

## SECTION 23 05 19 - METERS AND GAUGES

### PART 1 - GENERAL

#### 1.1 SYSTEM DESIGN REQUIREMENTS

- A. Air Filters: Provide pressure switches and magnehelic gauges across main building air filters.. Monitor each section separately and monitoring and gauges shall have separate tubing.
- B. Pressure Reducing Valves: Provide single pressure gauge on upstream and downstream of pressure reducing valves to independently indicate high and low pressure.
- C. Heating Water Systems: Provide solar-powered digital thermometers in wells on hot water systems, domestic and heating, to indicate supply and return temperatures.
- D. Air Systems: Provide visual on HVAC air distribution equipment to indicate temperatures at supply, return and mixed air points.
- E. Pumps: Provide separate pressure gauge in suction and discharge and temperature taps in pipes at each pump section and discharge. Do not use pump housing ports for gauges.
- F. Chilled and Condenser Water Systems: Provide dial thermometers in wells to indicate supply and return temperatures.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Glass Thermometers:
    - a. Marshalltown Instruments, Inc.
    - b. U.S. Gage
    - c. Mueller
  - 2. Direct Mount Dial Thermometers:
    - a. Marsh Instrument Co.; Unit of General Signal
    - b. Terice (H.O.) Co.
    - c. Weiss Instruments, Inc.
  - 3. Remote Reading Dial Thermometers:
    - a. Ametek/U.S. Gauge
    - b. Marsh Instrument Co.; Unit of General Signal
    - c. Weiss Instruments, Inc.
  - 4. Dual Type Insertion Thermometers and Wells:
    - a. Marsh Instrument Co.; Unit of General Signal
    - b. Taylor Instrument Co.
    - c. Weiss Instruments, Inc.
  - 5. Temperature Gauge Connector Plugs:
    - a. Fairfax Company
    - b. Peterson Equipment Co.
    - c. Universal Lancaster
  - 6. Pressure Gauges and Plugs:
    - a. Ametek/U.S. Gauge
    - b. Marsh Instrument Co.; Unit of General Signal
    - c. Weiss Instruments, Inc.
  - 7. Pressure Gauge Connector Plugs:

- a. Fairfax Company
  - b. Peterson Equipment Co.
  - c. Universal Lancaster
8. Venturi Flow Measuring Elements:
  - a. FDI (preferred)
  - b. HCI
  - c. Gerand
9. Calibrated Balancing Valves:
  - a. FDI (preferred).
  - b. HCI
  - c. Gerand
10. Automatic Balancing Valves
  - a. FDI (preferred)
  - b. Griswold

## 2.2 MATERIALS, GENERAL

### A. Thermometers:

1. Case: Die cast aluminum, finished in baked epoxy enamel, glass front, spring secured, 9 inches long.
2. Adjustable Joint: Die cast aluminum, finished to match case, 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, with locking device.
3. Tube and Capillary: Spirit filled, magnifying lens, 1% scale range accuracy, shock mounted.
4. Scale: Satin faced, non-reflective aluminum, permanently etched markings.
5. Stem: Copper plated steel, or brass, for separable socket, length to suit installation.
6. Range: Conform to the following:
  - a. Hot Water: 30 degree - 240 degree F with 2 degree F scale divisions.
  - b. Chilled Water: 0 degree - 100 degree F with 2 degree F scale divisions.

### B. Dial Type Insertion Thermometers

1. Type: Bi-metal, stainless steel case and stem, 1 inch diameter dial, dust and leak proof, 1/8 inch diameter stem with nominal length of 5 inches.
2. Accuracy: 0.5% of dial range.
3. Range: Conform to the following:
  - a. Hot Water: 0 degree - 240 degree F
  - b. Chilled Water: 0 degree - 100 degree.

### C. Thermometer Wells:

1. Thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2 inch extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

### D. Temperature Gauge Connector Plugs:

1. Temperature gauge connector plugs pressure rated for 500 psi and 200 degree F (93 degree C). Construct of brass and finish in nickel-plate, equip with 1/2 inch NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8 inch OD probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

### E. Pressure Gauges:

1. Type: General use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.
2. Case: Drawn steel or brass, glass lens, 4-1/2 inch diameter.
3. Connector: Brass with 1/4 inch male NPT. Provide protective siphon when used for steam service.
4. Scale: White coated aluminum, with permanently etched markings.
5. Range: Conform to the following:

