

SECTION 23 21 16

HYDRONIC AND PLUMBING PIPING SPECIALTIES

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. Diaphragm-type expansion tanks.
11. Air vents.
12. Air separators.
13. Strainers.
14. Pump suction fittings.
15. Combination pump discharge valves.
16. Flow controls.
17. Flow meters.
18. Relief valves.

B. Related Sections:

1. Division 23 - Hydronic Piping: Execution requirements for piping connections to products specified by this section.
2. Division 22

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 PERFORMANCE REQUIREMENTS

- A. Flexible Connectors: Provide at or near pumps, motorized equipment and where piping configuration does not absorb vibration.

1.04 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 and list 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.

1.05 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.

1.06 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.

1.07 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.08 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.

1.09 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.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements before fabrication.

1.11 WARRANTY

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

1.12 MAINTENANCE SERVICE

- A. Division 01 - Execution and Closeout Requirements: Maintenance service.

1.13 MAINTENANCE MATERIALS

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

1.14 EXTRA MATERIALS

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

PART 2 PRODUCTS

2.01 POSITIVE DISPLACEMENT METERS (LIQUID)

- A. AWWA C700, AWWA C701, AWWA C702, 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.
- B. Meter: Brass body turbine meter with magnetic drive register.
 1. Service: Cold water, 122 degrees F, Hot water, 200 degrees F.
 2. Nominal Flow: As determined by Developer/Design Builder.
 3. Pressure Drop at Nominal Flow: As determined by Developer/Design Builder.
 4. Maximum Flow: As determined by Developer/Design Builder.
 5. Maximum Operating Pressure: 250 psi.
 6. Accuracy: 1-1/2 percent.
 7. Maximum Counter Reading: 10 million gallons.
 8. Pipe Size: As determined by Developer/Design Builder.

2.02 HEAT CONSUMPTION METERS

- A. Meter: Brass body turbine meter with magnetic drive register, platinum temperature sensors.
1. Maximum Service Temperature: 200 degrees F.
 2. Nominal Flow: As determined by Developer/Design Builder.
 3. Pressure Drop at Nominal Flow: As determined by Developer/Design Builder.
 4. Maximum Flow: As determined by Developer/Design Builder.
 5. Maximum Operating Pressure: As determined by Developer/Design Builder.
 6. Accuracy: 1-1/2 percent.
 7. Maximum Counter Reading: 1 million btuh.
 8. Pipe Size: As determined by Developer/Design Builder.
 9. Power: 24 Volt converter.

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.
 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.

2.04 PRESSURE GAGES

- A. Manufacturers:
1. Ametek, U.S. Gauge Div.
 2. Ashcroft Dresser Industries Instrument Div.
 3. Marsh Instruments Co., Unit of General Signal
 4. Marshalltown Instruments, Inc.
 5. Miljoco Corp.
 6. Trerice (H.O.) Corp.
 7. Weiss Instruments, Inc.
 8. Weksler Instruments Corp.
 9. WIKA Instruments Corp.
 10. Substitutions: Division 01 - Product Requirements.
- B. Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon tube type, bottom connection.
- C. Case: Stainless steel or brass, acrylic lens, 4-1/2 inch diameter.
- D. Connector: Brass, 1/4 inch NPT.
- E. Scale: Aluminum with white finish and black markings.

- F. Accuracy: +1% of range span.
- G. Range: Conform to the following:
 1. Vacuum: 30 inch and 0-15 psi compound range; 1 inch and 1/2 PSI graduations.
 2. Chilled and heating water systems, except as otherwise indicated, 0-60 PSI range, 1 PSI graduation.
 3. Condenser water system, except as otherwise indicated: (0-15); (0-30) PSI range, (1/4 PSI); (1/2 PSI) graduation.
 4. Except as otherwise indicated: 0-100 PSI range, 1 psi graduation.

2.05 PRESSURE GAGE TAPS

- A. Siphon: 1/4 inch NPT straight coil constructed of brass tubing with threads on each end.
- B. Snubber: 1/4 inch NPT brass bushing with corrosion resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.
- C. Ball Valve: Brass, for 250 psi.

2.06 STEM TYPE THERMOMETERS

- A. Manufacturers:
 1. Marshalltown Instruments, Inc.
 2. Miljoco Corp.
 3. Trexco (H.O.) Co.
 4. Weiss Instruments, Inc.
 5. Weksler Instruments Corp.
 6. Substitutions: Division 01 - Product Requirements.
- B. Accuracy: Plus or minus 1% of range span or plus or minus one scale division to maximum of 1.5% of range span.
- C. Scale range: Temperature ranges for services listed as follows:
 1. Domestic Hot Water: 30 to 240 degree F with 2 degree F scale divisions
 2. Domestic Cold Water: 0 to 100 degree F with 2 degree F scale divisions
 3. Heating Water: 30 to 300 degree F with 2 degree F scale divisions
 4. Condenser Water: 0 to 160 degree F with 2 degree F scale divisions
 5. Chilled Water: 0 to 100 degree F with 2 degree F scale divisions
 6. Steam and Condensate: 50 to 400 degree F with 2 degree F scale divisions
- D. Liquid In Glass Thermometers
 1. Case: Die cast, aluminum finished, in baked epoxy enamel, acrylic front, spring secured, and 9 inches long.
 2. Adjustable Joint: Finished to match case, 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, with locking device.
 3. Tube: Blue reading, non-toxic organic filled, magnifying lens.
 4. Scale: V-shaped aluminum with white finish and black markings.
 5. Stem: Copper plated steel, aluminum or brass for separable socket, length to suit installation.
- E. Thermometer Wells: Stainless steel, pressure rated to match piping system design pressure; with 2 inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

