23 09 23 – Thermal Utility Metering

1. Introduction

   A. This Design Guideline covers utility metering and utility building entrance requirements for chilled water, heating water, and steam entrances.

   B. Designers to coordinate with Duke FMD on installation requirements where needed.

2. References

   A. Refer to the following Design & Construction Standard sections for reference, as needed:

      a. 23 21 13 Building Mechanical Piping
      b. 23 61 00 Chilled Water and Heating Hot Water Systems
      c. 23 22 13 Building Steam & Condensate Piping Systems
      d. 23 07 16 HVAC Piping and Equipment Insulation
      e. A33 63 00 Steam Energy Distribution

3. General Requirements:

   A. Duke FMD operates district energy and water systems to provide power, heating, and cooling utilities to University & Health System campus facilities. The metering applications listed below, and the resultant data are critical to the successful operation, maintenance, and sustainability goals of the campus, and as such, are critical to building design.

   B. The district energy utility metering equipment listed in this guideline are the only devices currently approved by Duke FMD for use in existing and new construction. Any variance in design, hardware, or equipment, other than those provided in this guideline must be approved by Duke FMD.

   C. For all applications, designers are to take care not to oversize hardware based on extreme operating conditions or unnecessarily conservative load calculations; rather, selecting metering hardware that meets the normal minimum and maximum loads anticipated by the facility through a normal operating year. Under no circumstances will Duke FMD accept “line-sizing” as a justification for meter / sensor hardware selection.

   D. For all applications, designers shall follow manufacturer instructions for installation, grounding, termination, and maintenance.

   E. Insulation for ultrasonic flow meters:

      a. Transducers shall be strapped directly to the pipe. In conditions where expansion and contraction of pipe diameter occurs, such as on Heating Hot Water piping, a 1/8” EPDM gasket material only under the flow meter strap and a stainless-steel spring-loaded strap is to be installed. Any variance other than those provided in this guideline must be approved by Duke FMD.
      b. Insulation shall be placed in a method where the insulation can be removed to access and service the transducers for maintenance. Approved methods are:

i. Closed-cell elastomeric insulation (Design Basis Armaflex) sized to prevent condensation in the space conditions of the location of the meter installation.
ii. Removable/Reusable Jackets
iii. Refer to Duke University Design Guidelines, *Section 23 07 16 HVAC Piping and Equipment Insulation*

F. For all device / sensor applications as part of the utilities metering package, designers shall coordinate with Duke FMD on developing the list of point names, alarms, notification groups and classes, return-to-normal, conditional pre-requisites, and escalation requirements.

G. For metering and valve elements of the utilities package, designers shall include instrumentation tagging, asset name and detail reporting, and designation of the parent asset to the owner project team.

H. For all applications where utilities metering and valve equipment has power greater than 48V supplied, Designer will designate installation of a manual switched disconnect mounted near the device, the rocker switch will have a weather resistant cover.

I. Refer to Duke University Design Guidelines, Section 23 07 16 HVAC Piping and Equipment Insulation for identification of piping standards.

4. Meter Applications

A. General Design and Installation Requirements

a. In certain applications, to be discussed with Duke FMD staff, district thermal piping supplied to process equipment will be provided with a full metering station for the system. Some examples are large process loads that constitute more than 15% of the building's load or critical process loads that cannot be easily disrupted.

b. All energy calculations and conversion are to be done in the building automation system, derived from the below specified hardware for flow, pressure, and temperature measurement. No standalone "flow computer" hardware is allowed.

c. All utility metering hardware are to be installed in locations and orientations that allow personnel simple access to calibrate, maintain, and replace these devices. Meters and other devices are to be located no higher than what is safely accessible with an 8 ft step ladder.

d. Meter locations shall be shown by the Design Development submission at the latest to allow for review and input.

e. All device displays will be located at eye level, easily readable and not blocked by piping or equipment.

