

SECTION 15120

HYDRONIC PIPING SPECIALTIES

**PART 1 –GENERAL**

1.1 SUMMARY

- A. Section includes positive displacement meters, heat consumption meters, pressure gages and pressure gage taps, thermometers and thermometer wells, static pressure gages, filter gages, expansion tanks, air vents, air separators, strainers, pump suction fittings, combination fittings, flow indicators, controls, meters, glycol specialties, steam traps, steam air vents, flash tanks, blow down tanks, pressure-reducing valves, steam safety valves and steam condensate meters.

1.2 REFERENCES

- A. ASME (American Society of Mechanical Engineers) - Boiler and Pressure Vessel Codes, SEC VIII-D - Rules for Construction of Pressure Vessels.
- B. ASME B40.1 (American Society of Mechanical Engineers) - Gauges - Pressure Indicating Dial Type - Elastic Element.
- C. ASTM E1 - Standard Specification for ASTM Thermometers.
- D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
- E. ASTM A105 - Forgings, Carbon Steel, for Piping Components.
- F. ASTM A126 - Grey Iron Castings for Valves, Flanges, and Pipe Fittings.
- G. ASTM A216 - Steel Casings, Carbon, Suitable for Fusion Welding, for High Temperature Service.
- H. ASTM A395 - Ferric Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
- I. AWWA C700 (American Water Works Association) - Cold-Water Meters - Displacement Type, Bronze Main Case.
- J. AWWA C701 (American Water Works Association) - Cold-Water Meters - Turbine Type, for Customer Service.
- K. AWWA C702 (American Water Works Association) - Cold-Water Meters - Compound Type.

- L. AWWA C706 (American Water Works Association) - Direct-Reading Remote-Registration Systems for Cold-Water Meters.
- M. AWWA M6 (American Water Works Association) - Water Meters - Selection, Installation, Testing, and Maintenance.
- N. UL 393 (Underwriters Laboratories, Inc.) - Indicating Pressure Gauges for Fire-Protection Service.
- O. UL 404 (Underwriters Laboratories, Inc.) - Gauges, Indicating Pressure, for Compressed Gas Service.

### 1.3 SYSTEM DESCRIPTION

- A. Use Thermostatic Steam Traps for:
  - 1. Steam radiation units.
  - 2. Convectors.
  - 3. Unit ventilators.
  - 4. Other similar terminal heating units.
- B. Use Float or Thermostatic Traps for:
  - 1. Unit heaters.
  - 2. Converters.
  - 3. Heating coils.
  - 4. Steam separators.
  - 5. Flash tanks.
  - 6. Piping..
  - 7. Heat exchangers.
- C. Use Inverted Bucket Steam Traps for:
  - 1. Main headers.
  - 2. Branch lines.
  - 3. Steam jacketed equipment.
  - 4. Direct steam injected equipment.
  - 5. De-aerators.
  - 6. Absorption chillers.

### 1.4 PERFORMANCE REQUIREMENTS

- A. Steam Traps:
  - 1. Select to handle minimum of two times maximum condensate load of apparatus served.
  - 2. Pressure Differentials:
    - a. Low Pressure Systems (15 psi maximum): 2 psi.
    - b. Medium Pressure Steam (40 psi maximum): 10 psi.

- c. High Pressure Steam (120 psi maximum): 30 psi.

## 1.5 SUBMITTALS

- A. See Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for manufactured products and assemblies required for this Project.
  - 1. Manufacturer's data listing 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 specialty.
  - 4. Submit electrical characteristics and connection requirements.
- C. Samples: Submit two of each product to be installed.
- D. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection, and hookup configuration. Include pipe and accessory elevations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

## 1.6 CLOSEOUT SUBMITTALS

- A. Section 01770 - Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of components and instrumentation, flow controls, flow meters, and other products. Submit inspection certificates for pressure vessels from Authority having jurisdiction.
- C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.8 PRE-INSTALLATION MEETING

- A. Section 01330 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect equipment.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- 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.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Store and protect equipment.
- B. Do not install instruments when areas are under construction, except for required rough in, taps, supports and test plugs.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.12 WARRANTY

- A. Section 01770 - Execution Requirements: Product warranties and product bonds.
- B. Provide a minimum of one year manufacturer's warranty for piping specialties.

