

236000S02 BUILDING AND PLANT CHILLED WATER METERING

GENERAL OVERVIEW

This standard will review requirements for chilled water metering for building-level systems and plant-level system.

A building chilled water energy metering system shall be installed on any facility connected to the UK Central Chilled Water System such that all chilled water used by the facility is metered. The metering shall consist of an insertion electromagnetic flow sensor and matched set of thermo-well insertion supply and return temperature sensors. An ultrasonic meter may be applied where pipe straight runs, obstructions, or pricing prohibit accurate application of an insertion electromagnetic meter. Multiple meters shall be used if required to measure the entirety of the building flow. The flow and temperature sensors shall be connected to a local microprocessor-based digital BTU meter display. This meter shall calculate energy flow (in BTUs) and report that value, along with instantaneous flow rates and temperatures to the Facility Management System (FMS) designated by the Director of Utilities and Energy Management.

Plant chilled water flow shall be measured at each chiller and each distribution point from the plant. The metering shall consist of an insertion electromagnetic flow sensor on small to medium diameter pipe (generally 4" – 20" OD) or an ultrasonic transit time clamp-on flow sensor on large pipe (generally greater than 20" OD). An ultrasonic meter may be applied where pipe straight runs, obstructions, or pricing prohibit accurate application of an insertion electromagnetic meter. If insertion temperature sensors are pre-existing in the system at the location of the meter installation, the FMS may use these temperatures to calculate energy (in BTUs) rather than installing additional temperature sensors and performing calculations within the flow meter. The plant meters shall therefore measure volumetric flow (gallons) and flow rate (GPM) and report values to the FMS for calculation and trending in BTUs. Individual chiller flow meters shall not be required to have a local flow display and may be connected directly into the FMS via 4-20mA signal or similar.

The meters shall have local memory such that a loss of power or connectivity does not result in the loss of data. System must resume full functionality automatically when normal power or connectivity is restored. Each flow meter and component shall be covered by the manufacturer's two year warranty. Any chilled water metering systems installed in chilled water plants or building distribution piping shall be designed for 250 psig water working pressure.

System designer shall be responsible for accurate and reliable metering, and any specification here within that may present an issue in a particular application should be addressed. Designer shall consult with UK Utilities Energy Engineer for any necessary exceptions to this standard. Design and installation shall follow all manufacturer specifications to ensure proper functionality. Installer shall perform field verification to demonstrate accurate and reasonable data upon completion of installation.

FLOW & TEMPERATURE SENSORS

Insertion Electromagnetic Sensor

For each building system the flow meter shall be installed either in the supply (preferred) or return pipe of the system to be measured following the manufacturer's instructions with particular attention paid to upstream and downstream straight pipe runs and obstructions. Insertion type flow meters shall be provided with all installation hardware necessary to enable manual insertion and removal of the meter without system shutdown. For installations in non-metallic pipe, install grounding rings or probes as required. Accuracy shall be within $\pm 1\%$ of rate from 2-20 ft/s. Overall turndown shall exceed 100:1. For bi-directional flow in chiller plants (i.e. bypass piping) a bi-directional flow meter shall be permitted. Flow meters shall be labeled or tagged locally with meter name and description. See UK Standard Drawing 236000D03 for further detail on this installation.

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Ultrasonic Transit Time Clamp-On Flow Meter

Where applicable in building or plant chilled water applications, an ultrasonic transit time clamp-on flow meter and transmitter shall be installed on the supply (preferred) or return pipe following the manufacturer's instructions with particular attention paid to upstream and downstream straight pipe runs and obstructions. The flow transducers shall be mounted with the manufacturer recommended hardware and coupling materials. Meter shall be field calibrated to an accuracy of $\pm 0.5\%$ of reading. Flow meters shall be labeled or tagged locally with meter name and description.

Temperature Sensors

Temperature sensors shall be loop-powered current based (mA) sensors and shall be bath-calibrated and matched (NIST* traceable) for the specific temperature range for each application. Sensors will be inserted into flow stream via thermo-well. The calculated differential temperature used in the energy calculation shall be accurate to within $\pm 0.15^\circ\text{F}$ (including the error from individual temperature sensors, sensor matching, input offsets, and calculations). Surface clamp-on temperature probes shall not be permitted.

All sensors shall use NEMA 4 or better enclosures. The flow sensors and temperature sensors shall be labeled or tagged locally to identify the connected meter and point being measured.

DIGITAL DISPLAY WITH LOCAL VISUAL INDICATORS

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 mounted at an elevation between 2ft and 6ft from the floor in an accessible location. Flow display device shall communicate to FMS via BACnet IP or BACnet MSTP and the following data points shall be visible locally from the digital display and reported to the FMS.

Energy Total (BTU) – not required locally for chillers or plant distribution

Instantaneous water flow (GPM)

Flow Total (Gallons)

Supply and return temperatures ($^\circ\text{F}$) - not required locally for chillers or plant distribution

DATA TRENDS

Total Energy (BTU), flow total (Gallons), flow rate (GPM), and temperatures ($^\circ\text{F}$) shall be trended in the building automation system as follows and passed through to the Utility Data Historian.

Points	Trend Frequency	Alarm
Device	COV	Offline
Energy Rate (BTUH)	600 seconds	none
Volume Rate (GPM)	600 seconds	none
Supply Temp (deg F)	600 seconds	none
Return Temp (deg F)	600 seconds	none
Energy Total (BTU)	600 seconds	none
Volume Total (Gal)	600 seconds	none

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DOCUMENTATION

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.

The local display and/or meter for building or plant chilled water meters shall be labeled on the face in a durable method with the following information:

- Campus Chilled Water
- Building Name, Number, Room or Name of Chiller or Distribution Piping Feed
- Meter ID # (UK Assigned)
- Meter Instance Number (UK Assigned) or equivalent
- Meter IP Information (UK Assigned) or equivalent
- Power Panel Circuit Feed

ACCEPTABLE MANUFACTURERS

Insertion Electromagnetic Meter:

- Onicon F-3500 Insertion Electromagnetic with System-10 BTU meter display or equal
- Onicon FB-3500 Insertion Electromagnetic (for bi-directional flow in plants or distribution only)

Ultrasonic Transit Time Meter:

- Flexim FLUXUS Type F721TE with Clamp-On Flow Transducers or equal
- Flexim FLUXUS Type F721 with Clamp-On Flow Transducers or equal (for plant or chiller applications where existing temperature sensors may be utilized)