A. Piping Standard: Black steel piping shall conform to ASTM A53 or ASTM A106 seamless, Schedule 40 weight pipe.

B. Fittings: Listed in accordance with ANSI LC4/CSA 6.32.

1. For natural gas service, -40 deg. F to 180 deg F at 125 PSI.

2. Sizes 1/2 inch through 4 inch, Schedule 40.

3. Schedule 40 steel fittings with zinc/nickel coating for use with IPS schedule 40 carbon steel, pipe conforming to ASTM A53 or ASTM A106. Fittings shall have an HNBR sealing element, 420 stainless steel grip ring, separator ring and "Smart Connect" (SC) feature.

C. Design Make: Viega Mega Press G System.

D. Acceptable Manufacturer: Viega.

2.04 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. Joints: Comply with the requirements of ASTM B828.

D. 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.

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

F. 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.

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

2.05 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.

2.06 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.

2.07 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.

2.08 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.

2.09 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.

2.10 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 Solvent: Aerators and deaerators as manufactured by Conine Manufacturing Co., Inc.

2.11 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.

2.12 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, similar to HoldRite strut-mounted cushion clamps. Fasten piping to trapeze at every third support, except uninsulated piping which shall be fastened at every support using strut-mounted cushion clamps.

5. Acceptable Manufacturers: B-Line, HoldRite, Kindorf, Unistrut or approved equal.

I. 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.

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

2.13 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.

C. Hubless cast iron fitting restraints shall be Holdrite Series #117 or approved equal.

2.14 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.

2.15 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.

2.16 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.

2.17 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.

2.18 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.

2.19 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

3.01 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.

3.02 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.

3.03 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.

3.04 PIPE CONNECTIONS

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

B. Copper 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. Steel Press Connections:

1. Natural Gas Systems: Sealing elements shall be verified for the intended use. Pipe ends shall be cut on a right angle (square) to the pipe. Pipe ends shall be reamed and all paint, lacquer, grease, oil, and dirt shall be removed from the pipe end with an abrasive cloth, or with a Ridgid MegaPress pipe end prep tool. Visually examine each fitting sealing element to ensure there is no damage. Insert the pipe fully into the fitting and mark the pipe wall at the face of the fitting. Always examine the pipe to ensure it is fully inserted into the fitting prior to pressing the joint. Steel Press fittings shall be installed using Ridgid, MegaPress Tools. Steel Press fittings shall be installed according to the most current edition of the manufacturer's installation guidelines. Installers shall be trained by a manufacturer representative on proper installation procedures.

2. Testing: After Steel Press fittings have been installed a “two step test” shall be followed. Utilizing air or, dry nitrogen, pressurize the system between 5 psi and 45 psi. Check the pressure gauge for pressure loss. If the system does not hold pressure, inspect entire system and check for un-pressed fittings. Should un-pressed fittings be identified, ensure the pipe is fully inserted into the fitting and properly marked prior to pressing the joint. After appropriate repairs have been made, test the system per local code, or specification requirements, not to exceed 200 psig.

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

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

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

G. 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.

H. 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.

I. 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. CPVC Piping: Join according to ASTM D 2846.
3. PVC Piping: Join according to ASTM D 2855.

3.05 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.

3.06 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.

3.07 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.

3.08 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.

3.09 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, fittings 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. Industrial Equipment:

1. Industrial Equipment shall be furnished by others and set in place by this contractor.
2. Provide all piping, stops, valves, traps and fittings unless otherwise noted on the drawings.
3. 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
Combined Water and Fire service	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Domestic water interior/hot, cold and circulating 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, cold and circulating 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
Sanitary, sanitary vent, (buried)	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Sanitary, sanitary vent and grease waste	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)

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
	Service weight cast iron soil pipe	No hub	No hub neoprene gasket and stainless steel clamp assembly
Water heater intake piping	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 3)
Water heater exhaust piping	Schedule 40 CPVC, AL-29-4C, Polypropylenel	Stainless steel, CPVC socket type, or Polypropylene to match pipe material	Sealed closure system (SEE NOTE 3)
Pump discharge	Schedule 40 galvanized steel	Galvanized cast iron drainage	Threaded
	Type L Copper	Wrought copper	No-lead solder
Natural gas (buried)	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Natural gas (exterior above grade)	Schedule 40, black steel	Butt welded steel	Welded (SEE NOTE 2)
	Schedule 40, black steel	Malleable iron, 2 in. and smaller	Threaded (SEE NOTE 2)
	Schedule 40, black steel	Steel with zinc/nickel coating	Press fit
Natural gas (interior)	Schedule 40, black steel	Malleable iron, 2 in. and smaller	Threaded (SEE NOTE 2)
	Schedule 40, black steel	Butt welded steel, 2-1/2 in. and larger	Welded (SEE NOTE 2)
Compressed air (shop and industrial)	Schedule 40, black steel	Malleable iron, 3 in. and smaller	Threaded
	Schedule 40, black steel	Butt welded steel, 4 in. and larger	Welded

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 the local 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: (Not Used). NOTE 4: PVC piping shall not be installed within return air plenums.

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

NOTE 5: CPVC piping, copper tube size (SDR11) permitted for piping 2 in. and smaller. CPVC piping, Schedule 80 permitted for piping 3 in. and larger.

NOTE 6: All uninsulated piping supported by trapeze hangers shall be securely fastened to each hanger using strut-mounted cushion clamps.

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, storm	Maintain 10 ft. head of water for two (2) hours.
Indirect waste	Maintain 10 ft. head of water for two (2) hours.
Acid waste and vent	Maintain 10 ft. head of water for two (2) hours.
Swimming pool piping	Refer to Section 225100 - "Pool Equipment".
Pump discharge	Hydrostatically test at 5 PSI greater than the pump rating for two (2) hours.
Fuel oil piping, supply and return, fill and vent	Refer to Section 227020 - "Fuel Storage Tanks and Accessories".
Engine exhaust	Test in accordance with the engineer/generator manufacturer's recommendations.
Natural gas	Refer to Section 227010 - "Natural Gas Systems".
LP gas (propane)	Refer to Section 227011 - "LP Gas System".
Reverse osmosis, deionized water	Test with inert gas (nitrogen) at a pressure of 125 PSI for two (2) hours.
Compressed air (house, shop and industrial)	Test with clean air or nitrogen at a pressure of 175 PSI for 24 hours.
Compressed air (medical, air intake)	Refer to Section 226100 - "Medical Compressed Air".
Vacuum (medical, exhaust piping)	Refer to Section 226200 - "Vacuum System".
Oxygen	Refer to Section 226300 - "Oxygen Systems".
Nitrous oxide, nitrogen	Test with oil free dry nitrogen at 1.5 times the working pressure (150 PSI min.) Maintain pressure until all joints have been examined. Refer to Section 226300 for applicable information.

END OF SECTION

SECTION 22 10 20
UNDERGROUND PIPING AND ACCESSORIES

PART 1 - GENERAL

1.01 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

1.02 SUBMITTALS

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

PART 2 - PRODUCTS

2.01 GENERAL

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

2.02 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.

2.03 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.

2.04 DUCTILE IRON PIPE AND FITTINGS

A. Pipe: AWWA C151/ANSI A21.51, Class 52, 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.

2.05 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.

2.06 POLYETHYLENE PIPE AND FITTINGS - NATURAL GAS

A. Pipe: ASTM D2513, SDR 11, PE3408 high-density polyethylene, black with yellow stripe, for conEdison.

B. Fittings: Same material as pipe Heat fusion joints, socket-type ASTM D2683

C. Acceptable Manufacturers: Adrisco, Chevron Phillips, or approved equal.

2.07 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.

2.08 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.

2.09 SCHEDULE OF PIPING MATERIALS

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

PART 3 - EXECUTION

3.01 TESTING

A. Sanitary and Storm:

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, fittings 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.

3.02 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.

3.03 GAS PIPING

A. Refer to Section 227010, "Natural Gas Systems".

3.04 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.

3.05 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 moisture proof. 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.

EXHIBIT "A" - PIPING MATERIALS (PLUMBING)

(Notes are at end of Exhibit "A")

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Combined Fire/Water service	Ductile iron water main with cement lining	Ductile iron	Mechanical or push-on type (SEE NOTE 3)
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
Ducting Pipe	Polyethylene		Mechanical (SEE NOTE 2)
Natural gas	Schedule 40 steel, factory applied corrosion protective coating	Butt welded steel	Welded (SEE NOTE 1)
	SDR 11 Polyethylene	Polyethylene	Heat fusion

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: Fittings and adapters used shall be specifically made for the piping system installed. All underground piping shall be installed within ducting pipe.

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 local 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
Sanitary, sanitary vent, storm	Maintain 10 ft. head of water for two (2) hours.
Natural gas	Refer to Section 227010 - "Natural Gas Systems".
Combined Fire/water 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

(PAGE INTENTIONALLY LEFT BLANK)

SECTION 22 10 30
PUMPS

PART 1 - GENERAL

1.01 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.

1.02 QUALITY ASSURANCE

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

1. 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.

1.03 SUBMITTALS

A. Submit manufacturer's data in accordance with the 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

2.01 HOT WATER CIRCULATING PUMP

A. Pump: Inline centrifugal, all stainless steel, system fluid lubricated, 145 psi working pressure, 230°F water temperature, ceramic shaft and radial rings, flange mount.

B. Motor: Impedance protected, stainless steel can and static o-ring seals to isolate stator from system fluid, non-overloading throughout the pump curve.

C. Electric Control: Demand control and aquastat for each pump and wiring to motor starter. Starter and time clock by Electrical Contractor.

D. Refer to schedule on drawings for capacity and electrical characteristics.

E. Acceptable Manufacturers: Armstrong, Bell and Gossett, Grundfos.

2.02 SUMP PUMP - SUBMERSIBLE

A. Pump: Simplex, submersible type, 2 in. discharge, bronze construction, non clog impeller, stainless steel shaft, capable of handling 5/8 in. solids, mechanical seal, minimum 50 gpm capacity.

B. Motor: Oil filled, permanent lubrication, automatic reset thermal overload, oil and water resistant power cord with plug, non-overloading throughout the pump curve.

C. Electric Control: Built-in automatic diaphragm-type pressure switch, completely prewired, requiring only receptacle for plug in power connection.

D. Basin: Fiberglass, 24 in. diameter, anti-floatation flange, perforated steel cover, with steel curb ring and concrete anchor.

E. Refer to schedule on drawings for capacity and electrical characteristics.

F. Acceptable Manufacturers: Hydromatic, Goulds, Weil, Zoeller.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Pumps shall be installed, aligned and started in accordance with manufacturers written installation instruction.

B. Install pumps in locations to provide access for maintenance and replacement of parts.

C. Support pumps and piping separately so that piping does not support pumps.

D. Provide the services of a factory trained mechanic to start up the system based on factory recommendations. Provide Owner instruction at time of start up. Submit three (3) copies of start up report to the Owner's Representative.

