

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Positive displacement meters.
2. Heat consumption meters.
3. Liquid flow meters.
4. Pressure gages.
5. Pressure gage taps.
6. Thermometers.
7. Thermometer supports.
8. Test plugs.
9. Flexible connectors.
10. Expansion tanks.
11. Diaphragm-type expansion tanks.
12. Air vents.
13. Air separators.
14. Strainers.
15. Flow meters.
16. Radiator valves.
17. Relief valves.
18. Glycol charging equipment.
19. Glycol solution.
20. Drain Valves

B. Related Sections:

1. Section 23 05 13 - Pipes and Tubes for HVAC Piping and Equipment: Piping: Execution requirements for piping connections to products specified by this section.
2. Section 23 21 23 - Hydronic Pumps: Execution requirements for piping connections to products specified by this section.

1.02 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
 - 2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- B. ASTM International:
 - 1. ASTM E1 - Standard Specification for ASTM Thermometers.
 - 2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
- C. American Water Works Association:
 - 1. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
 - 2. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
 - 3. AWWA C702 - Cold-Water Meters - Compound Type.
 - 4. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
 - 5. AWWA M6 - Water Meters - Selection, Installation, Testing and Maintenance.
- D. Underwriters Laboratories Inc.:
 - 1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
 - 2. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.03 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for manufactured products and assemblies used in this Project.
 - 1. Manufacturer's data indicating use, operating range, total range, accuracy, and location for manufactured components.
 - 2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
 - 3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
 - 4. Submit electrical characteristics and connection requirements.

- C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection, and hookup configuration. Include pipe and accessory elevations.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of actual locations of components and instrumentation, flow controls and flow meters.
- C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.05 QUALIFICATIONS

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

1.06 DELIVERY, STORAGE AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.
- B. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.08 FIELD MEASUREMENTS

- A. Verify field measurements before fabrication.

1.09 MAINTENANCE SERVICE

- A. Division 01 - Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of glycol fluid and glycol charging components for one (1) year from Date of Substantial Completion.

1.10 MAINTENANCE MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance materials.
- B. Furnish two (2) bottles of red gage oil for static pressure gages.

1.11 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two (2) pressure gages with pulsation damper dial thermometers.

PART 2 - PRODUCTS

2.01 POSITIVE DISPLACEMENT METERS (LIQUID)

- A. Manufacturers: Subject to requirements of the specification, provide the following manufacturer's products by one of the following or approved equal:
 - 1. Preso Meter
 - 2. Lincoln Meter
 - 3. Carlon Meter
- B. AWWA C701, positive displacement disc type suitable for fluid with bronze case and cast iron frost-proof, breakaway bottom cap, hermetically sealed register, remote reading to AWWA C706.
- C. Meter: Brass body turbine meter with magnetic drive register.
 - 1. Service: Cold water, 122 degrees F (50 degrees C) and Hot water, 200 degrees F (93 degrees C).
 - 2. Nominal Flow: Refer to drawings.

3. Pressure Drop at Nominal Flow: 1 psi.
4. Maximum Operating Pressure: 150 psi.
5. Accuracy: 1-1/2 percent.
6. Maximum Counter Reading: 100 million gallons (liters).

2.02 HEAT CONSUMPTION METERS

- A. Furnish materials in accordance with IBC-NJ.
- B. Meter: Brass body turbine meter with magnetic drive register, platinum temperature sensors.
 1. Maximum Service Temperature: 200 degrees F (93 degrees C).
 2. Nominal Flow: Refer to drawings.
 3. Pressure Drop at Nominal Flow: 1 psi (0 kPa).
 4. Maximum Operating Pressure: 150 psi (0 kPa).
 5. Accuracy: 1-1/2 percent.
 6. Maximum Counter Reading: 1 million btuh (kJ).
 7. Power: Lithium Battery.

