

**SECTION 230923.14  
FLOW METERING**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Design Requirements
  - 1. General Requirements
  - 2. Flow Metering
    - a. Steam Flow
    - b. Steam Condensate Flow
    - c. Chilled Water Flow

1.2 RELATED REQUIREMENTS

- A. 230900S03 – Instrumentation and Control for HVAC UK Controls Standard
- B. UK Meter Identifier Naming Convention

1.3 REFERENCE STANDARDS

- A. The work performed under these specifications shall be done in accordance with the following codes and standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of the document shall apply.
  - 1. American National Standards Institute (ANSI)
  - 2. American Society for Mechanical Engineers (ASME)
  - 3. Electronic Industries Association (EIA)
  - 4. Federal Energy Regulatory Commission (FERC)
  - 5. Institute of Electrical and Electronics Engineers (IEEE)
  - 6. The International Society of Automation (ISA)
  - 7. National Electrical Code (NEC)
  - 8. National Electrical Manufacturers Association (NEMA)
  - 9. National Electrical Reliability Council (NERC)
  - 10. National Fire Protection Association (NFPA)
  - 11. National Institute of Standards and Technology (NIST)
  - 12. Underwriters' Laboratories, Inc. (UL)
- B. Seller shall comply with all applicable codes and standards, whether or not identified in this listing. This specification refers to these publications by the basic designation only. These references shall govern the work except where they conflict with the Engineer's specifications. In case of conflict, the more stringent requirement, as interpreted by the Engineer, shall govern.

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#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Submittals
  - 1. Seller shall include manufacturer name, full model number, and any other information required for Engineer to review equipment conformity to the provided drawings and specifications.
  - 2. Submittals shall include but not be limited to:
    - a. List of supplied equipment with full part numbers, tags and design data
    - b. Product data sheets that can be used to decipher part number

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

#### 1.7 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

#### 1.8 SPECIAL TOOLS AND SPARE PARTS

- A. The Contractor shall provide a recommended spare parts list with the following information provided as a minimum:
  - 1. Contact information for the closest parts stocking location to the Owner.
  - 2. Critical spare parts shall be identified as those parts being associated with long lead times and/or those being critical to the unit's operation.
  - 3. Maintenance spares shall be identified as being those parts required to regularly perform scheduled maintenance on the furnished equipment. These spares shall include, but shall not be limited to, consumable spares that are required to be exchanged during scheduled maintenance periods.

- B. Spare parts shall be provided for each type and size of unit furnished. At a minimum, the following shall be provided:
  - 1. Provide the minimum spare parts recommended by the manufacturer.
  - 2. Provide one spare set of each type of power and control fuse installed within equipment.
- C. Any manufacturer specific special tool, not normally found in an electrician's toolbox, required to remove and install recommended or furnished spare parts shall be furnished.
- D. Spare parts shall be properly marked and packaged for long term storage. Printed circuit boards shall be provided in separate anti-static containers.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

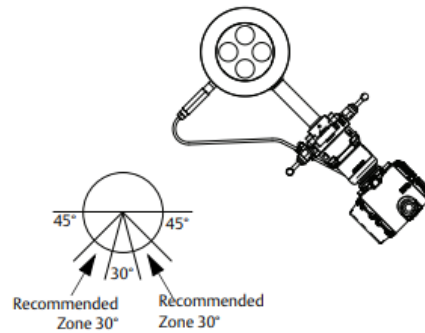
- A. Seller shall provide equipment according to information and requirements as defined in the Instrument Index.
- B. All documents shall be in the English language.
- C. Instrument data sheets shall be provided with all instrumentation provided or specified by an equipment manufacturer. These data sheets shall be presented on ISA Standard Specification Forms or equivalent.
- D. The furnished equipment shall be designed for the site conditions.
- E. Equipment shall be standardized on the following units of measure:
  - 1. Flow:
    - a. Liquid : Gallons per minute (gpm), pounds per hour (lb/hr)
    - b. Steam : Pounds per hour (lb/hr)
    - c. Gas : Standard Cubic Feet Per Hour (scfh)
    - d. Thermal Energy : British thermal units per hour (BTUH)
- F. Control signals shall be standardized on the following:
  - 1. Analog input signal: 4-20 mA (24VDC)
  - 2. All meters shall provide instantaneous flow and totalized flow via BACnet IP interface, only exception is Rosemount Industrial meters. Rosemount Industrial meters require an additional HART to Modbus convertor.
- G. Instrument tags shall be provided with the instruments and shall be permanently attached to the devices. If this is not possible, the instrument tag shall be fastened to the instrument with stainless steel wire.
- H. All instrumentation mounted inside, away from direct exposure to the elements, shall be as a minimum NEMA 12 construction unless it is in an environmentally controlled environment (e.g., the control room). If the instrument is mounted in an

environmentally controlled environment, the instrument shall be as a minimum NEMA 1 construction.