B. District Chilled Water and Heating Hot Water

a. Design & Installation

i. Main supply and return main piping connections will be provided with flow, pressure, and temperature transmitters for accurate utility metering.

b. Hardware

i. Flow: Katronic KatFlow Ultrasonic flow meter model # KF100, provided with transducer set appropriate to pipe size, material, and temperature. 4-20mA

passive output for flow range measured in gpm (supply & return) that are powered by the automation system. KatFlow 150 may be selected for needed readings on larger pipes or as recommended by manufacturer. **Project shall include factory authorized start-up and programming of the meter.**

ii. Temperature Chilled Water: Reotemp 100-ohm Resistive Temperature Device Temperature Sensor (RTD) and transmitter assembly model # RX8TPE1QX-CW, 4-20mA passive output for the measured temperature range of 30-90 Deg F as a matched pair to be installed on the supply & return headers that are powered by the automation system.

iii. Temperature Hot Water: Reotemp 100-ohm Resistive Temperature Device Temperature Sensor (RTD) and transmitter assembly model # RX8TPE1QX-HCW, 4-20mA passive output for the measured temperature range of 90-220 Deg F as a matched pair to be installed on the supply & return headers that are powered by the automation system.

iv. Automated Isolation Valving: Bray Model S70, 4-20mA modulating w/analog position feedback (supply & return). Provide switch to isolate 120V power locally for actuator replacement. Valve control module shall be configured to fail open upon loss of control command signal.

v. Pressure: Setra model # C206, pressure sensor, 4-20mA passive output for the 0-200 psi pressure range (supply & return) that are powered by the automation system.

C. District Steam and Condensate

a. Design & Installation

i. Main district steam supply piping connections to campus buildings are to be metered.

b. Hardware

i. Piping 2” NPS and larger: Veris Accelabar differential pressure flow meter, single transmitter option

ii. For horizontal installation arrangements, provide with integral transmitter port valves and direct mount transmitter

iii. For vertical (upward flow) installation arrangements, provide with integral port valves and remote mount transmitter kit

iv. For all material and installation requirements for steam systems, refer to sections *23 21 13 Building Mechanical Piping* and *23 22 13 Building Steam & Condensate Piping Systems*

D. Data Acquisition and BAS Integration

a. Thermal Utility Flow meters and associated transmitter hardware are to be connected to the Siemens building automation system. Designers, contractors, and integrators are to discuss instantaneous and totalized data capture intervals, specific BAS programming coding requirements, calculations, and long-term data storage requirements with Duke FMD.

E. Instrument Identification – Field Mounted Tags (for devices in this standard)

a. Tags for Instruments (inclusive but not limited to control valves, meters and sensors:

i. Tags shall be stainless steel, AISI 300 or 400 series. These shall have nominal minimum size of 1.75 x 2.75 inch and be of 26 ga minimum thickness (This is the minimum size needed for vendor to install owner-provided CMMS sticker on

reverse side of tag.). Size may be adjusted in accordance with the size of the device to be tagged. Initial size to be 3/16” with final size to be coordinated with Duke FMD. 5/64" mounting holes shall be punched 1/4" from each end for mounting.

ii. Critical instrument tags (control valves and sensors used to control) shall be red. Utilize silver/metal color for monitoring only sensors.

iii. See example tag below:

b. Identify control valves, meter and instrumentation sensors with rectangular stainless (SS) tags bearing system identification number and panel that controls the device in 3/8” to 1/2" black characters on one side of tag only. Attach tag to instrument with SS jack chain, SS ring, or SS braided wires with swag sleeves and "S" hook. Non-metallic fasteners are not allowed. Unless otherwise noted, device numbering shall match the Schedule and / or Points List on the Drawings.

c. Owner will provide the naming and asset template tracking spreadsheet to the designer.

d. Owner will furnish CMMS (EAM) sticker, and the vendor will install stickers on the back side of the tag.