2.07 TEST PLUGS

A. Manufacturers:

1. MG Piping Products Co.
2. Miljoco Corp.
3. Peterson Equipment Co.
4. Sisco, A Spedco, Inc. Co.
5. Trerice (H.O.) Co.
6. Watts Regulator Co.
7. Substitutions: Division 01 - Product Requirements.

B. Test plugs shall be nickel plated brass body, with 1/2" NPS fitting and 2 self sealing valve type core inserts suitable for inserting a 1/8" O.D. probe assembly from a dial type thermometer or pressure gage. Test plug shall have gasketed and threaded cap with retention chain and body of length to extend beyond insulation. Pressure rating shall be 500 PSIG.

C. Core material, conform to the following for fluids and temperature range: Air, Water, Oil and Gas, 20 to 2000 degrees F: Neoprene.

D. Test Kit: Provide test kit consisting of 1 pressure gage, gage adapter with probe, 2 bimetal dial thermometers and carrying case.

E. Ranges of pressure gage and thermometers shall be approximately 2 times systems operating conditions.

2.08 FLEXIBLE CONNECTORS

A. Flexible Pipe Connectors: Spool type, flexible rubber connections with guide rods insulated with grommets and washers for 2 inch and over; minimum 150 psig working pressure, maximum 250 degree F operating temperature. Connectors shall have flanged or threaded end connections to match equipment connected; and shall be capable of 3/4 inch misalignment.

B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 300 psig.

2.09 DIAPHRAGM-TYPE EXPANSION TANKS

A. Manufacturers:

1. Bell & Gossett ITT, Fluid Handling Div.
2. Amtrol, Inc.
3. Armstrong Pumps, Inc.
4. Taco, Inc.
5. Substitutions: Division 01 - Product Requirements.

B. Size and number as indicated, constructed of welded carbon steel for 125 psig working pressure, 375 degree F maximum operating temperature. Separate air charge from system water to maintain design expansion capacity, by means of a flexible diaphragm securely sealed into tank. Provide taps for pressure gage and air charging fitting, and drain fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Tank, with taps and supports, shall be constructed, tested, and labeled in accordance with ASME Pressure Vessel Code, Section VIII, Division I.

2.10 AIR VENTS

A. Manufacturers:

1. Bell & Gossett ITT, Fluid Handling Div.

2. Amtrol, Inc.
3. Armstrong Machine Works.
4. Hoffman Specialty ITT, Fluid Handling Div.
5. Spirax Sarco
6. Anvil International
7. Substitutions: Division 01 - Product Requirements.

- B. Manual Air Vent: Bronze body and nonferrous internal parts; 150 psig working pressure, 225 degree F operating temperature; manually operated with screwdriver or thumbscrew; and having 1/8 inch discharge connection and 1/2 inch inlet connection.

2.11 AIR SEPARATORS

- A. Manufacturers:

1. Bell & Gossett ITT, Fluid Handling Div.
2. Amtrol, Inc.
3. Armstrong Pumps, Inc.
4. Taco, Inc.
5. Substitutions: Division 01 - Product Requirements.

- B. Air separator: Welded black steel; ASME constructed and labeled for minimum 125 psig water working pressure and 375 degree F operating temperature; perforated stainless steel air collector tube designed to direct released air into compression tank; tangential inlet and outlet connections; screwed connections up to and including 2 inch NPS; flanged connections for 1-1/2 inch NPS and above; threaded blowdown connection; size as indicated for full system flow capacity.

2.12 STRAINERS

- A. Manufacturers:

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

2.13 PUMP SUCTION DIFFUSER FITTINGS

- A. Manufacturers:

1. Bell & Gossett
2. Substitutions: Division 01 - Product Requirements.

- B. 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.

- C. Accessories: Adjustable foot support, blow-down tapping in bottom, gage tapping in side.

2.14 COMBINATION PUMP DISCHARGE VALVES (TRIPLE DUTY VALVES)

- A. Manufacturers:
 - 1. Bell & Gossett
 - 2. Substitutions: Division 01 - Product Requirements.
- B. 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.