1.13 MAINTENANCE SERVICE

- A. Section 01770 - Execution Requirements: Maintenance service
- B. Provide monthly visits for one year starting from Date of Substantial Completion to make glycol fluid concentration analysis on site with refractive index measurement instrument. Detail findings with maintenance personnel in writing of corrective actions needed including analysis and amounts of glycol or water added.

1.14 MAINTENANCE MATERIALS

- A. Section 01770 - Execution Requirements: Spare parts and maintenance materials.

**PART 2 –PRODUCTS**

2.1 POSITIVE DISPLACEMENT METERS (LIQUID)

- A. AWWA C700, AWWA C701, or AWWA C702 (depending on service), 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.

2.2 HEAT CONSUMPTION METERS

- A. Meter: Brass body turbine meter with magnetic drive register, platinum temperature sensors.

2.3 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: Insert through welded threaded couplet, or installed in threaded nipple pipe section, or inserted through welded threaded couplet with isolation valve and insert-retract mechanism.
  2. Pressure rating: 275 psi.
  3. Maximum temperature: 400 degrees F.
  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 x 6 inch dial, stainless steel wetted metal parts, and direct reading of flow rate, with two 10 foot long nylon test hoses with fittings.
- C. Portable Meter Set: Dry single diaphragm type gage with magnetic drive, 2-1/2 inch x 6 inch dial, stainless steel wetted metal parts, and direct reading of flow rate. Mounted in rust-proof carrying case with two 10 foot long rubber test hoses with brass valves or quick connections for measuring stations.

2.4 PRESSURE GAGES

- A. Gage: ASME B40.1, UL 393 or UL 404 (depending on service) with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background, including isolation valve.

1. Case: Steel, cast aluminum, fiberglass reinforced polypropylene, stainless steel, or ABS.
2. Bourdon Tube: Brass phosphor bronze or Type 316 stainless steel.
3. Dial Size: As directed.
4. Mid-Scale Accuracy: One percent.
5. Scale: Both psi and kPa.

## 2.5 PRESSURE GAGE TAPS

### A. Needle Valve:

1. Brass, steel or stainless steel, ¼ inch NPT for minimum 300 psi.

### B. Ball Valve:

1. Brass or stainless steel, ¼ inch NPT for 250 psi.

### C. Pulsation Damper:

1. Pressure snubber, brass with ¼ inch NPT connections.

### D. Siphon:

1. Steel schedule 40, brass, iron or stainless steel, ¼ inch NPT angle or straight pattern.

## 2.6 STEM TYPE THERMOMETERS

### A. Thermometer: ASTM E1, red appearing liquid, lens front tube, cast aluminum case with enamel finish.

1. Size: 7-inch, 9 inch or 12 inch scale, as directed.
2. Window: Clear glass or Lexan.
3. Stem: Brass, ¾ inch NPT, 3-1/2 inches long.
4. Accuracy: ASTM E77 2 percent.
5. Calibration: Both degrees F and degrees C.

### B. Thermometer: ASTM E1, adjustable angle, red appearing liquid, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.

1. Size: 7-inch, 9 inch or 12 inch scale, as directed.
2. Window: Clear glass or Lexan.
3. Stem: Brass, ¾ inch NPT, 3-1/2 inches long.
4. Accuracy: ASTM E77 2 percent.
5. Calibration: Both degrees F and degrees C.

## 2.7 DIAL THERMOMETERS

### A. Thermometer: ASTM E1, stainless steel case, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens,

stainless steel stem.

1. Size: as directed.
2. Lens: Clear glass or Lexan.
3. Accuracy: 1 percent.
4. Calibration: Both degrees F and degrees C.

B. Thermometer: ASTM E1, stainless steel case, adjustable angle with front calibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.

1. Size: 3 inch or 5 inch diameter dial.
2. Lens: Clear glass or Lexan.
3. Accuracy: 1 percent.
4. Calibration: Both degrees F and degrees C.

C. Thermometer: ASTM E1, stainless steel or drawn steel with enamel finish case, vapor or liquid actuated with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer glass lens.