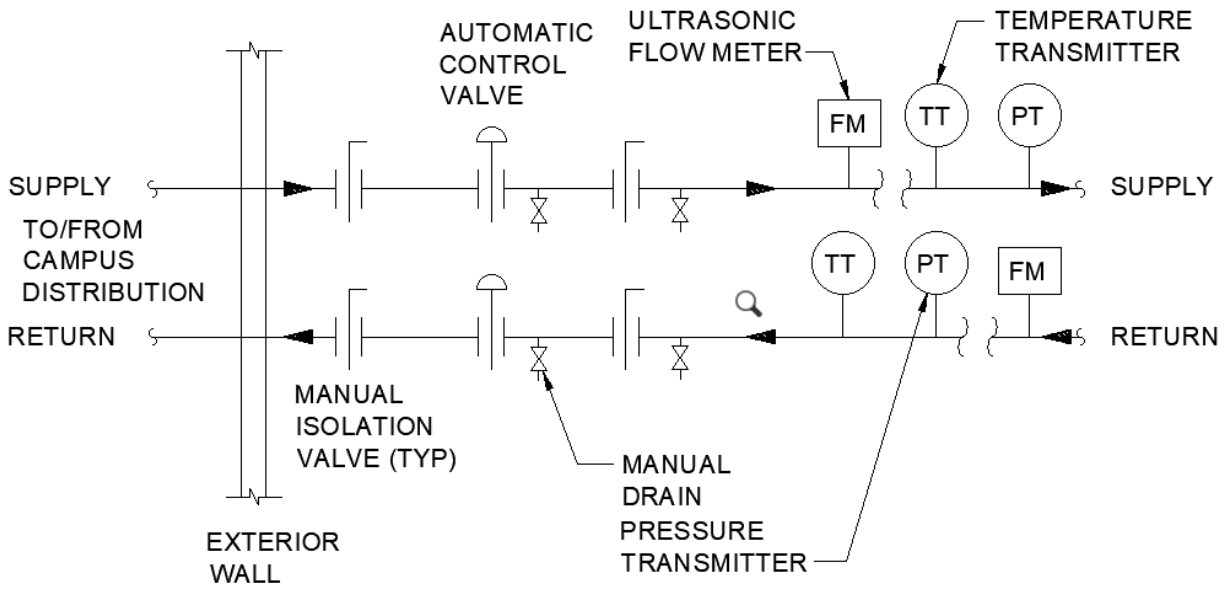
e. Label all new utility metering, monitoring and control devices.

f. Affix tag to permanent part or body of instrument, not to removable part such as lid, or as directed by Owner.

g. Do not mark on instruments with permanent markers, i.e.: felt pens or paint sticks.