E. All wiring for sump pump(s) between control panel and junction box shall be continuous. No junction boxes allowed within pump basin.

3.02 HOT WATER CIRCULATING PUMP

A. Install shutoff valve and strainer on pump suction; check valve, balancing valve and shutoff valve in pump discharge. Install pressure gauge on suction and discharge piping. Adjust gpm of each circulating pump to capacity as noted.

3.03 SUMP PUMP

A. Install gate valve and check valve in discharge piping for each pump.

B. Simplex pump operation shall be completely automatic. Pressure style switch shall start and stop the pump at the factory set levels. Float style switches shall be adjusted to start and stop the pump at the specified levels.

C. Install liquid level control devices at proper elevation to produce specified sump drawdown. Secure control devices to discharge piping with corrosion resistant brackets and fasteners.

D. Install high water alarm and make electrical connections. Install liquid level control device at proper liquid depth. Secure control device to discharge piping with corrosion resistant brackets and fasteners.

3.04 TESTING

A. Test hot water recirculating pumps for operation.

B. Test sanitary pumping systems for operation at specified liquid depths.

C. Test high water alarm for operation at specified liquid depth.

D. Certify in writing that tests have been performed and the systems are properly operating. Submit three (3) copies of all test reports to the Owner's Representative.

END OF SECTION

(PAGE INTENTIONALLY LEFT BLANK)

SECTION 22 11 00
WATER SUPPLY

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 SUBMITTALS

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

PART 2 - PRODUCTS

2.01 WATER PIPING

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

2.02 WATER METER

A. Water Service: AWWA Standard C702 compound type. Obtain meter from local Water Authority. Pay all costs.

1. Acceptable Manufacturers: Hersey, Rockwell, Trident, or approved equal.

B. Fire Service: Mainline meter for large flows with full flow waterway and bypass, same size as fire service, FM approved, AWWA Standard C703 cold water meters - fire service type. Shall meet Local Water Authority Standards.

1. Acceptable Manufacturers: Hersey, Trident or approved equal.

2.03 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 909.
4. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

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

1. Cast iron 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 909.
4. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

C. 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 709 DCDA.
7. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

D. 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.

2.04 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 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

3.01 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.

3.02 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.

3.03 WATER METER

A. Provide pressure gauge on outlet side of meter. Provide line size strainer on inlet side of meter. Provide concrete base or pipe stands to support meter assembly. Provide bypass piping with sealed valve around meter.

B. The water meter assembly and piping arrangement shall be installed in accordance with the local Water Authority Standards.

3.04 BACKFLOW PREVENTERS

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

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

3.05 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.

3.06 ARRANGEMENTS

A. Provide for application to and obtain approval from the local Water Authority for connection to municipal systems.

B. Contact the Water Authority for the extent of their work, the costs, fees, required permits and their installation requirements. Make all arrangements, pay all costs, fees and obtain all permits. Include all costs within the base bid.

3.07 CLEANING AND DISINFECTING

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

3.08 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

(PAGE INTENTIONALLY LEFT BLANK)

SECTION 22 13 00
SANITARY, WASTE AND STORM DRAINAGE SYSTEMS

PART 1 - GENERAL

1.01 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.

1.02 SUBMITTALS

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

PART 2 - PRODUCTS

2.01 PLUMBING DRAINAGE SYSTEM

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

2.02 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.

2.03 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

3.01 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.

3.02 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.

3.03 ARRANGEMENTS

A. Make arrangements and obtain approval of the local Sewer Department to connect to the municipal system.

B. Contact the local Sewer Department for the extent of their work, the costs, fees, required permits and installation requirements. Make all arrangements, pay all costs, fees and obtain all permits. Include all costs within the Base Bid.

3.04 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.

3.05 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.

3.06 TESTING

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

END OF SECTION

(PAGE INTENTIONALLY LEFT BLANK)

SECTION 22 13 19.23

OIL WATER SEPARATOR

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install the oil water separator and appurtenances in accordance with the Drawings and these specifications.

1.2 RELATED WORK:

A. Section 31 00 00, EARTHWORK

1.3 QUALITY CONTROL INSPECTION:

A. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the Engineer. Such inspection may be made at the place of manufacture, or on the work site after delivery, or at both places, and the sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. All sections which have been damaged beyond repair during delivery will be rejected and, if already installed, shall be repaired to the Engineer’s acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.

B. All sections shall be inspected for general appearance, dimensions, soundness, etc. The surface shall be dense, close textured and free of blisters, cracks, roughness and exposure of reinforcement.

C. Imperfections may be repaired, subject to the acceptance of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi when tested in accordance with ASTM C-109. Epoxy mortar may be utilized for repairs.

1.4 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Shop Drawings

1. Structural design calculations and shop drawings shall be certified by a Professional Engineer retained by the unit manufacturer or Contractor and licensed in the state where the system is to be installed. Six (6) copies of said shop drawings shall be submitted to the Engineer for review and approval.

PART 2 - PRODUCTS

2.1 MATERIALS AND DESIGN:

A. Concrete for the precast oil water separator shall conform to ASTM C 857 and C 858.

B. Brick or masonry used to build the manhole frame to grade shall conform to ASTM C 32 or ASTM C 139 and shall be installed in conformance with all local requirements.

C. Casting for manhole frames and covers shall be in accordance with ASTM A48, CLASS 30B and AASHTO M105.

D. A bitumen sealant in conformance with ASTM C 990 shall be utilized in affixing the aluminum swirl chamber to the concrete vault.