1. Size: as directed.
2. Lens: Clear glass or Lexan.
3. Length of Capillary: Minimum 5 feet, 6 feet or 10 feet, as directed.
4. Accuracy: 2 percent
5. Calibration: Both degrees F and degrees C.

## 2.8 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

## 2.9 TEST PLUGS

A. ¼ inch NPT or ½ inch NPT brass or stainless steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with:

1. Neoprene core for temperatures up to 200 degrees F.
2. Nordel core for temperatures up to 350 degrees F.
3. Viton core for temperatures up to 400 degrees F.

B. Test Kit:

1. Carrying case, internally padded and fitted containing:
  - a. One, two, 2-1/2, or 3-1/2 inch diameter pressure gages, as directed.
  - b. Two gage adapters with 1/8 inch probes.
  - c. Two 1 or 1-1/2 inch dial thermometers.

2.10 STATIC PRESSURE GAGES

- A. Dial Gages:
  - 1. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front calibration adjustment, 2 percent of full scale accuracy.
- B. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

2.11 EXPANSION TANKS

- A. Construction: Closed, welded steel, tested and stamped in accordance with ASME SEC 8-D; cleaned, prime coated, and supplied with steel support saddles; with taps for installation of accessories.
- B. Gage Glass Set: Brass compression stops, guard, and inch red line glass, maximum 24 inches length, long enough to cover tank for 2 inches above bottom to 2 inches below top.
- C. Quick Connect Air Inlet
  - 1. Compressed Air: 75 inches of 1/4 inch diameter braided reinforced air hose, air chuck, check valve, and shut-off valve on supply from control air compressor.
  - 2. Expansion Tank: Inlet tire check valve, manual air vent, tank drain, and pressure relief valve.
- 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.
- E. Provide isolation valve, drain tee, and union on water connection to expansion tanks.

2.12 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Construction: Welded steel, tested and stamped in accordance with ASME SEC 8-D; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible butyl or EPDM diaphragm sealed into tank, and steel support stand.
- B. Accessories: Pressure gage and air-charging fitting, provide union and tank drain.
- C. 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.
- D. Provide isolation valve, drain tee, and union on water connection to expansion tanks.

### 2.13 AIR VENTS

- A. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch 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.
  - 2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.
- C. Washer Type.
  - 1. Brass with hydrosopic fiber discs, vent ports, adjustable cap for manual shutoff, and integral spring loaded ball check valve.

### 2.14 AIR SEPARATORS

- A. Dip Tube Fitting:
  - 1. For 125 psig operating pressure; to prevent free air collected in boiler from rising into system.
- B. In-line Air Separators:
  - 1. Cast iron for sizes 1-1/2 inch and smaller, or steel for sizes 2 inch and larger; tested and stamped in accordance with ASME SEC 8-D; for 125 psig operating pressure.
- C. Combination Air Separators/Strainers:
  - 1. Steel, tested and stamped in accordance with ASME SEC 8-D; for 125 psig operating pressure, with integral bronze strainer, tangential Inlet and outlet connections, and internal stainless steel air collector tube.

### 2.15 STRAINERS

- A. Size 2 inch and Under:
  - 1. Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- B. Size 2-1/2 inch to 4 inch:
  - 1. Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
- C. Size 5 inch and Larger:
  - 1. Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.16 PUMP SUCTION FITTINGS

- A. Fitting: Angle pattern, cast-iron body. Threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger. Rated for 175 psig working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.
- B. Accessories: Adjustable foot support, blow-down tapping in bottom, gage tapping in side.

2.17 COMBINATION PUMP DISCHARGE VALVES

- A. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psig operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.18 FLOW CONTROLS

- A. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet combination blow-down and back-flush drain.
- B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psig.
- C. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.
- D. Accessories: In-line strainer on inlet and ball valve on outlet.

2.19 FLOW METERS

- A. Orifice type by-pass circuit with direct reading gage, soldered or flanged piping connections for 125 psig working pressure, with shut off valves, and drain and vent connections.
- B. Direct reading with insert pitot tube, threaded coupling, for 150 psig working pressure, maximum 240 degrees F, 5 percent accuracy.
- C. Cast iron, wafer type, orifice insert flow meter for 250 psig working pressure, with read-out valves equipped with integral check-valves and caps with gaskets.
- D. Calibrated, plug type balance 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, balance 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 two, 3 percent accuracy pressure gages with 0-135 inches and 0-60 feet pressure ranges for 500 psig maximum working pressure. Color-coded hoses for low and high-pressure connections, and connectors suitable for connection to read-out valves.

