

## SECTION 23 05 19 - METERS AND GAGES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Thermometers.
  - 2. Thermometer wells.
  - 3. Gages.
  - 4. Test plugs.
  - 5. Thermal Energy Meters
- B. This Contractor shall provide all devices, piping, valving, relays, end switches, control components, power wiring, control wiring and interlock wiring as required to accomplish the sequence of operations for the specified meters and instrumentation and thereby provide a fully operational system

#### 1.3 DEFINITIONS

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

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Shop Drawings: Schedule for thermometers, gages and flowmeters indicating manufacturer's number, scale range, and location for each.
- C. Product Certificates: For each type of thermometer, gage and flowmeter, signed by product manufacturer.
- D. Operation and Maintenance Data: For flowmeters to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Product options: Drawings indicate size, profiles and connections for instrumentation and are based on the specific types and models indicated.
- B. Electrical components, devices and accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- C. Standards: If any item in this specification as furnished by the contractor is manufactured in a location which does not certify ASME/ANSI standards, the contractor is to pay the owner for all expenses incurred by the owner for an outside testing company to confirm such compliances.
- D. Pressure and temperature rating:
  - 1. Each meter and gauge shall be rated and suitable for the piping system that it is being installed in.
  - 2. Refer to applicable piping section for service temperature and pressure rating of systems that meters and gauges are to be installed in.
  - 3. Minimum upstream and downstream straight pipe diameters for meters shall be provided as per manufacturer's published recommendations.

#### 1.6 COORDINATION

- A. Coordinate the location and installation of all items furnished under this specification with and including but not limited to the following:
  - 1. Equipment installation details.
  - 2. Purchased equipment.
  - 3. Piping shop drawings.
  - 4. Field conditions.

### 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. Tserice, H. O. Co.
  - 2. Weiss Instruments, Inc.
  - 3. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
  - 4. Miljoco Corporation

- B. Case: Die-cast aluminum 9 inches long.
- C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens, silicone shock mounted.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Plastic.
- F. Connector: Adjustable type, 180 degrees in vertical plane.
- 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.

## 2.2 DIRECT-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  - 2. KOBOLD Instruments, Inc.
  - 3. Terrice, H. O. Co.
  - 4. Weiss Instruments, Inc.
  - 5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div
  - 6. Miljoco Corporation
- B. Case: Dry type, stainless steel , 4-1/2-inch diameter.
- C. Element: Bourdon tube or other type of pressure element.
- D. Movement: Mechanical, connecting element and pointer.
- E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- F. Pointer: Red metal.
- G. Window: Plastic.
- H. Ring: Stainless steel .
- I. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- J. Thermal System: Liquid- filled bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.

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

### 2.3 REMOTE-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AMETEK, Inc.; U.S. Gauge Div.
  - 2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  - 3. Miljoco Corp.
  - 4. Trerice, H. O. Co.
  - 5. Weiss Instruments, Inc.
  - 6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: Dry type, stainless steel, 4-1/2-inch diameter with holes for panel mounting.
- C. Element: Bourdon tube or other type of pressure element.
- D. Movement: Mechanical, connecting element and pointer.
- E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- F. Pointer: Red metal.
- G. Window: Plastic.
- H. Ring: Stainless steel.
- I. Connector: Back union type.
- J. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.
- K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

### 2.4 BIMETALLIC-ACTUATED DIAL THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  - 2. Miljoco Corp.
  - 3. Trerice, H. O. Co.
  - 4. Weiss Instruments, Inc.
  - 5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

6. WIKA Instrument Corporation.

- B. Description: Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.
- C. Case: Liquid-filled type, stainless steel with 5-inch (127-mm) diameter.
- D. Element: Bimetal coil.
- E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- F. Pointer: Red metal.
- G. Window: Plastic.
- H. Ring: Stainless steel.
- I. Connector: Adjustable angle type.
- J. Stem: Metal, for thermowell installation and of length to suit installation.
- K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.5 THERMOWELLS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Miljoco Corp.
  - 2. Trerice, H. O. Co.
  - 3. Weiss Instruments, Inc.
  - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
  - 5. WIKA Instrument Corporation.
- B. Manufacturers: Same as manufacturer of thermometer being used.
- C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.6 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Miljoco Corp.
  - 2. Trerice, H. O. Co.
  - 3. Weiss Instruments, Inc.
  - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Dry type for steam only, liquid-filled case type for all other services.