2.2 MANUFACTURER:

A. The oil water separator shall be Arrow Concrete product designed for a design load of HS-20, or approved equal and shall have a capacity (gallons) as shown on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. The oil water separator shall be constructed according to the sizes shown on the Drawings and as specified herein. Install at elevations and locations shown on the Drawings or as otherwise required by the Engineer.

B. Place the base of the unit on a granular subbase of minimum thickness of six inches after compaction or of greater thickness and compaction if specified elsewhere. The granular subbase shall be checked for level prior to setting and the precast base section of the trap shall be checked for level at all four corners after it is set. If the slope from any corner to any other corner exceeds 0.5% the base section shall be removed and the granular subbase material re-leveled.

C. After setting the precast roof section of the oil water separator, set precast concrete manhole riser sections, to the height required to bring the cast iron manhole covers to grade, so that the sections are vertical and in true alignment with a ¼-inch maximum

tolerance allowed. Backfill in a careful manner, bringing the fill up in 6-inch lifts on all sides. If leaks appear, clean the inside joints and caulk with lead wool to the satisfaction of the Engineer. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of the oil water separator shall conform to ASTM specification C 891 "Standard Practice for Installation of Underground Precast Utility Structures".

D. Holes made in the concrete sections for handling or other purposes shall be plugged with a non-shrink grout or by using grout in combination with concrete plugs.

E. Where holes must be cut in the precast sections to accommodate pipes, do all cutting before setting the sections in place to prevent any subsequent jarring which may loosen the mortar joints. The Contractor shall make all pipe connections.

END OF SECTION 22 13 19.23

(PAGE INTENTIONALLY LEFT BLANK)

SECTION 22 30 10
EQUIPMENT

PART 1 - GENERAL

1.01 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.

1.02 SUBMITTALS

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

PART 2 - PRODUCTS

2.01 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 recessed anti-flood rim; Jay R. Smith Figure #2010 with #F37 rim.
3. Type C: Cast iron body, flashing collar with weepholes, 12 in. diameter grate, heavy duty, deep body, removable sediment bucket; Jay R. Smith Figure #2243C.

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, Mifab, Watts or Zurn.

2.02 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, Mifab, Watts or Zurn.

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

2.04 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.

2.05 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.

2.06 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".

2.07 WATER PRESSURE GAUGES

A. Construction to be Bourdon tube type; 4-1/2 in. diameter, minimum dial face, in cast aluminum case, 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.

2.08 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.

2.09 TEMPERATURE MIXING VALVE - HIGH/LOW TYPE

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. High/low style, single thermostatic mixing valve with 3/4 in. inlet and 1 in. outlet. Flow capacity of 21 gpm at 5 psi pressure drop, and 43 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: Powers Series LFSH 1430, Leonard, or Symmons.

2.10 TRENCH DRAIN

A. Extra Heavy Duty 12" wide grate having safe live load between 7,500 lbs and 10,000 lbs, DIN 19580/EN1433 rated grate and top rim Load Classification 'E'.

B. Pre-sloped Trench Drain System. High density polyethylene structural composite drain channel with 1.04% bottom slope. All sections 96 in. modular lengths, heavy-duty galvanized steel frame with anchor studs, integral top frame, interlocking ends and radiused bottom. Combination tie-down/leveling devices at 20 in. intervals. Integral rebar clip.

C. Galvanized Heel-proof ductile slotted grate - Class E

D. High density polyethylene structural composite catch basin with sediment basket. Complete with interlocking ends, combination tie-down/leveling devices and heavy duty galvanized heel-proof ductile grate - Class E. Integral rebar clip. Heavy duty frame, Zurn model Z887-12 or equal.

E. Provide rebar steel stakes for temporary support and leveling during installation. Size per drain manufacturer.

F. Manufacturer: Zurn Z-882-HDG Trench Drain System or equal.

PART 3 - EXECUTION

3.01 EQUIPMENT CONNECTIONS

A. Plumbing Contractor shall:

1. Provide all roughing and final water, waste, vent, gas, air, vacuum, diesel and/or oxygen 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.

3.02 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.

3.03 WALL HYDRANTS

A. Install minimum 24 in. above grade.

3.04 HOSE BIBBS

A. Install at low points of piping system.

3.05 SHOCK ABSORBERS

A. Install in vertical position.

3.06 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.

3.07 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.

3.08 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.

END OF SECTION

(PAGE INTENTIONALLY LEFT BLANK)

SECTION 22 32 00
COMPRESSED AIR AND VACUUM EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

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

B. Equipment listed in this section shall be used for laboratory and general use only.

1.02 SUBMITTALS

A. Submit shop drawings for all items specified in this section under Part 2 - Products.

1.03 EQUIPMENT MANUFACTURER

A. All system equipment specified under this section shall be provided by the same supplier.

B. Make arrangements for supplier's representative to supervise, inspect and test installation to assure system operates as specified.

PART 2 - PRODUCTS

2.01 DISTRIBUTION PIPING

A. Refer to Specification Section 221010, "Piping Systems and Accessories".

B. Connections: All brazed connections except valves or equipment requiring threaded connections.

C. Fittings:

1. Vacuum: Long-turn drainage pattern, brazing type fittings.
2. Compressed Air: Brazing type fittings.

2.02 VALVES

A. Refer to Specification Section 220523, "Valves".

2.03 COMPRESSED AIR SYSTEM

A. Provide Champion Model HR15-12, or equivalent Ingersoll-Rand, base mounted, duplex compressors and motors, continuous duty rated two stage reciprocating type with sealed bearings, rated to produce a total of 97.4 CFM at 175 psig, and a maximum pressure of 175 psi. The compressor motor shall be NEMA rated, 15 HP at 480 volts, 60 Hz, three phase.