- I. All instrumentation mounted outside, exposed to the elements, in non-corrosive environments, shall be as a minimum NEMA 4 construction.
- J. All instrumentation mounted outside, exposed to the elements, in corrosive environments, shall be as a minimum NEMA 4X construction.
- K. Electronic instruments installed in classified area shall be selected in accordance with IEC code requirements. Electronic instruments in hazardous area shall be intrinsically safe. Where intrinsic safe instruments are not available Explosion proof or purged instruments shall be selected. Certification shall be provided by a recognized laboratory.
- L. The component parts of instruments will be of material suitable for the process. Movements or wetted parts for instruments will be stainless steel or better when specified. Materials exposed to the process fluid will be in accordance with the fluid conditions (pressure, temperature, and corrosion).
- M. All components, particularly if containing electric contacts, will be vibration resistant. All components will be constructed of material which is resistant to corrosion by the process fluid with which they are in contact internally and to the ambient air environment to which they are externally exposed.
- N. Each meter shall have a local totalizing digital display. Display components to be enclosed in a NEMA 4 or greater enclosure and all displays and alarms to be visible with enclosure shut. The display shall be remotely mounted from the flow sensor where high temperatures may be a concern based on manufacturer specifications. The display shall be mounted at an elevation between 4ft and 6ft from the floor in an accessible location. The shortest practical cabling length available is preferred.

## 2.2 DESIGN REQUIREMENTS

- A. Steam Flow, all straight run pipe length situations:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Rosemount
  - 2. Description:
    - a. 3051SFC DP Flow Meter with integrated compact orifice plate.
    - b. Direct mount, integral 3-valve manifold.
    - c. Suitable for pipe sizes ½" through 12".
    - d. Mounting Suitable for Application: Transmitter mounted as shown below in horizontal pipe, or mounted in vertical pipe with flow up.



- e. Straight run pipe length requirements: 2 diameters upstream and downstream from most flow disturbances.
  3. Performance:
    - a. Flow Rate: 1.75% of flow rate accuracy, 8:1 turndown.
    - b. Measurement Range: 0 to 250 in H<sub>2</sub>O
    - c. Static Pressure Limit: 0.5 psia to 3626 psig
    - d. Process Temperature Range: Minus 40 to plus 450 deg F.
  4. Wetted Parts Construction:
    - a. Orifice Plate: Type 316 stainless steel.
    - b. Process Connection: NPS 1-1/2.
  5. Enclosure:
    - a. Aluminum
    - b. Threaded cover
    - c. NEMA 4
    - d. Electrical Connection: Terminal block
    - e. Conduit Connection: 1/2-14 NPT
- B. Steam Condensate Flow, all straight run pipe length situations:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Flexim
  2. Description:
    - a. FLUXUS Type F721
    - b. Suitable for pipe sizes 1/2" through 100".
    - c. Mounting Suitable for Application: Mounted in vertical pipe with flow up. If meter cannot be mounted vertically as described, situation must be reviewed with the engineer.
    - d. 120VAC/24VDC External power supply required.
    - e. BACnet IP communications
  3. Performance:
    - a. Flow Rate: 1.0% of flow rate accuracy.
    - b. Measurement Range: 0.03 to 82 ft/s
    - c. Process Temperature Range: Minus 328 to plus 1112 deg F.
  4. Wetted Parts Construction:
    - a. N/A
  5. Enclosure:
    - a. Aluminum
    - b. IP66

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- c. Electrical Connection: Terminal block
  - d. Conduit Connection: 1/2-14 NPT
- C. Chilled Water Flow (Pipe diameter 4" – 20") adequate straight run pipe length situations:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Onicon
  - 2. Description:
    - a. F-3500 Insertion Electromagnetic with Onicon System-10 BTU display
    - b. Mounting Suitable for Application: Switch vertically mounted in horizontal pipe, or switch horizontally mounted in vertical pipe with flow up.
    - c. Straight run pipe length requirements: 10 diameters upstream and 5 diameters downstream from most flow disturbances.
    - d. 24VDC External power supply required.
    - e. RTD temperature sensors and wells for connection to Onicon display.
    - f. BACnet IP communications
  - 3. Performance:
    - a. Flow Rate: 1.0% of flow rate accuracy
    - b. Measurement Range: 0.1 to 20 ft/s
    - c. Pressure Limit: 400 psig
    - d. Process Temperature Range: 15 to 150 deg F.
  - 4. Wetted Parts Construction:
    - a. Probe: Type 316 stainless steel.
    - b. Process Connection: 1" NPT adaptor.
  - 5. Enclosure:
    - a. Aluminum
    - b. NEMA 4
- D. Chilled Water Flow (Pipe diameter greater than 4") reduced straight pipe length situations:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Flexim
  - 2. Description:
    - a. FLUXUS Type F722 with Onicon System-10 BTU display
    - b. Suitable for pipe sizes 1/2" through 100".
    - c. Mounting Suitable for Application: Mounted in horizontal pipe.
    - d. 120VAC/24VDC External power supply required.
    - e. RTD temperature sensors and wells for connection to Onicon display.
    - f. BACnet IP communications
  - 3. Performance:
    - a. Flow Rate: 1.0% of flow rate accuracy.
    - b. Measurement Range: 0.03 to 115 ft/s
    - c. Process Temperature Range: Minus 328 to plus 1112 deg F.
  - 4. Wetted Parts Construction:
    - a. N/A