- C. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
  - 1. Case: Liquid-filled type, 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.
  - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
  - 6. Pointer: Red metal.
  - 7. Window: Plastic.
  - 8. Ring: Aluminum .
  - 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
  - 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
  - 11. Range for Fluids under Pressure: Two times operating pressure.
  
- D. Remote-Mounting, Dial-Type Pressure Gages: ASME B40.100, indicating-dial type.
  - 1. Case: Dry type, cast aluminum, 4-1/2-inch diameter with holes for panel mounting.
  - 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.
  - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
  - 6. Pointer: Red metal.
  - 7. Window: Plastic.
  - 8. Ring: Aluminum.
  - 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
  - 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
  - 11. Range for Fluids under Pressure: Two times operating pressure.
  
- E. Provide single gauge for pump installations mounted to a 4-port trumpet valve
  
- F. Pressure-Gage Fittings:
  - 1. Valves: NPS 1/4 brass or stainless-steel needle type.
  - 2. Syphons: 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.

## 2.7 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Terrice, H. O. Co.

2. Watts Industries, Inc.; Water Products Div.

- 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 deg 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 deg F shall be CR.
  - 2. Insert material for air or water service at minus 30 to plus 275 deg 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 deg 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 deg F.
  - 4. Carrying case shall have formed instrument padding.

## 2.8 INSERTION-TURBINE, THERMAL-ENERGY METER SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Data Industrial Corp.
  - 2. ONICON Incorporated.
- B. Description: Flow sensor, strainer, two temperature sensors, transmitter, meter, and connecting wiring.
- C. Flow Sensor: Insertion-type turbine or paddle-wheel element with corrosion-resistant-metal body and transmitter.
  - 1. Pressure Rating: 125 psig (860 kPa).
  - 2. Temperature Range: 40 to 250 deg F (5 to 121 deg C).
- D. Meter: Solid-state integrating type.

1. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units (joules).
  2. Accuracy: Plus or minus 1 percent.
  3. Battery Pack: Five-year lithium battery.
- E. Strainer: Full size of main line piping.

## PART 3 - EXECUTION

### 3.1 THERMOMETER APPLICATIONS

- A. Install liquid-in-glass thermometers in the following locations:
1. Inlet and outlet of each hydronic zone.
  2. Inlet and outlet of each boiler and air cooled chiller.
  3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
  4. Inlet and outlet of each mixing valve.
- B. Install direct-mounting, vapor-actuated dial thermometers in locations where temperature sensing bulb is more than 5 feet from viewing position.
- C. Install remote-mounting, vapor-actuated dial thermometers in cabinets and panels.
- D. Install liquid-filled-case-type, bimetallic-actuated dial thermometers at suction and discharge of each pump.
- E. Provide the following temperature ranges for thermometers:
1. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
  2. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.

### 3.2 GAGE APPLICATIONS

- A. Install liquid-filled-type pressure gauges at suction and discharge of each pump and all other services.

### 3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.
- C. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees where thermometers are indicated.



- D. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- E. Install remote-mounting pressure gages on panel.
- F. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).
- G. Install needle-valve and syphon fitting in piping for each pressure gage for steam.
- H. Install test plugs in tees in piping.
- I. Install flow indicators, in accessible positions for easy viewing, in piping systems.
- J. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.
- K. Install flowmeter elements in accessible positions in building chilled water piping systems.
- L. 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.

#### 3.4 CONNECTIONS

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

#### 3.5 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION