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PART 1 GENERAL

1.1 DESCRIPTION

A. Purpose

1. This section covers hot water energy (or BTU) sub-meters (domestic hot water, heating hot water, or other hot water services in the building requiring metering) for use on the UW Seattle Campus hot water systems.
2. This section is intended for metering these loads when the services are generated via alternative means – i.e. not by a steam to hot water converter or electric or natural gas fired water heater. For hot water loads provided via the latter listed sources, refer to the appropriate meter specification sections for metering those systems.

1.2 QUALIFICATIONS

A. Approved manufacturers

1. Hot Water Energy Sub-Meter
 - a. BTU Energy Meter
 - 1) Onicon Inc. – System-10 BTU Meter
 - 2) Or approved equal
 - b. Flow Tube Meter – New Construction
 - 1) Onicon Incorporated – F-3100 Series
 - 2) Or approved equal
 - c. Insertion Meter – Retrofit Existing Meters
 - 1) Onicon Incorporated – F-3500 Series
 - 2) Or approved equal

1.3 RELATED SECTIONS

1. 01 91 00 – General Commission Requirements
2. 23 08 00.11 – Mechanical Meter Integration and Commissioning

1.4 REFERENCES

A. Applicable codes, standards, and references codes, regulations and standards

1. ANSI B16.5 Class 150 RF
2. AWWA Class B
3. NEMA 4X/6P (IP66/IP67)
4. CSA
5. State and local codes and ordinances

B. Attachments and Details

1. 23 00 00 Attachment #1 – Mechanical Meter Schematic

1.5 COORDINATION

- A. Coordinate design of utility services and associated mechanical systems in accordance with 23 00 00 Attachment #1 – Mechanical Meter Schematic
- B. Coordinate Operations and Maintenance training times with the Owner.
- C. The project team shall complete the required fields on the “Early Building Services (EBS)” tab of the UW-IT Outlet Schedule. All fields listed under “Project Responsibility” on the EBS tab must be filled in.
- D. If a UW-IT Outlet Schedule is not being maintained for the project, the project team shall submit a FacNet IP Address Request by emailing uwfot@uw.edu with the subject line: “FacNet IP address request.”

In the body of the email, provide the following information for each IP address being requested:

- 1. Location: Room name and number
 - A. If using an existing biscuit jack, include the Outlet ID (label on the data outlet).
- 2. Device Type: For example, Electrical Meter, CCW Meter, Data Collection Controller, etc.
- 3. IDF Room: IT service origination for data jack, if known.
- 4. Panel Name: Device enclosure name or label.
- 5. MAC Address: Format should follow standard convention (e.g., 00:05:e4:05:0D:d2).
- E. Device startup, commissioning, and integration into the Owner’s data aggregation software shall be completed in accordance with the Startup, Commissioning, and Integration Specification (26 08 00.11 for Electrical or 23

08 00.11 for Mechanical).

- F. (For mechanical systems only) BACnet Device Instance ID provisioning shall be coordinated on the “Early Building Services (EBS)” tab with both the UW Facilities OT Team and the UWF Environmental Control Systems Manager (ECSM), Shop 69. Use of uncoordinated or self-assigned Device Instance IDs is strictly prohibited. If a UW-IT Outlet Schedule is not being maintained for the project, requests may also be emailed to uwfot@uw.edu with the subject line “BACnet Device ID Request” and coordination with Shop 69 will be managed by UW Facilities OT and the ECSM.

1.6 SUBMITTALS

- A. Submittals shall only be approved by Campus Utilities and Operations
 - 1. Submittals shall be in accordance with Conditions of the Contract and Division 01 Specification Sections.
 - 2. Submittals shall be complete and provide all necessary details for full review of products and shop drawings against project design documents. Incomplete or partial submittals will be rejected and not reviewed.
 - 3. Submit detailed maintenance manuals and drawings, which include catalog information indicating the complete electrical and mechanical characteristics.
 - 4. Submit dimensioned cross-sectional drawings (manufacturer’s data sheets are

acceptable).

5. Submit finished meter tests – Manufacturer’s Certified Test Reports showing accuracy tests
6. Submit a completed “Mechanical Meter Profile Report” form per Specification 23 08 00.11 Appendix A for each meter.

B. The project team shall complete the required fields on the “Early Building Services (EBS)” tab of the UW-IT Outlet Schedule. All fields listed under “Project Responsibility” on the EBS tab must be filled in.

C. If a UW-IT Outlet Schedule is not being maintained for the project, the project team shall submit a FacNet IP Address Request by emailing uwfot@uw.edu with the subject line: “FacNet IP address request.”

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1.7 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with Conditions of the Contract and Division 01 Specification Sections.
- B. Operations and Maintenance Manuals shall include catalog information indicating complete electrical and mechanical characteristics.
- C. Manufacturer’s Certified Test Reports

D. Manufacturer's drawings of meter wiring diagram.

1.8 MEETINGS

A. Pre-installation conference

1. The Contractor shall request a pre-installation conference with the UW Meter Shop (Shop 69) before project construction begins.

B. Attend meetings with the Owner and/or Owner's Representative as required to resolve any installation or functional problems.

PART 2 PRODUCTS

2.1 GENERAL

A. These hot water sub-meter specifications are in accord with the Owner's policy to construct permanent installations with long life, coupled with maximum reliability and safety.

2.2 HOT WATER BTU SUB-METER

A. The following shall apply to hot water BTU sub-meters installed on the UW Campus:

1. BTU meter shall be provided with two temperature sensors.
 - a. Temperature sensors shall have a differential temperature accuracy of +/- 0.15 degree F over the calibrated range
2. BTU meter shall have the following accuracy:
 - a. +/- 1.0% of reading from 2 to 20 ft/sec
 - b. +/- 0.02 ft/sec below 2 ft/sec
3. BTU meter shall be capable of receiving a 0-15V pulse input from a flow meter.
4. BTU meter shall accommodate fluid temperature range
 - c. 32°F to 200°F Standard
 - d. 120°F to 300°F Optional
5. BTU meter shall have digital display and totalization for local monitoring. Local display shall include supply temperature, return temperature, gallons per minute (GPM), btu/hr, gallons and btu (dual mode). Display shall be mounted at easy reading level (4'-5') above finished floor (AFF).
6. BTU meter shall have an isolated solid state dry contact for energy totalization.
7. Meter housing shall be NEMA 4X rated.
8. Meter shall be suitable ambient temperatures of -20 to 140° F.
9. Meter shall be provided with memory retention of program parameters in the event of a power loss.
10. BTU meter shall accommodate a 120V AC source.
11. BTU meter shall have a RJ45 port with BACNet IP communication protocol.
12. BTU meter shall have 2 4-20mA analog inputs available.

2.3 HOT WATER FLOW SUB-METER

A. The following shall apply to the hot water flow sub-meters installed on the UW

Campus:

1. In-line magnetic flow meter shall use electromagnetic sensing method.
2. Meter shall have a flow range of 0.10 ft/sec to 33 ft/sec.
3. Meter shall have a reading accuracy as follows:
 - a. +/- 0.4% for velocities between 3.3 ft/sec and 33 ft/sec
 - b. +/- 0.75% for velocities between 1 ft/sec and 3.3 ft/sec
4. Meter shall have empty pipe detection
5. Meter shall measure fluids with conductivity greater than or equal to 5.0 uS/cm
6. Meter shall have an option for bidirectional flow
7. Meter shall have a stainless-steel internal flow tube.
8. Meter body shall be constructed of stainless steel.
9. Meter shall be capable of ANSI Class 150 flange connections, with the option of ANSI Class 300 flange connections
10. Meter shall be provided with ground rings for each side
11. Meter shall have a maximum operating pressure of 230-580 psi depending flange rating
12. Meter shall be suitable for installations on pipes from 1" to 48"
13. Meter shall accommodate fluid temperature range
 - a. 32°F to 200°F Standard
 - b. 120°F to 300°F Optional
14. Meter electronics shall be housed in a NEMA 4X enclosure.
15. Meter shall be suitable for ambient temperatures of 0 to 140°F.
16. Meter shall have a local digital display that indicates total flow, flow rate, flow direction and alarm conditions
17. Meter shall have non-volatile memory for retention of program parameters and totalized values.
18. Meter shall be equipped with a 4-20 mA analog output for flow rate
19. Meter shall have a programmable digital/pulse outputs.
20. Meter shall accommodate 120V AC power source.

PART 3 EXECUTION

3.1 REQUIREMENTS

- A. Application
 1. Hot water sub-meter shall be provided and installed as a complete meter system including accessories.
 2. Hot water sub-meters shall be provided and installed as required by code and rating system credits per project.
- B. General installation
 1. Identification and Labeling