2.03 LIQUID FLOW METERS

- A. Measuring Station: Type 316 stainless steel pitot type flow element with safety shut-off valves and quick coupling connections.
 1. Support: Inserted through welded threaded couplet with isolation valve and insert-retract mechanism.
 2. Pressure rating: 275 psi (1896 kPa).
 3. Maximum temperature: 400 degrees F (204 degrees C).
 4. Accuracy: Plus 0.55 percent to minus 2.30 percent.
 5. Labeling: Metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.
- B. Meter Set: Dry single diaphragm type gage with magnetic drive, 2-1/2 inch (65 mm) x 6 inch (150 mm) dial, stainless steel wetted metal parts, and direct reading of flow rate, with two 10 foot (3 m) long nylon test hoses with fittings.
- C. Portable Meter Set: Dry single diaphragm type gage with magnetic drive, 2-1/2 inch (65 mm) x 6 inch (150 mm) dial, stainless steel wetted metal parts, and direct reading of flow rate. Mounted in rust-proof carrying case with two 10 foot (3 m) long rubber test hoses with brass valves or quick connections for measuring stations.

2.04 PRESSURE GAGES

- A. Gage: ASME B40.1, UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
 - 1. Case: Cast aluminum.
 - 2. Bourdon Tube: Brass.
 - 3. Dial Size: 4-1/2 inch (114 mm) and 8-1/2 inch (216 mm)] diameter.
 - 4. Mid-Scale Accuracy: One percent.
 - 5. Scale: Both psi and kPa.

2.05 PRESSURE GAGE TAPS

- A. Needle Valve: Brass, 1/4 inch (6 mm) NPT for minimum 300 psi (2070 kPa).
- B. Ball Valve: Stainless Steel, 1/8 inch (3 mm) NPT for 250 psi (1720 kPa).
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch (6 mm) NPT connections.
- D. Siphon: Steel, Schedule 40, 1/4 inch (6 mm) NPT angle or straight pattern.
- E. Scale ranges shall be:
 - Oil Pumps - 0 PSI to 125 PSI
 - Other Systems - 0 PSI to (2 x Operating Pressure) PSI
(Minimum 0 PSI to 30 PSI)

2.06 STEM TYPE THERMOMETERS

- A. Manufacturers: Subject to requirements of the specification, provide the following manufacturer's products by one of the following or approved equal:
 - 1. Weksler
 - 2. Taylor
 - 3. Mueller
 - 4. Substitutions: Division 01 - Product Requirements.
- B. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
 - 1. Size: 9 inch (229 mm) scale.
 - 2. Window: Clear [glass] [Lexan].

3. Stem: Brass, 3-1/2 inch (89 mm) long.
 4. Accuracy: ASTM E77 2 percent.
 5. Calibration: Both degrees F and degrees C.
- C. Scale ranges should be as follows:
- | | |
|-----------------|-----------------|
| Hot water | - 30°F to 240°F |
| Condenser water | - 20°F to 120°F |
| Chilled water | - 0°F to 100°F |

2.07 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions[, and with cap and chain].
- B. Flange: 3 inch (76 mm) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.08 TEST PLUGS

- A. 1/4 inch (6 mm) NPT or 1/2 inch (13 mm) NPT brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with:
 1. Neoprene core for temperatures up to 200 degrees F (93 degrees C).
 2. Nardel core for temperatures up to 350 degrees F (176 degrees C).
 3. Viton core for temperatures up to 400 degrees F (204 degrees C).
- B. Test Kit:
 1. Carrying case, internally padded and fitted containing:
 - a. Two 3-1/2 inch (89 mm) diameter pressure gages.
 - b. One gage adapters with 1/8 inch (3 mm) probes.
 - c. Two 1-1/2 inch (38 mm) dial thermometers.
 - 1) Scale range: 0 to 200 degrees F (93 degrees C).

2.09 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Manufacturers: Subject to requirements of the specification, provide the following manufacturer's products by one of the following or approved equal:
 1. Bell & Gosset
 2. Taco
 3. Substitutions: Division 01 - Product Requirements.

- B. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure, with flexible butyl diaphragm sealed into tank, and steel support stand.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to minimum pressure required to flood highest point in piping system plus 5 psig.
- D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow prevention device, test cocks, strainer, vacuum breaker, and by-pass valves to meet local code.
- E. Provide closed expansion tanks for the closed water systems where located and of sizes and capacities as indicated on Drawings. Drain lines shall terminate at nearest floor drain. Tanks shall be constructed in accordance with ASME Code for unfired vessels.
- F. Provide concrete pad for floor-mounted tanks and proper support from structure for suspended tanks.
- G. Install all accessories and trim as shown on typical details for expansion tanks including pressure gauges and pressure reducing valves.