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5. Enclosure:
  - a. Aluminum
  - b. IP66
  - c. Electrical Connection: Terminal block
  - d. Conduit Connection: 1/2-14 NPT
  
- E. Chilled Water Flow (Pipe diameter greater than 20"): adequate straight-length situation:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Flexim
  2. Description:
    - a. FLUXUS Type F721TE
    - b. Suitable for pipe sizes 1/2" through 100".
    - c. Mounting Suitable for Application: Mounted in horizontal pipe.
    - d. 120VAC/24VDC External power supply required.
    - e. RTD temperature sensors and wells for connection to FLUXUS meter
    - f. BACnet IP communications
  3. Performance:
    - a. Flow Rate: 1.0% of flow rate accuracy.
    - b. Measurement Range: 0.03 to 82 ft/s
    - c. Process Temperature Range: Minus 328 to plus 1112 deg F.
  4. Wetted Parts Construction:
    - a. N/A
  5. Enclosure:
    - a. Aluminum
    - b. IP66
    - c. Electrical Connection: Terminal block
    - d. Conduit Connection: 1/2-14 NPT

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
- C. Indicate dimensioned locations with mounting height for all surface-mounted products to walls and ceilings on shop drawings.
- D. Do not begin installation without submittal approval of mounting location.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

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### 3.2 INSTALLATION REQUIREMENTS

- A. Install products in accordance with manufacturer's instructions.
- B. Reference 232200D06 Steam Condensate Meter Installation details for specific requirements.

### 3.3 CHECKOUT PROCEDURES

- A. Description:
  - 1. Check out installed products before continuity tests, leak tests, and calibration.
  - 2. Check instruments for proper location and accessibility.
  - 3. Check instruments for proper installation with respect to direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.
  - 4. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.
- B. Flow Instrument Checkout:
  - 1. Verify that sensors are installed correctly with respect to flow direction.
  - 2. Verify that sensor attachment is properly secured and sealed.
  - 3. Verify that processing tubing attachment is secure and isolation valves have been provided, if applicable
  - 4. Inspect instrument tag against approved submittal.
  - 5. Verify that recommended upstream and downstream distances have been maintained.
  - 6. Verify signal strength and quality meets manufacturer's recommended values on all ultrasonic flowmeters

### 3.4 ADJUSTMENT, CALIBRATION, AND TESTING

- A. Description:
  - 1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
  - 2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
  - 3. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.
  - 4. Equipment and procedures used for calibration shall meet instrument manufacturer's recommendations.
  - 5. Provide diagnostic and test equipment for calibration and adjustment.
  - 6. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
  - 7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.



8. If after-calibration-indicated performance cannot be achieved, replace out-of-tolerance instruments.
  9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.
- B. Analog Signals:
1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
  2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
  3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.
- C. Communication Signals:
1. Verify readings on operator interface match readings on meter's display

### 3.5 CLOSEOUT ACTIVITIES

- A. Installer shall perform field verification to demonstrate accurate and reasonable data upon completion of installation
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
- C. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
- D. Provide minimum of two hours of training.
- E. Provide a complete set of system documentation in a digital format for library archival. Documentation to include installation, calibration, operation, maintenance and repair manuals of sufficient detail to enable customer to install, calibrate, operate, maintain and repair the complete system. Documentation also to include warranty details, circuit schematics, wiring interconnection diagrams and necessary mechanical drawings.

### 3.6 FACILITY MANAGEMENT SYSTEM (FMS) & NETWORK CONNECTION

- A. Refer to Section, 230900S03 - INSTRUMENTATION AND CONTROL FOR HVAC UK Controls Standard.

### 3.7 PROTECTION

- A. Protect installed system components from subsequent construction operations.

*END OF SECTION*