- a. Reference section 23 05 53 Identification of Mechanical Piping and Equipment
 - b. All wiring and devices shall be properly labeled in accordance with system diagrams and wiring details to identify device tag, name, and purpose.
 - c. Wire labels shall be machine made shrink type labels and match wire designations on the instrumentation drawings.
 - d. Field devices including flow meters and temperature sensors shall be labeled with Brother P-touch or equal.
 - e. Label in accordance with other sections of this specification.
2. Installation
- a. Only personnel qualified and experienced in this type of work shall make connections.
 - b. The installation of meters shall be done with care to avoid damage.
 - 1) Meters showing damage after installation shall be replaced.
 - 2) Meters shall have adequate clearance to service, repairs, and replacement.
 - 3) Data collection cabinets hung improperly shall be properly secured and all paint scratches shall be touched up.
 - c. Provide adequate pipe diameters upstream and downstream of installed meter. See Manufacturer's recommendations.
 - d. Meters shall be installed such that the display can be easily read and accessible. Meter display shall be mounted at an easily read height (4' - 5') above finished floor (AFF). A shield shall be supplied if display is in direct sunlight.
 - e. Provide Pete's Plugs adjacent to each temperature sensors to provide owner a test point for the temperature sensors.
 - f. Each hot water flow meter shall have a dedicated twisted-pair shielded cable installed for each 24VDC digital pulse out to the BTU meter.
 - g. Each temperature transmitter shall have dedicated twisted-pair shielded cable installed to transmit the 4-20 mA signal to the BTU meter. Signal cable shall be installed in a dedicated low voltage conduit.
 - h. A dedicated conduit shall be installed for the data cabling per manufacture recommendations.
 - i. Provide shutoff valves and a bypass connection to allow for continuous service during periods of meter maintenance.
 - j. Provide appropriate installation kit based upon pipe material.
 - k. Provide adequate slack in flexible conduit to allow for the removal of the flow meter.
 - l. Each device requiring communication on the FacNet network shall be provided with a dedicated Category 6 (CAT6) communication cable. The cable shall be installed in a minimum 1" rigid conduit and terminated at a FacNet data jack in accordance with UW-IT Specification Drawing OL-

CI-2. The data jack shall be housed inside the following Milbank enclosure components:

- 1) Milbank #12126-LC1 (12" x 12" x 6" enclosure)
- 2) Milbank #A-LKSFMKEYL (hinged cover with lock)
- 3) Key: #2233

Refer to UW-IT Specification Drawing CNT-CI-2: [CNT-CI-2 Drawing](#)

- m. The Milbank enclosure shall be mounted in a serviceable area within 10' of the device that will be communicating on the FacNet network. Any exceptions must be reviewed and approved by the Owner.
 - n. The Milbank enclosure shall be mounted at an accessible height (4'-5') above the finished floor. Exceptions must be reviewed and approved by the Owner.
 - o. A durable label (Brother P-touch or equal) shall be affixed to the exterior of the enclosure cover, indicating the IT Room from which service originates.
 - p. Where shared use of a FacNet data jack is proposed (e.g., electrical meter and lighting control device sharing a connection), the Contractor shall coordinate with the Owner and obtain approval prior to installation.
3. UW Campus Utilities and Operations will check the Contractor's work to ensure the accuracy of the installation.
- a. The Contractor shall arrange with the Owner for the times when Owner's services will be required, and under no circumstances shall the Contractor connect to the existing system without Owner's knowledge.
 - b. The proper connection of the wires and cables to other systems as specified is entirely the responsibility of the Contractor.
 - c. Contractor shall not energize meter until Owner or owner's representative has inspected wiring.
4. Install meters per manufacturer's recommendations.
5. Meter shall be UL Listed from manufacture or shall be field listed.
- C. Mounting and electrical connections
1. In accordance with manufacturer's installation instructions.
 2. Rigid-style GRC or IMC conduit must be used for installations in utility tunnels, utility vaults, or building service entrances. EMT conduit is only permissible in mechanical rooms and inside buildings. EMT fittings shall be compression type. All conduits must use threaded conduit style junctions (LB, LR, LL, C, TEE, etc.) with no unused/open hubs or Knockout holes (No 4" sq., etc). LFMC liquid-tight flexible metallic conduit shall be used when transitioning from conduit to device.
 3. Install a dedicated 120VAC circuit from a normal panelboard to the Hot Water BTU Meter with #12 THHN/THWN stranded wire to provide power to the flow meters and temperature sensors. Wiring shall be in a dedicated ¾" conduit run with no sharing of conduit for multiple power sources. All wiring shall be continuous with no breaks from source to endpoint.

4. Do not provide secondary means of 120VAC electrical disconnect external of Hot Water BTU Meter. Safe means of access will be achieved by LOTO of dedicated circuit feeding device at service panelboard.
5. Hot Water BTU Meter must be clearly labeled to show 120V service including panel name, circuit, and room number. Label shall read (for example) *"Fed from PCB-01-N01, Circuit 25 – Located in Room 025"*
6. 120v Electrical Panel must be clearly labeled to show circuit/feed to Hot Water BTU Meter. Label shall read *"System Hot Water BTU Meter."*
7. Install 24VDC circuits from the Hot Water BTU Meter to the flow meters and temperature sensors. 24V circuit shall be TSP and installed in a $\frac{3}{4}$ " conduit. A conduit is to be used when transitioning from conduit to device. From conduit to device, use $\frac{1}{2}$ " LFMC with enough slack to allow for the removal of the device.

D. Testing

1. Contractor to verify meter is reading accurately. Contractor shall present meter verification plan and gain approval from UW Campus Utility and Operations on meter reading verification.
2. Contractor to submit meter accuracy report of verified meter reading.
3. Contractor shall supply all test equipment and meters to verify accuracy of meter reading.

E. Integration and Commissioning

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END OF SECTION