2.10 AIR VENTS

- A. Manual Type: Short vertical sections of 2 inch (50 mm) diameter pipe to form air chamber, with 1/8 inch (3 mm) brass needle valve at top of chamber.
- B. Float Type:
 - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
- C. Where the hot and cold water system is trapped and air is liable to be pocketed, furnish and install a manual vent to properly relieve the system of air. The discharge from these vents shall be piped with copper tubing to the nearest slop sink, floor drain or to a location easily accessible from the floor.

2.11 AIR SEPARATORS

- A. Dip Tube Fitting: For 150 psig (1034 kPa) operating pressure; to prevent free air collected in boiler from rising into system.
- B. Combination Air Separators/Strainers: Steel, tangential, tested and stamped in accordance with ASME Section VIII to suite the operating pressure, with integral bronze strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube, support brackets.
- C. Air separators shall be Rolaitrol as manufactured by Bell & Gossett or approved equal. Provide brackets, supports and angle iron frame.

2.12 STRAINERS

- A. Size 2 inch (50 mm) and Smaller:
 - 1. Screwed brass, iron or steel body to suite the working pressure (minimum 175 psig), Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
- B. Size 2-1/2 inch (65 mm) to 4 inch (100 mm):
 - 1. Flanged iron or steel body to suite the working pressure (minimum 175 psig), Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.
- C. Size 5 inch (125 mm) and Larger:
 - 1. Flanged iron or steel body to suite the working pressure (minimum 175 psig), basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.
- D. For each strainer, provide blow-off valve and cap.

2.13 FLOW METERS

- A. Orifice type by-pass circuit with direct reading gage, soldered or flanged piping connections for 125 psig (860 kPa) working pressure, with shut off valves, and drain and vent connections.
- B. Direct reading with insert pitot tube, threaded coupling, for 150 psig (1034 kPa) working pressure, maximum 240 degrees F (115 degrees C), 5 percent accuracy.
- C. Cast iron, wafer type, orifice insert flow meter for 250 psig (1720 kPa) working pressure, with read-out valves equipped with integral check-valves and caps with gaskets.
- D. Calibrated, plug type balancing valve with precision-machined orifice, readout valves equipped with integral check valves and caps with gaskets, calibrated nameplate and indicating pointer.
- E. Cast iron or bronze, globe style, balancing valve with hand wheel with vernier type ring setting and memory stop, drain connection, readout valves equipped with integral check valves and caps with gaskets.
- F. Portable meter consisting of case containing one, 3 percent accuracy pressure gage with 0-60 feet (0-180 kPa) pressure range for 500 psig (3450 kPa) maximum working pressure. Color-coded hoses for low and high-pressure connections, and connectors suitable for connection to read-out valves.

2.14 RADIATOR VALVES

- A. Angle or straight pattern, rising stem, inside screw globe valve for 125 psig (860 kPa) working pressure, with bronze body and integral union for screwed connections, renewable composition disc, plastic wheel handle for shut-off service, and lock-shield key cap and set screw memory bonnet for balancing service.

2.15 RELIEF VALVES

- A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.
- B. Provide one or more relief or safety valves on the low pressure side of the pressure reducing valve station. The capacity of the relief valve shall be such that the pressure rating of the lower pressure piping and equipment will not be exceeded if the reducing valve sticks open.
- C. Steam pressure relief valves on piping and equipment unless otherwise specified shall be of the pop safety type. They shall have enclosed springs and side outlets. Valve discharge piping shall be run to the high roof of the main buildings.
- D. Relief valves 2" and smaller shall be bronze, screwed, semi-finished and valves 2-1/2" and larger shall be iron body, bronze mounted and flanged.

2.16 DRAIN VALVES

- A. Provide drain valves with hose bibb end at all low points of water systems. Drain valves shall be gate type. Minimum 3/4" drain size shall be used up to 4" pipe size. 2" drain size shall be used for pipes 5" size and over. Also provide a fill valve for each water system, with a back-flow preventer as described below. All drain and fill valves shall have caps or plugs as applicable.