5. Meter and Device Installation Details

A. Campus Chilled Water and Heating Hot Water



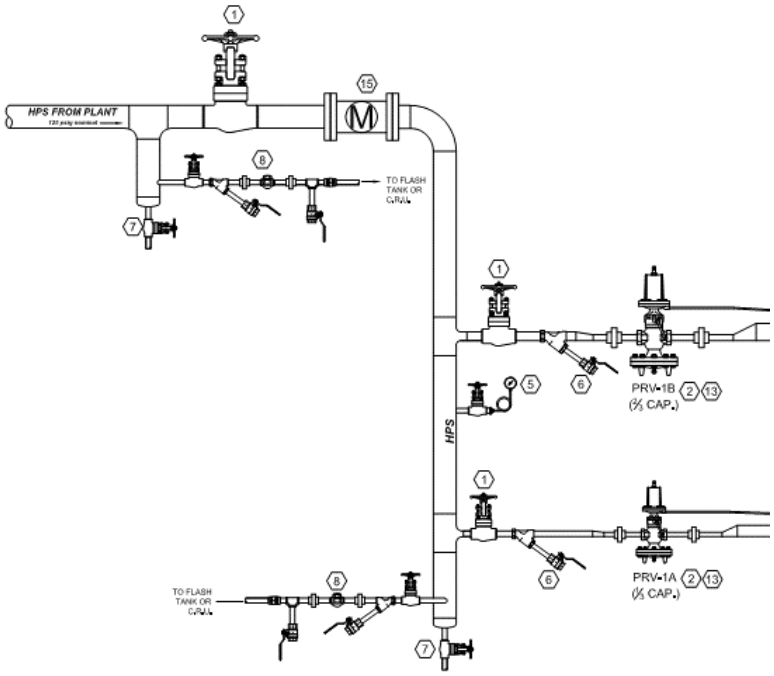
CHILLED & HEATING WATER BUILDING CONNECTION DETAIL

NOT TO SCALE

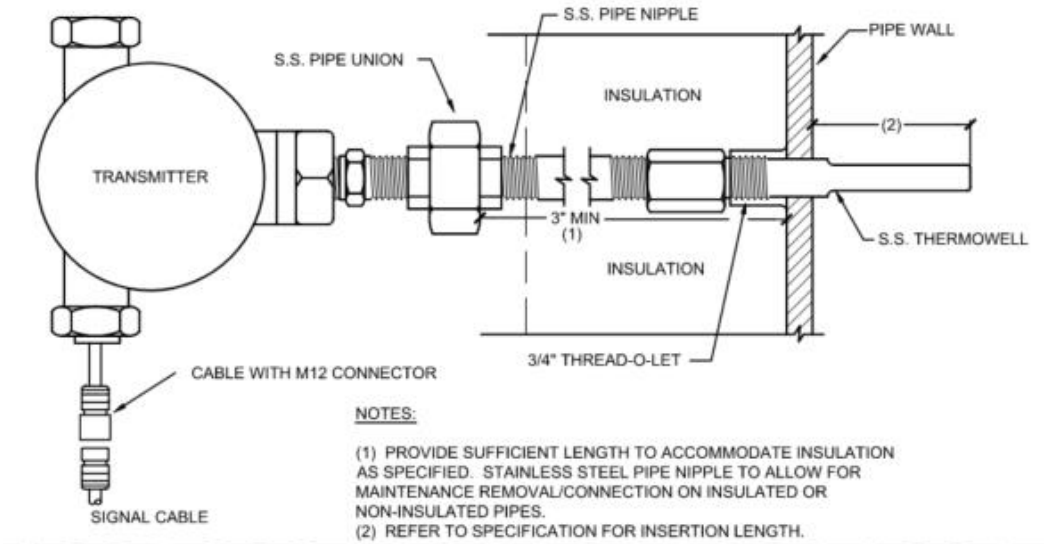
Notes:

1. Follow manufacturer recommendations for meter installations.
2. Thermowells are flow obstructions.

B. District Steam – Refer to A336300 Steam Energy Distribution for additional details.



C. Temperature Transmitter Assembly

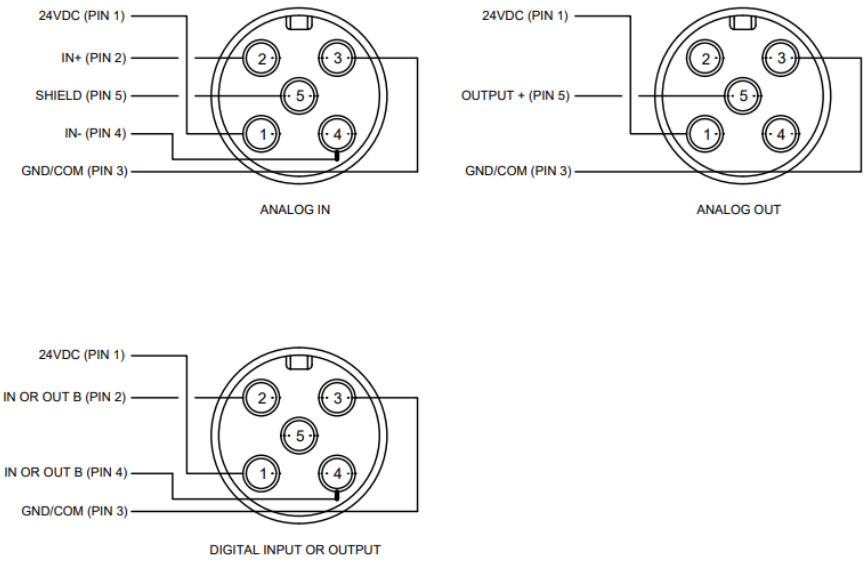


9 **TEMPERATURE ELEMENT HOUSING WITH TRANSMITTER**
SCALE: NONE

Notes:

1. Nipple-union-nipple configuration shall ensure the end of temperature probe in the path of water flow.

D. Temperature and Pressure Transmitter Wiring



4 M12 CONNECTOR PINOUT
SCALE: NONE

Notes:

1. REOTEMP and Pressure sensors 4-20ma Analog signal will use a 5 pin M12 connector.
    a. Pin 1 24VDC positive,
    b. Pin 2 not used
    c. Pin 3 24VDC negative return signal,
    d. Pin 4 not used
    e. Pin 5 shield connection to ground.
2. M12 connector shall be ordered as part of the submittal package to be approved by the designer. The M12 connector will be factory installed or included with the sensor / meter to be field installed.
3. The M12 cabling connections from the sensor / meter will be terminated to a five-pole terminal strip. At the end of the conduit transition to the sensor / meter, vendor will add a single gang box matching the rating of the conduit. The twisted shield cable will originate at the control system I/O module and be torqued to the valve set by the terminal strip. The transition to the M12 cabling from the gang box will have a metal compression connector with rubber gasket to provide strain relief for the cable.