

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes meters and gages for mechanical systems and water meters installed outside the building.
- B. Related Sections include the following:
 - 1. Division 22 Section “Meters and Gages for Plumbing Piping.”
 - 2. Mechanical equipment Sections that specify meters and gages as part of factory-fabricated equipment.

1.2 SUBMITTALS

- A. Product Data: Include scale range, ratings, and calibrated performance curves for each meter, gage, fitting, specialty, and accessory specified.
- B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.
 - 1. Include manufacturer's recommended installation requirements for pipe diameters both upstream and downstream for each installation type/location.
 - 2. Certification of materials compatibility for seat, gaskets and seal materials with piping system fluids.
- C. Product Certificates: Signed by manufacturers gages certifying accuracy under specified operating conditions and compliance with specified requirements.
- D. Maintenance Data: For gages to include in maintenance manuals. Include data for the following:
 - 1. Flow-measuring systems.

1.3 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Two of each type of gauge installed on the project

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1.4 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

PART 2 - PRODUCTS

2.1 THERMOMETERS, GENERAL

- A. Scale Range: Temperature ranges for services listed are as follows:
 - 1. Chilled Water: minus 18 to plus 38 deg C, with 1-degree scale divisions.
- B. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.
- C. Thermometers shall be non-mercury type pipe thermometers.

2.2 LIQUID-IN-GLASS THERMOMETERS

- A. Description: ASTM E 1.
- B. Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 230 mm long.
- C. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
- D. Tube: Red or blue reading, organic-liquid filled with magnifying lens.
- E. Scale: Satin-faced nonreflective aluminum with permanently etched markings.
- F. Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

2.3 REMOTE-READING, FILLED-SYSTEM DIAL THERMOMETERS

- A. Description: Vapor-actuated, remote-reading dial type.
- B. Case: Drawn steel or cast aluminum, with 115-mm- diameter, glass lens.
- C. Movement: Brass, precision geared.

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- D. Scale: Progressive, satin-faced nonreflective aluminum with permanently etched markings.
- E. Tubing: Bronze, double-braided, armor-over-copper capillary; of length to suit installation.
- F. Bulb: Copper with separable socket for liquids; averaging element for air.

2.4 BIMETAL DIAL THERMOMETERS

- A. Description: ASME B40.3; direct-mounting, universal-angle dial type.
- B. Case: Stainless steel with 125-mm- diameter, glass lens.
- C. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
- D. Element: Bimetal coil.
- E. Scale: Satin-faced nonreflective aluminum with permanently etched markings.
- F. Stem: Stainless steel for separable socket, of length to suit installation.

2.5 INSERTION DIAL THERMOMETERS

- A. Description: ASME B40.3, bimetal type.
- B. Dial: 25-mm diameter.
- C. Case: Stainless steel.
- D. Stem: Dustproof and leakproof 3-mm- diameter, tapered-end stem with nominal length of 125 mm.

2.6 SEPARABLE SOCKETS

- A. Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.
 - 1. Material: Brass, for use in copper piping.
 - 2. Material: Steel, for use in steel piping.
 - 3. Extension-Neck Length: Nominal thickness of 50 mm, but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.
 - 4. Insertion Length: To extend to center of pipe.
 - 5. Cap: Threaded, with chain permanently fastened to socket.
 - 6. Heat-Transfer Fluid: Oil or graphite.

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2.7 THERMOMETER WELLS

- A. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.
 - 1. Material: Brass, for use in copper piping.
 - 2. Material: Steel, for use in steel piping.
 - 3. Extension-Neck Length: Nominal thickness of 50 mm, but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
 - 4. Insertion Length: To extend to center of pipe.
 - 5. Cap: Threaded, with chain permanently fastened to socket.
 - 6. Heat-Transfer Fluid: Oil or graphite.

2.8 PRESSURE GAGES

- A. Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.
- B. Case: Drawn steel, brass, or aluminum with 115-mm- diameter, glass lens.
- C. Connector: Brass, DN8.
- D. Scale: White-coated aluminum with permanently etched markings.
- E. Accuracy: Grade A, plus or minus 1 percent of middle 50 percent of scale.
- F. Range: Comply with the following:
 - 1. Vacuum: 100 kPa of vacuum to 103 kPa of pressure.
 - 2. Fluids under Pressure: Two times the operating pressure.

2.9 PRESSURE-GAGE FITTINGS

- A. Valves: DN8 brass or stainless-steel needle type.
- B. Syphons: DN8 coil of brass tubing with threaded ends.
- C. Snubbers: ASME B40.5, DN8 brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.10 TEST PLUGS

- A. Description: Nickel-plated, brass-body test plug in DN15 fitting.
- B. Body: Length as required to extend beyond insulation.

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- C. Pressure Rating: 3450 kPa minimum.
- D. Core Inserts: One or two self-sealing valves, suitable for inserting 3-mm OD probe from dial-type thermometer or pressure gage.
- E. Core Material for Air, Water, Oil, and Gas: Minus 7 to plus 93 deg C, chlorosulfonated polyethylene synthetic rubber.
- F. Core Material for Air and Water: Minus 35 to plus 136 deg C, ethylene-propylene-diene terpolymer rubber.
- G. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.
- H. Test Kit: Pressure gage and adapter with probe, two bimetal dial thermometers, and carrying case.
 - 1. Pressure Gage and Thermometer Ranges: Approximately two times the system's operating conditions.