2.17 WATER RELIEF VALVES

- A. Where required provide ASME water relief valve of. Each valve shall be provided with manual lifting lever capable of opening the valve as desired. A discharge line shall be run to floor drain from each valve. No shutoff valve shall be placed between relief valve and system

2.18 GLYCOL CHARGING

- A. Provide a make-up water tank, 100 gallon capacity minimum, of polyethylene. Tank shall have make-up water receiver tunnel, glass gage for level indication, automatic make-up water float valve and shall be mounted at least 36" above the floor, on galvanized steel legs.
- B. Below the tank, on a steel platform, provide make-up water pumps of the two-stage turbine type, with high head and low volume 2 GPM. Wire pump starter controls to the pressure switch on expansion tank. Active pump thru a manual selector switch, shall start pumping upon demand by the expansion tank level or pressure switch and cut off upon reaching the high limit of the expansion tank controller. Provide check valves, shut-off and other appurtenances as required.

2.19 GLYCOL SOLUTION

- A. Inhibited propylene glycol and water solution mixed 40 percent glycol - 60 percent water, suitable for operating temperatures from -10 degrees F.

PART 3 - EXECUTION

3.01 INSTALLATION - METERS

- A. Install heat consumption meters and liquid flow meters with shutoff valves on inlet and outlet in the following locations:
 - 1. Positive Displacement Meter Location:
 - a. Steam condensate return.
 - b. Expansion tank make-up.
 - c. Cooling tower make-up.
 - 2. Heat Consumption Meter Location:
 - a. Heating water system.
 - b. Steam condensate return.
 - 3. Flow Meter Location:
 - a. Heating water system.
 - b. Condensate water system.
 - c. Chilled water system

3.02 INSTALLATION - THERMOMETERS AND GAGES

- A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.
 - 1. In inlet and outlet of water coil.
 - 2. In inlet and discharge side of each pump.
 - 3. At each expansion tank.
 - 4. Other locations as shown on the drawings.
 - 5. At inlet and outlet of each heat exchanger and chiller.
- B. Install gage taps in piping.
- C. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Extend nipples to allow clearance from insulation.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches (65 mm) for installation of thermometer sockets. Allow clearance from insulation.

- E. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Install at the following locations:
 - 1. In inlet and outlet water connections at each water coil bank in each air handling unit.
 - 2. In inlet and outlet of hot water heat exchangers.
 - 3. Supply, return and mixed air duct of each air handling unit.
 - 4. In supply and return water connection to each heating coil provide a thermometer and pressure gauge.
 - 5. Chilled water heater.
 - 6. At other locations shown on drawings.
 - 7. Inlet and outlet of each chiller.
- F. Coil and conceal excess capillary on remote element instruments.
- G. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- H. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- I. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.03 INSTALLATION - HYDRONIC PIPING SPECIALTIES

- A. Locate test plugs adjacent to thermometers and thermometer sockets and pressure gage taps as indicated on Drawings.
- B. Where large air quantities accumulate, provide enlarged air collection standpipes.
- C. Install manual air vents at system high points.
- D. For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.
- E. Provide drain valves at all coils, pieces of equipment and at all low points in system. Pipe to local floor drain.
- F. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- G. Provide drain and hose connection with valve on strainer blow down connection.
- H. Support pump fittings with floor mounted pipe and flange supports.

- I. Provide radiator valves on water inlet for the following terminal heating unit types: radiation, unit heaters, and fan coil units.
- J. Provide radiator-balancing valves on water outlet for the following terminal heating unit types: radiation, unit heaters, and fan coil units.
- K. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- L. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- M. Pipe relief valve outlet to nearest floor drain.
- N. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- O. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.

3.04 FIELD QUALITY CONTROL

- A. Section 01 - Quality Requirements, and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test for concentration of glycol and water solution and submit written test results.

3.05 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean and flush glycol system before adding glycol solution.

3.06 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 01 - Execution and Closeout Requirements: Requirements for protecting installed construction.
- B. Do not install hydronic pressure gauges until after systems are pressure tested.

END OF SECTION