## 2.20 RADIATOR VALVES

- A. Angle or straight pattern, rising stem, inside screw globe valve for 125 psig 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.

## 2.21 RELIEF VALVES

- A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

## 2.22 GLYCOL CHARGING

- A. Mixing Tank: Steel drum with fittings suitable for filling and hand pump for charging, rubber hose for connection of hand pump to system.
- B. Storage Tank: Closed type, welded steel constructed, tested and stamped in accordance with ASME SEC 8-D; cleaned, prime coated, and supplied with steel support saddles. Construct with taps for installation of accessories.
- C. Expansion Tank: Diaphragm type with vent fitting with air separator, and automatic air vent.
- D. Air Pressure Reducing Station: Pressure reducing valve with shut-off valves, strainer, check valve and needle valve bypass.

## 2.23 INVERTED BUCKET TRAPS

- A. Trap:
  - 1. Construction: ASTM A126, cast iron body with bolted cover, stainless steel bucket, stainless steel seats and plungers, and stainless steel lever mechanism with knife edge operating surfaces.
  - 2. Rating: WSP per system design.

3. Features: Access to internal parts without disturbing piping, top test plug, bottom drain plugs.
4. Accessories: Integral inlet strainer of stainless steel, inlet check valve and bimetal air vent.

## 2.24 FLOAT AND THERMOSTATIC TRAPS

### A. Trap:

1. Construction: ASTM A126, cast iron body and bolted cover, stainless steel or bronze bellows type air vent, stainless steel float, stainless steel lever and valve assembly
2. Rating: WSP per system design.
3. Features: Access to internal parts without disturbing piping, bottom drain plug.
4. Accessories: Gage glass with shut-off cocks.

## 2.25 THERMODYNAMIC TRAPS

### A. Trap:

1. Construction: Stainless steel body, disc, and cap.
2. Rating: 600 psig WSP.
3. Features: Stainless steel insulating cap, 1/4 inch steel blow down valve, integral strainer

## 2.26 THERMOSTATIC TRAPS

### A. Pressure Balanced: (As Specified)

1. Trap: ASTM A395 cast iron, brass, or ASTM A216 WCB cast steel body and bolted or screwed cover and integral ball joint union for WSP per design. Phosphor bronze, Monel or Stainless steel bellows, stainless steel valve and seat; integral stainless steel strainer.

### B. Freeze Proof:

1. Trap: Cast iron body for 300 psig WSP, bronze bellows, stainless steel valve and seat, external adjustment.

### C. Bimetallic:

1. Trap: ASTM A105 forged steel body and cover, for 300 psig WSP, bimetal element with stainless steel components, integral Type 304 stainless steel strainer screen, 1/4 inch blow down valve.

## 2.27 STEAM AIR VENTS

### A. 125 psig WSP:

1. Balanced Pressure Type: Cast brass body and cover; access to internal parts without disturbing piping; stainless steel bellows, stainless steel valve and seat.

- B. 225 psig WSP:
  - 1. Balanced Pressure Type: ASTM A126 cast iron body and cover; access to internal parts without disturbing piping; phosphor bronze bellows, stainless steel valve and seat.

## 2.28 PRESSURE REDUCING VALVES

- A. Bronze or cast iron body, stainless or chrome steel valve spring, stem, and trim, phosphor bronze diaphragm, direct acting or pilot operated, threaded up to 2 inches, flanged over 2 inches.

## 2.29 SAFETY RELIEF VALVES

- A. Valve: Bronze body, stainless steel valve spring, stem, and trim, direct pressure actuated, capacities ASME certified and labeled.
- B. Accessories: Drip-pan elbow.

## 2.30 STEAM CONDENSATE METERS

- A. Cast iron body, stainless steel rotor and gears, tungsten carbide bearings, bronze trim, vortex-type meter with vane type rotor.
- B. Standard meter registers in gallons, calibrated for water at 200 degrees F, with temperature correction chart.