2.11 FLOW-MEASURING SYSTEMS

- A. System includes calibrated flow element, separate meter, hoses or tubing, valves, fittings, and conversion chart compatible with flow element, meter, and system fluid.
 - 1. Flow range of flow-measuring element and meter covers operating range of equipment or system where used.
 - 2. Display: Visual instantaneous rate of flow.
- B. Permanent Meters: Suitable for wall or bracket mounting. Include 150-mm- diameter, or equivalent, dial with fittings and copper tubing for connecting to flow element.
 - 1. Scale: Liters per second.
 - 2. Accuracy: Plus or minus 1 percent of center 60 percent of range.
- C. Include complete operating instructions with each meter.
- D. Venturi Flow Elements: Differential-pressure-design, flow-element fitting made for installation in piping.
 - 1. Construction: Bronze, brass, or factory-primed steel; with brass fittings and attached tag with flow conversion data. Include ends threaded for DN50 and smaller elements and flanged or welded for DN65 and larger elements.
 - 2. Pressure Rating: 1725 kPa.
 - 3. Temperature Rating: 121 deg C.

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2.12 TURBINE FLOWMETERS

- A. Description: Insertion type; measures flow directly in liters per second.
1. Construction: Bronze or stainless-steel body and plastic turbine or impeller, with integral direct-reading scale.
 2. Pressure Rating: 1035 kPa minimum.
 3. Temperature Rating: 82 deg C minimum.
 4. Display: Visual instantaneous rate of flow.
 5. Accuracy: Plus or minus 2-1/2 percent.

2.13 VORTEX-SHEDDING FLOWMETERS

- A. In-Line Vortex-Shedding Flowmeter: Made for installation between pipe flanges; measures flow directly in liters per second.
1. Construction: Stainless-steel body, with integral transmitter and direct-reading scale.
 2. Pressure Rating: 6900 kPa minimum.
 3. Temperature Rating: 260 deg C minimum.
 4. Display: Visual instantaneous rate of flow.
 5. Integral Transformer: For low-voltage power operation.
 6. Accuracy: Plus or minus 7/10 percent for liquids and 1-1/4 percent for gases.
- B. Insertion Vortex-Shedding Flowmeter: Made for installation in pipe; measures flow directly in liters per second.
1. Construction: Stainless-steel probe, with integral transmitter and direct-reading scale.
 2. Pressure Rating: 6900 kPa minimum.
 3. Temperature Rating: 260 deg C minimum.
 4. Display: Visual instantaneous rate of flow.
 5. Integral Transformer: For low-voltage power connection.
 6. Accuracy: Plus or minus 1 percent for liquids and 1-1/2 percent for gases.

2.14 FLOW INDICATORS

- A. Description: Instrument for visual verification of flow; made for installation in piping systems.
1. Construction: Bronze or stainless-steel body, with sight glass and plastic pelton-wheel indicator.
 2. Pressure Rating: 860 kPa.
 3. Temperature Rating: 93 deg C.

2.15 THERMAL-ENERGY FLOWMETERS

- A. Instruments include turbine-wheel or flow-sensor element and meter, two temperature sensors, transmitter, solid-state calculator with integral battery pack, integral stop valves, strainer, and magnetic trap.
1. Construction: Bronze body.
 2. Pressure Rating: 860 kPa.
 3. Temperature Range: 4.4 to 121 deg C.
 4. Data Output: Six-digit electromechanical counter with readout in kilowatt hours or joules.
 5. Accuracy: Plus or minus 1 percent.
 6. Battery Pack: Five-year lithium battery.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install in the following locations:
1. Inlet and outlet of each chiller.
 2. Suction and discharge of each hydronic pump.

3.2 GAGE APPLICATIONS

- A. Install dry-case-type pressure gages at chilled-water inlets and outlets of chillers.
- B. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

- A. General: Install meters, gages, and accessories according to manufacturer's written instructions for applications where used. Provide recommended upstream and downstream straight pipe diameters to achieve specified accuracy.
- B. Install direct-mounting thermometers and adjust vertical and tilted positions.
- C. Install separable sockets in vertical position in piping tees where fixed thermometers are indicated.
1. Install with socket extending to center of pipe.
 2. Fill sockets with oil or graphite and secure caps.

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- D. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.
 - 1. Fill wells with oil or graphite and secure caps.
- E. Install gauge cocks or ball valves for all pressure gauge installations.
- F. Install dry-type pressure gages in the following locations:
 - 1. Chilled-water inlets and outlets of chillers.
- G. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- H. Install remote-mounting pressure gages on panel.
- I. Install needle-valve and snubber fitting in piping for each pressure gage for fluids.
- J. Install test plugs in tees in piping.
- K. Install flow indicators, in accessible positions for easy viewing, in piping systems.
- L. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.
- M. Install flowmeter elements in accessible positions in piping systems.
- N. Install differential-pressure-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions.
- O. Install wafer-orifice flowmeter elements between two pipe flanges.
- P. Install permanent indicators on walls or brackets in accessible and readable positions.
- Q. Install connection fittings for attachment to portable indicators in accessible locations.
- R. Install flowmeters at discharge of hydronic system pumps and elsewhere as indicated.
- S. Assemble components and install thermal-energy meters.
- T. Mount meters on wall if accessible; if not, provide brackets to support meters.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

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1. Install gages adjacent to machines and equipment to allow service and maintenance.
 2. Connect flow-measuring-system elements to meters.
 3. Connect flowmeter transmitters to meters.
 4. Connect thermal-energy-flowmeter transmitters to meters.
- B. Make electrical connections to power supply and electrically operated meters and devices.
- C. Ground electrically operated meters.
1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Install electrical connections for power and devices.
- E. Electrical power, wiring, and connections are specified in Division 26 Sections.

3.5 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.
- C. Clean windows of meters and gages and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION 230519