1. Wet-Receiver tank shall be ASME rated for 200 psig working pressure with liquid level gauge glass, safety relief valve, manual drain valve and a timed automatic solenoid drain valve. Tank shall be horizontal with a capacity of 120 gallons.
2. Dry-Receiver tank shall be ASME rated for 200 psig working pressure with liquid level gauge glass, safety relief valve, manual drain valve and a timed automatic solenoid drain valve. Tank shall be vertical with a capacity of 400 gallons.
3. Automatic start and stop operation duplex NEMA 12 control panel, with automatic lead/lag sequencing, circuit breaker disconnects for each motor, 120V control circuit transformer, audible and visual alarms, automatic alternation and Hand-Off-Automatic selector switches for each compressor. Provide two (2) year warranty.

B. Refrigerated Dryer:
1. General: Provide Ingersoll-Rand Model D170NC refrigerated air dryer or approved equal capable of reducing the temperature of 100 CFM air at 175 psig to a pressure dew point (33°F to 39°F). Include with automatic drain valve.
2. Dryer shall incorporate a hermetically sealed air cooled refrigeration compressor/condenser and liquid refrigerant filter dryer.
3. Dryer shall be equipped with a panel mounted evaporator light, power-on light and pre-wired power cord.
4. Electrical Requirements: 120 volts, 60 Hz, single phase.

C. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.

D. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

E. Air-line Lubricators: Drip chamber and sight dome for observing oil drop entering air stream, with oil-feed adjustment screw and quick-release collar for easy bowl removal. Include mounting bracket if wall mounting is indicated. Provide with automatic feed device for supplying oil to lubricator.

F. Safety Valves: ASME Boiler and Pressure Vessel Code: section VIII, "Pressure Vessels" construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety for compressed-air service.

G. Pressure Regulating Valves:

1. Air-Main Pressure Regulators: Pilot operated, Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, rated for 250 psig inlet pressure
2. Air-Line Pressure Regulators: Diaphragm or pilot operated, Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, rated for 200-psig minimum inlet pressure.
3. Design Equipment: Cash Acme No. E-55, arranged for compressed air.

2.04 QUICK COUPLINGS:

A. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

B. Automatic-Shutoff Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
1. Socket End: One-way valve and threaded inlet for connection to piping or threaded hose fitting.
2. Plug-end: straight-through type with barbed outlet for attaching hose.

C. Valveless Quick Couplings: straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
1. Socket End: O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
2. Plug-end: Barbed outlet for attaching hose.

2.05 HOSE ASSEMBLIES:

A. Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.
1. Hose: Reinforced double wire-braid, CR-covered hose for compressed-air service.
2. Hose Clamps: Stainless steel clamps or bands.
3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless steel O-ring or gasket seal swivel coupling with barbed ends for connecting two sections of hose.
4. Hose Splicers: one-piece, straight-through brass or stainless steel fitting with barbed ends for connecting two sections of hose.

2.06 HOSE REELS

A. Compressed Air Hose Reels shall be Lincoln Model No. 85010-50 low pressure wheel for air with all accessories as required for a complete compressor reel assembly as manufactured by Lincoln Industrial, St. Louis, MO, or Alemite or Graco.

1. Fifty feet of half inch (1/2) air hose
2. Reel latch that automatically locks at desired position
3. Air chuck attachement for tire, Lincoln Model No. 6691 hand held meter.
4. Ball stop included
5. Maximum Pressure: 350 psi
6. Material Inlet/Outlet: half inch (1/2) NPT (female)

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. Installations:

1. All work in this section shall be done in accordance with the equipment manufacturer's installation instructions and the latest applicable Codes and NFPA requirements.
2. Provide rigid supports for all valves and equipment to avoid strain on piping.

B. Cleanouts:

1. Install cleanouts in vacuum piping at the top of each riser, at all 90° turns, etc. Use only "Y" type fittings; tees are not acceptable.

3.02 TESTING

A. After installation of tubing but before connecting to system components, test piping sections with a minimum 150 psig of oil free dry nitrogen.

1. Test each joint for leaks by means of soap suds.
2. All leaks shall be located, repaired and piping retested.

3.03 EQUIPMENT START-UP

A. Provide equipment start-up services by a factory-authorized technician based on factory recommendations. Technician shall inspect the work for proper installation, operation and to confirm specified operating parameters. Submit three (3) copies of startup reports with all factory checkout data in writing to the Owner's Representative.

END OF SECTION

SECTION 22 34 00
WATER HEATERS

PART 1 - GENERAL

1.01 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.

1.02 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.
7. Condensate Neutralizer Kit.

1.03 SPECIAL COORDINATION

A. Coordinate all work of other trades in Mechanical Room.

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

2.01 WATER HEATER COMMERCIAL GAS-FIRED, CONDENSING TANK TYPE

A. Provide 60 gallon 160 PSI ASME condensing tank type gas water heater with recovery rate of 138 at 100°F rise.

B. Provide units with 98% minimum thermal efficiency and sealed, submerged combustion chamber. Provide units with zero clearance capabilities from combustibles. Provide units with power burner and diagnostic electronic controls. Modulating burner with 5:1 turndown.