2.15 AUTOMATIC FLOW CONTROLS

- A. Manufacturers:
 - 1. Griswold
 - 2. Substitutions: Division 01 - Product Requirements.
- B. Automatic pressure compensating flow control valves shall have the capacities and pressure differential characteristics as indicated and conform to the following specifications.
- C. Valves shall be factory set and shall automatically limit the rate of flow to required engineered capacity within $\pm 5\%$ accuracy over an operating pressure differential of at least 14 times the minimum required for control.
- D. The control mechanism of the valve shall consist of a self-contained, open-chamber cartridge assembly with unobstructed flow passages that eliminate accumulation of particles and debris. All internal working parts shall be type 300 passivated stainless steel. No plated materials are acceptable.
- E. The type 300 passivated stainless steel cartridge assembly shall consist of a spring-loaded cup. The cup shall be guided at two points and shall utilize the full available differential pressure across the valve to actuate the cup and thereby reduce friction and hysteresis and eliminate binding. It shall have a thin orifice plate for self-cleaning of the variable inlet ports over the full control range. Cartridge must be removable in one piece.
- F. Valves shall be available in four pressure differential ranges, with the minimum range requiring less than 2 PSIG to control flow. Valve bodies shall be provided with inlet and outlet tappings suitable for connection of instruments for verification of flow rates, and shall be marked to show direction of flow. Valve bodies shall be rated for use at not less than 150% of system designed operating pressure.
- G. Certified performance data for the flow control valve, based on independent laboratory tests, supervised and witnessed by a registered professional engineer, shall be available.
- H. Each automatic flow control valve shall be furnished with a valve kit consisting of 1/4 inch X 2 inch minimum size nipples, quick disconnect valves and fittings suitable for use with the measuring instruments specified.
- I. Performance certification of valves, based on independent laboratory tests, shall be available.
- J. Flow control valve shall be warranted for period of five years from date of original sale.
- K. Valve shall be flanged type.

2.16 FLOW METERS

- A. Manufacturers:
 - 1. Armstrong Pumps, Inc.

2. Barco Div., Marison Industries
 3. Gerand Engineering Co.
 4. Substitutions: Division 01 - Product Requirements.
- B. Flow rate of elements and meters shall be same as connected equipment or system.
- C. Calibrated Plug Valves: 125 PSIG water working pressure, 250 degrees F maximum operating temperature, bronze body, and plug valve with calibrated orifice. Provide with connections for portable differential pressure meter with integral check valves and seals. Valve shall have integral pointer and calibrated scale to register degree of valve opening. Valves 2 inches and smaller shall have threaded connections and 2-1/2 inch valves shall have flanged connections.
- D. Venturi Type Flow Elements:
1. Type: Differential pressure venturi type, designed for installation in piping.
 2. Construction: Bronze or cadmium plated steel with brass fittings and attached tag with flow conversion data. Ends shall be threaded for 2 inch and smaller elements and flanged or welded for 2-1/2 inch and larger elements.
- E. Meters
1. Portable meters: Differential pressure gage and two 12 foot hoses in carrying case with handle.
 2. Scale: In inches of water unless otherwise indicated.
 3. Accuracy: Plus or minus 2% between 20 to 80% of range.
 4. Each meter shall be complete with operating instructions.
 5. Provide two meters to the County.

2.17 RELIEF VALVES

- A. Manufacturers:
1. Bell & Gossett
 2. Substitutions: Division 01 - Product Requirements.
- B. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

PART 3 EXECUTION

3.01 INSTALLATION - METERS

- 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.

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.
- B. Install gage taps in piping
- C. Install pressure gages with pulsation dampers. Provide ball valve to isolate each gage. Extend nipples to allow clearance from insulation.
- D. Install pressure gages in piping tee with pressure gage valve, located on pipe at most readable position.

- E. Install in the following locations, and elsewhere as indicated:
 1. At suction and discharge of each pump.
 2. At discharge of each pressure reducing valve.
 3. At building water service entrance.
 4. At chilled water and condenser water inlets and outlets of chillers.
- F. Pressure Gas Needle Valves: Install in piping tee with snubber. Install siphon in lieu of snubber for steam gages.
- G. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
- H. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.
- I. Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.
- J. Install in the following locations and elsewhere as indicated:
 1. At inlet and outlet of each hydronic boiler and chiller.
 2. At inlet and outlet of each hydronic coil in air handling units and built up central systems.
 3. At inlet and outlet of each hydronic heat exchanger.
 4. At inlet and outlet of each hydronic heat recovery unit.
- K. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.
- L. Coil and conceal excess capillary on remote element instruments.
- M. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- N. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- O. 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 adjacent to pressure gages and pressure gage taps.
- B. Where large air quantities accumulate, provide enlarged air collection standpipes.
- C. Install manual air vents at system high points and heat transfer coils.
- D. For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.
- E. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- F. Provide drain and hose connection with valve on strainer blow down connection.
- G. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.
- H. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.
- I. Support pump fittings with floor mounted pipe and flange supports.

- J. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- K. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- L. Pipe relief valve outlet to nearest floor drain.
- M. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

3.04 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
- C. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not to be tested.

3.05 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Flush system with clean water and clean the strainers.

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