- a. Vacuum: 30 inch Hg - 15 psi
    - b. Water: 0 - 200 psi
    - c. Steam: 0 - 150 psi. High pressure
      - 1) 0 - 25 psi. Low pressure
  6. Provide all steam pressure gauges with pigtail and shut-off valve suitable for temperature and pressure for specified service.
- F. Pressure Gauge Cocks:
1. Brass with 1/4 inch female NPT on each end and "T" handle brass plug
  2. Siphon: 1/4 inch straight coil constructed of brass tubing with 1/4 inch male NPT on each end. On steam pipe only.
  3. Snubber: 1/4 inch brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.
- G. Pressure Gauge Connector Plugs:
1. Provide pressure gauge connector plugs pressure rated for 500 psi and 200 degree F. Construct of brass and finish in nickel-plate equipped with 1/2 inch NPS fitting, and self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8 inch OD probe assembly from dial type insertion pressure gauge. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.
- H. 2-1/2 Inch and Larger Venturi Flow Measuring Elements:
1. Primary flow measuring elements consisting of solid brass or bronze venturi tubes. Tubes larger than 2 inches may be cast iron or steel. Steel tubes may be fabricated or cast with cadmium or zinc-plating. Line throats of cast iron tubes with bronze and plate cast iron portion with cadmium. Each station complete with safety shutoff valves, and quick coupling connections for use with a master portable meter set or individual permanently mounted meter. Tubes calibrated and tested by independent testing laboratory and performance data furnished with shop drawings.
  2. Manufacturer shall certify venturi for actual piping configuration. Any necessary piping changes required for certification shall be provided without cost.
  3. Provide venturi with throat diameter such that specified rate of flow will register scale reading of between 20% and 80% of full scale value.
  4. Unrecovered head loss at maximum flow shall not exceed 10% for venturi used with permanently located meters and shall not exceed 12 inches w.g. when used with portable meters.
  5. Provide each primary element with integral tab or metal tag on stainless steel wire extending outside pipe covering on which is stamped or clearly printed in plainly visible position the following information:
    - a. Manufacturer's name and address.
    - b. Serial number of meter to which element is to be connected.
    - c. Name, number or location of equipment served.
    - d. Specified rate of flow.
    - e. Multiplier (including unity, where applicable) to be applied to meter reading, including correction for operating temperatures and glycol solutions.
  6. Provide taps with shutoff valves and quick connecting hose fittings for portable meters.
- I. Inches and Smaller Calibrated Balance Valves:
1. Calibrated balance valves equipped with readout valves to facilitate connecting of differential pressure meter to balance valves. Equip each readout valve with integral EPT check valve designed to minimize system fluid loss during monitoring process. Provide calibrated nameplate to indicated degree of closure of precision machined orifice. Construct balancing valve with internal EPT O-ring seals to prevent leakage around rotating element. Provide balance valves with preformed polyurethane insulation suitable for use on heating and cooling systems, and to protect balance valves during shipment.
- J. Portable Flow Meters:

1. Provide differential pressure gage and two 12-foot hoses in carrying case with equalizing manifold, check seals, and appurtenances. Plus or minus 2 percent accuracy between 20 to 80 percent of range. Provide master chart for conversion of meter readings to gallons per minute. Provide adapters as necessary.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

#### A. Temperature Gauges:

1. General: Install temperature gauges in vertical upright position, and tilted so as to be easily read by observer standing on floor.
2. Locations: Provide in the following locations and elsewhere as indicated:
  - a. At inlet and outlet of each chiller.
  - b. At inlet and outlet of each condenser.
  - c. At inlet and outlet of each hydronic coil in air handling units and built-up central systems.
  - d. At inlet and outlet of each hydronic heat exchanger or converter.
  - e. At inlet and outlet of each hydronic heat recovery unit.
  - f. At inlet and outlet of each thermal storage tank.
  - g. At inlet and outlet of each pump.
  - h. At each air handler to monitor Supply Air, Return Air, and Mixed Air temperatures.
  - i. Primary and secondary chilled water supply and return and bridle connection
3. Thermometer Wells: In vertical upright position. Fill well with oil or graphite, secure cap.
4. Temperature Gauge Connector Plugs: Located on pipe at most readable position. Secure cap.

#### B. Pressure Gauges:

1. General: Provide pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.
2. Locations: Provide in the following locations:
  - a. At suction and discharge of each pump.
  - b. At inlet and discharge of each pressure reducing valve.
  - c. At water service outlet.
  - d. At inlet and outlet of water cooled condensers and refrigerant cooled chillers.
  - e. At steam source heating equipment including but not limited to converters and hot water generators.
  - f. At BAS heating or cooling differential pressure sensor
3. Pressure Gauge Cocks: Provide in piping tee with snubber. Install siphons for steam pressure gauges.
4. Pressure Gauge Connector Plugs: Located on pipe at most readable position. Secure cap.

#### C. Flow Measuring Devices:

1. General: Provide flow measuring devices on piping systems located in accessible locations at most readable position.
2. Arrange piping in accordance with manufacturer's published literature. In horizontal pipes, place connections slightly above horizontal centerline of pipe.
3. Install so connections for attachment to portable flow meter hoses is readily accessible
4. Locations: Provide in the following locations and elsewhere as indicated:
  - a. At discharge of each pump.
  - b. At inlet of each hydronic coil in built-up central systems.
5. Calibrated Balance Valves: Provide on piping with readout valves in vertical upright position. Maintain minimum length of straight unrestricted piping equivalent to 5 pipe diameters upstream and downstream of valve and/or fittings.

### 3.2 TESTING, CLEANING AND CERTIFICATION

- #### A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

- B. Cleaning: Clean windows to meters and gauges and factory-finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer's touch-up paint.
- C. Certification: Provide meters and gauges whose accuracies, under specified operating conditions, are certified by manufacturer.

**END OF SECTION 23 05 19**