C. Provide AGA rated, ASME stamped temperature and pressure relief valve. Pipe to drain.

D. Provide venting as per detail sealed vertical using manufacturer approved CPVC Schedule 40, Polypropylene, or AL-294C stainless steel construction. Terminations per code.

E. Provide condensate drain for exhaust elbow.

F. Provide condensate neutralizer for drain.

G. Provide a three (3) year warranty against tank leakage.

H. Provide start up report from factory authorized service agent to include combustion efficiency, safety and operating control check and verification of proper venting.

I. Design Equipment: AO Smith CYCLONE Model Mxi Modulating.

J. Acceptable Manufacturers: AO Smith, Lochinvar, State, or approved equal.

2.02 WATER HEATER CONDENSATE NEUTRALIZER FILTERS

A. High density polyethylene or polypropylene, seamless construction, bolted access cover with collar and neoprene seal.

B. Limestones or marble chips, 1 in. to 3 in. size, quantity per basin manufacturer.

C. Acceptable Manufacturers: AO smith, Enfield, Orion or Sloan.

2.03 THERMAL EXPANSION TANK

A. Vertical steel expansion tank constructed and designed per ASME Code Section VIII, 125 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. Refer to drawing schedule for factory pre-charged pressure, volume, and maximum acceptance factors. The manufacturer will be similar to y Amtrol, Wessel or approved equal.

B. Design Equipment: Amtrol.

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

2.04 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

3.01 WATER HEATERS

A. Install each heater on a 4 in. high concrete pad.

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 gas pressure regulator when inlet gas pressure exceeds 14 in. w.c.

G. 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. Fuel supply piping and connection(s).
3. Combustion efficiency.
4. Verification of proper temperature rise across heater(s).
5. Verification of proper venting with draft reading.
6. Operating and safety controls.
7. Proper operation of equipment.
8. Verification of piping arrangement and aquastat location.
9. Verification of proper gas pressure to unit and to burners.
10. Relief valve settings and AGA BTU capacities.
11. All control settings.

H. 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.

I. Place equipment in operation.

J. 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.

3.02 CONDENSATE NEUTRALIZERS

A. Verify if condensate neutralizer is available from factory to be provided with water heater to site.

B. Install unit with 1/2 in. polyethylene or polypropylene tubing or piping in accordance with the water heater manufacturer's recommendations.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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.

1.04 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

2.01 WATER CLOSETS

A. WC-A (ADA):

1. American Standard #2257.101 Afwall, wall hung, vitreous china, siphon jet, elongated bowl, 1.28 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.

2.02 URINALS

A. UR-A (ADA):

1. American Standard #65901.501, Washbrook 0.5 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-U 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.

2.03 FLUSH VALVES

A. FV-A: Sloan #8111-1.28 GPF, sensor operated, battery powered, closet flushometer, for left or right hand supplies, exposed diaphragm type, 1 in. screwdriver angle stop with vandal resistant metal cap and replaceable sensor window, bumper on stop, vacuum breaker, adjustable tailpiece, sweat solder adaptor kit, cast wall flange with set screw, override button, adjustable sensor on centerline of fixture, sentinel flush every 24 hours after last flush, low battery flashing LED and powered by (4) size AA batteries, 3 year battery life @ 4,000 flushes per month.

B. FV-U: Sloan #8186-0.5 GPF, sensor operated, battery powered, urinal flushometer, for left or right hand supplies, exposed diaphragm type, 3/4 in. screwdriver angle stop with vandal resistant metal cap and replaceable sensor window, vacuum breaker, adjustable tailpiece, sweat-solder adaptor kit, cast wall flange with set screw, override button with adjustable sensor on centerline of

fixture, sentinel flush every 24 hours after last flush, low battery flashing LED and powered by four (4) size AA batteries, three (3) year battery life @ 4,000 flushes per month.

2.04 LAVATORIES

A. LAV-A (ADA):

1. American Standard #0355.012 Lucerne, 20 in. x 18 in., wall hung, vitreous china lavatory with 4 in. centers, front overflow, self-draining deck and punching for concealed arm carrier, fitted with 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, cast brass escutcheon with set screws.
   e. Jay R. Smith Series 700 concealed arm floor mounted carrier with rectangular uprights.
   f. Cover exposed waste, stops and supply piping with ADA conforming pipe covers, Truebro, Inc. "Lav-Guard".
   g. Mount at ADA required height and location or as shown on Architectural drawings.

B. LAV-B (ADA):

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".

2.05 SINKS

A. SK-A (ADA):

1. Elkay Lustertone LRAD2219, 22 in. x 19 in. x 6 in. deep, nickel type 302 stainless steel single bowl sink, ADA compliant, three (3) faucet holes, 18 gauge, self-rimming for countertop installation, fitted with the following:

a. F-B 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.

2.06 FAUCETS

A. F-A:

1. Chicago Faucets Hytronic #116.221.AB.1, dual supply, with user adjustable temperature mixing valve and integral checks, CP solid cast brass electronic sensor faucet, battery operated, deck mounted, 4 in. centers, lead-free, cover plate, vandalproof non-aerating spray outlet, stainless steel braided hose supply, ADA compliant and fitted with the following:

a. 0.50 GPM aerator.

b. Chicago #131-ABNF, lead-free, thermostatic mixing valve, 3/8 in. connections.

c. 6 volt lithium CRP2 battery.

d. ADA compliant, chrome plated.

B. F-B:

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. Chicago #131-ABNF, lead-free thermostatic mixing valve, 3/8 in. connections.

c. #317 4 in. wrist blade handles.

d. ADA compliant.

2.07 SERVICE SINK

A. SS-A:

1. American Standard Akron #7695.008, 24 in. x 20 in. cast iron acid resisting, drilled back, enameled one-piece service sink with stainless steel rim guard on three sides, supported on wall hanger and fitted with the following:

a. T&S Brass #B-0665-BSTP, lead-free, exposed sink faucet with integral stops, hose end spout with bucket hook, vacuum breaker, union couplings, threaded 1/2 in. outside, rough plated body.

b. American Standard #7798.030 3 in. cast iron acid resisting enameled inside adjustable trap standard with cleanout plug and strainer.

2.08 MOP BASINS

A. MB-A:

1. Fiat Model MSB, molded stone, 24 in. x 24 in**.** x 10 in. deep, stainless steel flat strainer, 2 in. outlet 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 2424 Stainless Steel Wall Guard.

f. Provide silicone sealant between wall, floor and mop basin.

2.09 SHOWERS

A. SH-A (SHOWER, ADA):

1. Aquatic Advantage #16030BFSC, 62-3/8 in. x 32-3/4 in. x 78-1/2 in. (exterior), one piece shower cabinet, white acrylic with fiberglass and polyester resin backing, smooth wall, 2 in., chrome plated cast brass center drain, for right or left hand valves as indicated on drawings and fitted with the following:

a. Reinforcement to accommodate grab bar locations.

b. Grab bars.

c. Fold-up shower seat, soap dish, curtain rod.

d. Vinyl flexible dam.

e. Fixed shower head and hand-held shower system.

f. Moen commercial T8346EP15, 1.5 chrome finish trim, WaterSense certified.

g. Moen single handle Posi-Temp pressure balancing shower valve with check stops maximum temperature stop.

h. Hand-held shower with non-positive pause, 30 in. slide bar, drop ell, 69 in. metal hose and mounting hardware.

i. Cabinet shall be set in a bed of mortar.

2.10 EMERGENCY SHOWER AND EYE/FACE WASH (FREE-STANDING)

A. Equal to Speakman #SE-607 free-standing emergency shower complete with deluge shower head, stay open valve with rigid pull rod and ring, stanchion floor flange, interconnecting fittings, aerated eye/face wash, 1/3 in. full flow valve activated by hand and foot with stainless steel bowl.

2.11 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

3.01 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.

3.02 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.

3.03 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.

3.04 CONNECTIONS

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

3.05 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

SECTION 22 70 10
NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.01 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.

1.02 SUBMITTALS

A. Provide manufacturer's data sheets and installation instructions for all equipment and accessories in this section in accordance with Basic Mechanical/Electrical Requirements and Division 01.

1.03 QUALITY ASSURANCE

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

1. 2020 Fuel Gas Code of New York State.
2. American Gas Association.
3. Local Utility Company.

B. Provide equipment and accessories that are listed and labeled by a nationally recognized testing laboratory.

1.04 GAS SERVICE

A. All new underground gas service piping from the street main to, and including, the gas meter will be installed by CoEdison.

B. The cost of this work shall be included in this Contractor's bid.

C. This Contractor shall provide the meter pad, pipe bollards and meter enclosure.

1.05 GAS PRESSURE

A. The maximum allowable gas pressure inside the building is 1/2 psi.

1.06 UNDERGROUND GAS PIPING

A. All underground gas piping located downstream of the gas meter shall be installed by a ConEdison approved utility contractor in accordance with the gas company's requirements.

B. The cost of this work shall be included in this Contractor's bid.

PART 2 - PRODUCTS

2.01 GAS PIPING

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

B. All exposed exterior and interior piping shall be primed and painted with one coat of alkyd primer and two coats of exterior acrylic latex gloss enamel. Color shall be as selected.

2.02 VALVES

A. Refer to Specification Section 220523, "Valves".

2.03 GAS PRESSURE REGULATORS

A. Cast iron body, die-cast aluminum alloy diaphragm case, field adjustable, removable orifice, internal relief valve, threaded connections, lockup style.

B. Inlet pressure 27 in. wc, outlet pressure 14" in. wc, 0 to 3,700 CFH.

C. Design Equipment: Sensus.

D. Manufacturers: Sensus, Fisher Controls or approved equal.

2.04 GAS METER

A. Rotary type, 175lb meter, flanged connections, aluminum case, polished aluminum impellers, tamper resistant, counter with instrument drive, pulse output, temperature compensated.

B. Capacity: 3,700 CFH, inlet gas pressure 0.5 psi.

C. Design Equipment: Dresser Series B3 Roots Meter.

D. Manufacturers: Dresser, Sensus, American Meter or approved equal.

2.05 FLEXIBLE CONNECTORS

A. Stainless steel construction and in accordance with ANSI Z21.24.

2.06 GAS METER PAD

A. 3000 psi concrete pad on 12 in. gravel base, depth, length and width as required by the utility company.

2.07 GAS METER FENCE ENCLOSURE

A. Chain-link fabric, framework and fittings shall be hot-dipped galvanized produced to conform to ASTM-120.

B. Intermediate Posts, Gate Post and End Post: 3 in. O.D., Schedule 40 steel, with caps.

C. Top and Bottom Rails: 1-5/8 in. O.D., Schedule 40 steel.

D. Fabric: Hot dipped galvanized steel 2 in. mesh, 9 gauge, 84 in. high with knuckle top.

E. All fencing materials enclosing gas meter-regulator assemblies shall meet or exceed requirements of utility company.

2.08 LOCATOR TAPE

A. Yellow plastic tape, intended for direct-burial service, not less than 6 in. wide x 4 mils thick with #10 AWG coated stranded copper wire tracer. Lettering on the tape shall state, "CAUTION: BURIED GAS LINE BELOW".

B. Manufacturers: Calpico, Griffolyn, Terra Tape or approved equivalent.

PART 3 - EXECUTION

3.01 ARRANGEMENTS

A. Make arrangements with Patrick Farrell, Customer Project Manager for Consolidated Edison Company of New York, Inc., Cell: 646-245-6993 / Office: 914-789-6079 to provide the gas service and meter at the indicated location.

B. Contact the utility company for the cost of the service, its fees and required permits. Pay all costs and include within the base bid.

C. The service load is 3,700,000 Btuh. The pressure at the meter outlet shall be set at 14 in. wc.

D. Coordinate all service requirements with the utility company.

E. The contractor shall arrange for the plumbing inspector to inspect the gas piping and vent installations upon completion including underground and rough-ins, as well as installation of gas-fired appliances.

3.02 GAS METER PAD

A. Provide concrete pad on 12 in. gravel base. Verify exact size and placement of meter pad with the utility company.

B. Provide with 6 x 6, 10/10 WWM in top one-third of the concrete meter pad.

3.03 GAS METER FENCE ENCLOSURE

A. Provide chain link fence enclosure with roof and locked swing gate at each exterior gas meter location. Enclosure size and swing gate at location required by utility company. Minimum 14 ft. x 6 ft. x 7 ft. high with 4 ft. swing gate.

B. Installation of fencing shall meet the requirements of ASTM F-567 (Part 3) and utility company.

C. All posts shall be set in minimum 12 in. diameter concrete to at lease three feet below grade. Posts shall extend a minimum of 7 ft. above grade.

D. Intermediate post shall be spaced a maximum of 10 ft. on center. Posts shall be provided at all corners, ends and gate openings.

E. Posts shall be set at least 24 in. away from any part of the gas meter-regulator assembly or as required by utility company.

F. Entire fenced area extending a minimum of 6 in. outside of the enclosure shall be surfaced with a layer of crushed stone, a minimum of 6 in. thick. Place stone atop black landscaping fabric.

3.04 GAS DISTRIBUTION SYSTEM

A. Provide distribution system from gas meter outlet, including meter pad, fence enclosure, mains, risers, branches, drips, shut-offs and other required parts. Connect to equipment or appliances indicated or specified as requiring gas for their operation.

B. Provide shutoff valve at the meter outlet. Provide all parts and accessories needed to connect to meter.

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

3.05 PIPING INSTALLATION

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

B. Drips and Sediment Traps: Install drips at points where condensate may collect. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.

C. 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.

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

E. Provide pressure regulator in supply to each gas fired appliance as required.

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

G. 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.

H. 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.

I. Install pressure-relief or pressure-limiting devices so they can be readily operated to determine if valve is free; test to determine pressure at which they will operate; and examine for leakage when in closed position.

J. Install gas piping across exit corridors within an airtight conduit constructed of Schedule 40 seamless black steel pipe with welded joints. Vent conduit to outside of exit corridor.

3.06 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 the 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 with inside smooth; 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. Exercise caution to prevent heat related damage to plastic parts within the gas meter or regulators.

B. Welder qualifications: Welded piping fabricated by certified welder. Welder shall be certified under ASME or API Code III.

3.07 CONNECTIONS

A. Install gas piping next to gas-utilizing equipment and appliances for 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. Valves, unions and flexible connectors shall be same size as the gas supply piping to the equipment.

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

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

3.08 UNDERGROUND PIPING INSTALLATION

A. All underground piping shall be installed by a utility approved contractor in accordance with the gas company's requirements.

B. Qualification by the utility company is required for the individual making heat-fusion joints.

C. The service main shall be installed with a minimum 36 in**.** cover and shall in all cases conform to be requirements of the pipe manufacturer instructions.

D. Install piping a minimum 5 ft. - 0 in. from buildings.

3.09 LOCATOR TAPE

A. Install the locator tape with the gas main, which can be used to help determine the location of the gas piping at a future time. Locate directly over the buried gas line at a depth of 6 in. below finished grade.

B. Terminate tracer wire in cast iron boxes. Maximum spacing between boxes shall be 500 ft.

3.10 GAS PIPING TESTS

A. Test natural gas systems according to 2020 Fuel Gas Code of New York State and the local utility requirements unless otherwise noted:

1. Test pressure shall be 1-1/2 times working pressure, but not less than 3 psi for two (2) hours for steel piping.
2. Pressure testing of plastic piping shall be per utility's requirements.

B. Tests shall be witnessed by utility company. Make arrangements, provide all necessary items to complete testing and pay all costs.

C. All tests shall be performed prior to the connection of equipment. Regulator shall be isolated from test pressures. Soap test shall be conducted on all joints. Repair leaks and defects with new materials. Retest system until satisfactory results are obtained.

D. Verify correct pressure settings for pressure regulators.

E. Provide written certification that tests have been conducted and satisfactorily completed. Submit to Owner's Representative.

3.11 GAS LINE PURGING

A. At completion of pressure test, purge all natural gas systems according to 2020 Fuel Gas Code of New York State and the utility company requirements.

B. Provide three (3) days notice to utility company to have the meter unlocked for service and equipment start up. Make all arrangements and pay all fees as required by the Utility Company.

END OF SECTION