# PART 3 – EXECUTION

## 3.1 INSTALLATION

- A. Install positive displacement meters in accordance with AWWA M6, with isolating valves on inlet and outlet. Provide full line size bypass with globe valve for liquid service meters.
- B. Install one pressure gage per pump, with taps before strainers and on suction and discharge of pump; pipe to gage.
- C. Install gage taps in piping.
- D. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Install siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.
- E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Ensure sockets allow

clearance from insulation.

- F. Install thermometers in air duct systems on flanges.
- G. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Where thermometers are provided on local panels, duct or pipe mounted thermometers are not required.
- H. Locate duct-mounted thermometers minimum 10 feet downstream of mixing-dampers, coils, or other devices causing air turbulence.
- I. Coil and conceal excess capillary on remote element instruments.
- J. Install static pressure gages to measure across filters and filter banks, (inlet to outlet). On multiple banks, provide manifold and single gage.
- K. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- L. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- M. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- N. Locate test plugs as applicable.
- O. Where large air quantities can accumulate, provide enlarged air collection standpipes.
- P. Provide manual air vents at system high points and as indicated.
- Q. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- R. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- S. Provide drain and hose connection with valve on strainer blow down connection.
- T. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.
- U. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.

- V. Support pump fittings with floor mounted pipe and flange supports.
- W. Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.
- X. Provide radiator-balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.
- Y. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- Z. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- AA. Pipe relief valve outlet to nearest floor drain.
- BB. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- CC. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.
- DD. Steam Traps:
  - 1. Provide minimum 3/4 inch size on steam mains and branches.
  - 2. Install with union or flanged connections at both ends.
  - 3. Provide gate valve and strainer at inlet, and gate valve and check valve at discharge.
  - 4. Provide minimum 10 inch long, line size dirt pocket between apparatus and trap
- EE. In high pressure and medium pressure mains, provide 3/4 inch nipple in bottom of main, extending 3/4 inch into and above bottom of pipe. Provide dirt pocket with 1/2 inch high pressure thermostatic trap.
- FF. Provide pressure-reducing stations with pressure reducing valve, bypass with valve, strainer and pressure gage on upstream side, relief valve and pressure gage on downstream side of pressure reducing valve.
- GG. Pressure-reducing station shall be one or two stages as indicated to produce flat reduced pressure curve over range of capacity. Locate pilot operator control minimum 6 feet downstream of valve.
- HH. Rate relief valves for pressure upstream of pressure reducing station, for full operating capacity. Set relief at maximum 20 percent above reduced pressure.

- II. Terminate relief valves to outdoors 2 feet minimum above roof. Provide drip pan elbow with drain connection to nearest floor drain.
- JJ. When several relief valve vents are connected to a common header, header cross section area shall equal sum of individual vent outlet areas.

### 3.2 FIELD QUALITY CONTROL

- A. Test for strength of glycol and water solution and submit written test results.

### 3.3 CLEANING

- A. Clean and flush glycol system before adding glycol solution.

### 3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Remove thermostatic elements from steam traps during temporary and trial usage, and until system has been operated and dirt pockets cleaned of sediment and scale.
- B. Do not install hydronic and steam pressure gauges until after systems are pressure treated.

### 3.5 INSTALLATION LOCATIONS

#### A. Positive Displacement Meter Location:

1. Condensate return.
2. Domestic cold water.
3. Expansion tank make-up.
4. Cooling tower make-up.

#### B. Flow Meter Location:

1. Heating water system
2. Condensate water system.
3. Chilled water system.

#### C. Pressure Gage Tapping Location:

1. Control valves  $\frac{3}{4}$  inch and larger - inlets and outlets.
2. Major coils - inlets and outlets.
3. Heat exchangers - inlets and outlets.
4. Chiller - inlets and outlets.
5. Boiler - inlets and outlets.

#### D. Thermometer Socket Location:

1. Control valves 1 inch and larger - inlets and outlets.
2. Reheat coils - inlets and outlets.

3. Cabinet heaters - inlets and outlets.
4. Unit heaters - inlets and outlets.

E. Dial Thermometer Location:

1. Each supply air zone.
2. Outside air.
3. Return air.
4. Mixed air.

END OF SECTION