SECTION 230519 - METERS AND GAGES FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermometers.
   2. Gages.
   3. Test plugs.
   5. Flowmeters.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include materials and finishes, dimensions, and accuracies. For pressure gages, submit pressure range for each application. For thermometers, submit temperature range and scale divisions for each application. For water and flow meters, submit performance curves.

B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Trerice, H. O. Co.
   2. Weiss Instruments, Inc.

B. Case: Die-cast aluminum or brass, 9 inches long in mechanical rooms, 7 inches long elsewhere.

C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

I. Range: The maximum operating temperature should not exceed 75% of the full-scale range. The normal operating range should be in the middle half of the range (between 25% and 75% of the full-scale range); whenever possible.

2.2 DUCT-TYPE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Palmer - Wahl Instruments Inc.
2. Weiss Instruments, Inc.

B. Case: Die-cast aluminum, 7 inches long.

C. Tube: Red or blue reading, organic filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Metal, for installation in mounting bracket and of length to suit installation.

H. Mounting Bracket: Flanged fitting for attachment to duct and made to hold thermometer stem.

I. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

J. Range: The maximum operating temperature should not exceed 75% of the full-scale range. The normal operating range should be in the middle half of the range (between 25% and 75% of the full-scale range); whenever possible.

2.3 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, threaded, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

C. Materials: Brass in copper piping systems, Type 316 stainless steel in all other piping
systems.

D. Lagging Extensions: Provide in insulated piping systems, length suitable for insulation thickness.

2.4 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. Ernst Gage Co.
3. Palmer - Wahl Instruments Inc.
4. Winters Instruments

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type, drawn steel, stainless steel, or cast aluminum, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Pointer: Red or other dark-color metal.
7. Window: Glass.
8. Ring: Metal.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Range: The maximum operating pressure should not exceed 75% of the full-scale range. The normal operating range should be in the middle half of the range (between 25% and 75% of the full-scale range); whenever possible.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass gage cock with lever handles, or brass or stainless-steel needle type.
2. Siphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Peterson Equipment Co., Inc.
2. Sisco Manufacturing Co.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 degrees F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 degrees F shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 degrees F shall be EPDM.

E. Test Kit: Furnish one test kit containing one pressure gage and adaptor, two thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gage: Small bourdon-tube insertion type with 2 to 3 inch diameter dial and probe. Dial range shall be 0 to 200 psig.
2. Low-Range Thermometer: Small bimetallic insertion type with 1 to 2 inch diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 degrees F.
3. High-Range Thermometer: Small bimetallic insertion type with 1 to 2 inch diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 degrees F.
4. Carrying case shall have formed instrument padding.

2.6 WATER METERS

A. Positive Displacement Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ABB Water Meters, Inc.
   b. Grinnell Corporation; Mueller Co.; Hersey Meters.
   c. Water Specialties Corp.

2. Description: AWWA C700, nutating disc type, bronze main case. Register flow in gallons unless cubic feet are indicated.

2.7 VENTURI FLOWMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps, Inc.
2. Gerand Engineering Co.

B. Description: Differential-pressure design for installation in piping; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.

C. Construction: Bronze, brass, or factory-primed steel; with brass fittings and attached tag with flow conversion data. Pressure Rating: 250 psig.

D. Temperature Rating: 250 deg F.

E. End Connections for NPS 2 and Smaller: Threaded.

F. End Connections for NPS 2-1/2 and Larger: Flanged or welded.

G. Range: Flow range of flow measuring element and flowmeter shall cover operating range of equipment or system served.

H. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.
3. Range: The maximum operating flow should not exceed 75% of the full-scale range. The normal operating range should be in the middle half of the range (between 25% and 75% of the full-scale range); whenever possible.

I. Portable Indicators: Differential-pressure type calibrated for connected flowmeter element and having two 12-foot hoses in carrying case.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of range.
3. Range: The maximum operating flow should not exceed 75% of the full-scale range. The normal operating range should be in the middle half of the range (between 25% and 75% of the full-scale range); whenever possible.

J. Operating Instructions: Include complete instructions with each flowmeter.

2.8 PITOT-TUBE FLOWMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dieterich Standard Inc.
2. Preso Meters Corporation.
3. Taco, Inc.

B. Description: Insertion-type, differential-pressure design for inserting probe into piping and measuring flow directly in gallons per minute.
C. Construction: Stainless-steel probe of length to span inside of pipe; with integral transmitter and direct-reading scale.

D. Pressure Rating: 150 psig minimum.

E. Temperature Rating: 250 degrees F minimum.

F. Display: Visual instantaneous rate of flow.

G. Integral Transformer: For low-voltage power connection.

H. Accuracy: Plus or minus 1 percent for liquids and gases.

2.9 FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dwyer Instruments.
2. Ernst Gage Co.
3. OPW Engineered Systems; Dover Corp.

B. Description: Instrument for installation in piping systems for visual verification of flow.

C. Construction: Bronze or stainless steel body; with sight glass and indicator, and threaded or flanged ends.

D. Pressure Rating: 125 psig.

E. Temperature Rating: 200 degrees F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass or solar-powered digital thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler and chiller.
3. Inlet and outlet of each hydronic coil in air handling units and built-up central systems.
4. Inlet and outlet of each hydronic heat exchanger.
5. Inlet and outlet of each hydronic heat-recovery unit.
6. Inlet and outlet of each thermal storage tank.
7. Outside-air, return-air, and mixed-air ducts.

B. Provide the following temperature ranges for thermometers:
   1. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
   2. Condenser Water: 0 to 160 deg F, with 2-degree scale divisions.
   3. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.
   4. Steam and Condensate: 30 to 300 deg F, with 5-degree scale divisions.

3.2 Air Ducts: Minus 40 to plus 110 deg F, with 2-degree scale divisions.

3.3 GAGE APPLICATIONS
   A. Install pressure gages for discharge of each pressure-reducing valve.
   B. Install pressure gages at chilled- and condenser-water inlets and outlets of chillers. Provide one gage across each tube bundle with gage cocks to permit independent measurement of inlet and outlet pressures.
   C. Install pressure gages at heating-water inlets and outlets of boilers. Provide one gage across boiler with gage cocks to permit independent measurement of inlet and outlet pressures.
   D. Install pressure gages at water inlets and outlets of heat exchangers. Provide one gage across each side of heat exchanger with gage cocks to permit independent measurement of inlet and outlet pressures.
   E. Install pressure gages at suction and discharge of each pump. Provide one gage with gage cocks for each pump to permit independent measurement of suction, discharge, and strainer inlet pressures.
   F. Provide the following pressure ranges for pressure gage:
      1. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
      2. Range for Fluids under Pressure: Two times operating pressure.

3.4 INSTALLATIONS
   A. Install direct-mounting thermometers and adjust vertical and tilted positions.
   B. Install thermowells with socket extending a minimum of 2 inches into fluid, but not less than one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.
   C. Prime thermowells with an approved heat transfer medium such as graphite or heat transfer paste to provide optimal accuracy and response time.
   D. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.
E. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

F. Install gage cock and snubber fitting in piping for each pressure gage for fluids (except steam).

G. Install needle-valve and siphon fitting in piping for each pressure gage for steam.

H. Install test plugs in tees or Thread-o-lets in piping.

I. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.

J. Install flowmeter elements in accessible positions in piping systems.

K. 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.

L. Install permanent indicators on walls or brackets in accessible and readable positions.

M. Install connection fittings for attachment to portable indicators in accessible locations.

N. Install flowmeters where indicated on drawings.

3.5 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

B. Connect flowmeter system elements to meters.

3.6 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.

END OF SECTION