

SECTION 26 09 01 – CAMPUS CENTRAL METERING SYSTEM DESIGN CRITERIA

PART 1 - GENERAL

1.1 SUMMARY:

- A. This section details the general requirements for metering of building electrical, standby power, Chilled water, Hot water (Medium temperature and High Temperature) and natural gas services, and related metering system accessories.

1.2 RELATED SECTIONS

- A. Section 01301- Design Guidelines for Energy and Environment
- B. Section 01771 - Contract Record Documents
- C. Section 260010 – Electrical Design Criteria

1.3 GENERAL:

- A. Electrical consumption and usage data for buildings connected to the Brown campus electrical distribution systems, as well as other selected buildings, is monitored by a Siemens-brand, web-based campus metering system. This system is generally comprised of individual building meters and submeters, which are interconnected via the campus Ethernet to a central computer server and software. The metering system is presently configured to operate on Siemens “WinPM” supervisory software.
- B. High Temperature Hot Water, Medium Temperature Hot Water and district cooling system Chilled Water consumption and usage data for select buildings connected to the campus central heating systems and district chiller systems is also monitored by the campus metering system. This information is provided by thermal (BTU) meters, which includes interval and totalized flow rates and BTU consumption, and instantaneous supply and return water temperature information. This system is separate and distinct from the Johnson Controls and Andover (TAC) building automation and control systems.
- C. Natural gas consumption for select buildings is also monitored by the campus metering system.
- D. Emergency generators are monitored and supervised by the campus metering system for energy usage and alarm monitoring.

1.4 GENERAL METERING REQUIREMENTS:

- A. Proposed meter locations and the specific type of meter shall be reviewed by the FM Engineering Office and be specified in the project design documents. All new meters and submeters shall match and be fully compatible with the existing campus metering system components and software.
- B. Metering is to include provision of all required interconnection wiring, metering accessories (i.e. split-core current transducers, temperature transducers, etc.), 120 VAC power supply connections, data communications wiring and Ethernet data connections.
- C. Metering system installation shall include all required system configuration, calibration and programming for the software integration of the meters into the campus metering system. Software integration of electric, thermal, gas and generator metering data into the campus metering system typically includes the following:
 - 1. Development of building screens for display of meter data,
 - 2. Setup of historical trend logs for meter interval data and all system status alarm points,
 - 3. Development of “virtual” meter totalizers for combining various loads as may be required,
 - 4. Linking of meter data into various monthly building consumption reporting programs, “reporter” meter data polling programs, building energy use “dashboards”, and meter data validation and communications polling programs.
- D. Unless otherwise noted, all materials and wiring are to be provided by the Project, as well as all required meter and campus metering system programming and metering integration. The Project will be responsible for obtaining the meter startup and calibration services, as well as the software integration services from Siemens.
- E. For thermal meters, all required meter configuration, calibration and programming shall also be included for the integration of the thermal meters into the campus metering system software. The contractor will be responsible for obtaining the software setup and meter configuration from both the thermal meter vendor and Siemens.
- F. Interconnection wiring diagrams to suit the specific project metering needs and required metering interfaces shall be developed by the Project team and included as a project submittal.

1.5 SUBMITTALS:

- A. Metering system interconnection wiring diagrams, and screen shots depicting building meter screen displays, meter data and “virtual” meter configuration shall be submitted for approval by FM Operations and Engineering.

1.6 ELECTRICAL METERING:

- A. Provide metering of incoming electrical power for new building construction as well as for electrical and mechanical systems renovations to existing buildings where metering is not already installed.
- B. Exceptions for electrical metering are for small (1-3 family) residential facilities, small Residence halls (less than 50 beds), administrative buildings and commercial spaces that are separately metered by the local utility, and leased spaces where Brown is a tenant.
- C. Submetering of major building systems (Lighting, HVAC, etc.), or of select spaces within the building, may be required for LEED Measurement and Verification purposes, by specific building Program requirements or for submetering of commercial tenants within the building.
- D. In general, the following electrical meter types are presently utilized as noted:
 - 1. Medium-voltage distribution feeders: Siemens type 9610, 9510 and PACS 4200.
 - 2. Incoming power meters for Research Labs, Libraries, Academic and Administrative buildings with research or a large proportion of Information Technology/computer systems, or other equipment sensitive to power quality issues: Siemens type 9510.
 - 3. Incoming power meters for Residential buildings, typical Athletic facilities, Administration buildings and Classroom buildings: Siemens type PACS 4200.
 - 4. Submetered building loads: Siemens type PACS 4200.
 - 5. Large Generator meters: Siemens type 9360.

1.7 ELECTRIC METER INSTALLATION REQUIREMENTS:

- A. See Section 26 09 02 - Campus Metering Network Connection Criteria for typical utility meter requirements and procedures for connection to the campus Ethernet.
- B. See Section 26 09 03 for typical utility meter interconnection wiring details.
- C. For retrofit applications and for new building loads that are served via small panelboards, utilize prewired metering enclosures, as supplied by Siemens, installed adjacent to the metered equipment. The enclosure generally consists

of a meter (type as required), interconnection wiring fused terminal strips for voltage leads and control power, and shorting blocks for connection to the current transformers.

- D. For larger building loads that are served via a new distribution switchboard(s), install the meters directly within a dedicated, barriered metering compartment designed within the switchboard. The metering compartment shall be factory prewired, to terminal strips, with all required three-phase current transducers, voltage inputs and 120 VAC meter power supply.

1.8 THERMAL (BTU) METERING:

- A. Provide thermal (BTU) metering for new building construction, as well as for mechanical systems renovations of existing high-consumption buildings that are located on the main campus and which have connections to the campus central heating systems and/or district cooling systems, where thermal metering is not already installed.
- B. Thermal (BTU) metering is not required for buildings that have their own independent heating and cooling systems.

1.9 THERMAL (BTU) METER INSTALLATION REQUIREMENTS:

- A. Thermal meters shall be wired back to the nearest accessible building electrical meter via a Modbus output and Belden # 9841, run in ¾" conduit. Where directed, flow meters shall also be wired back to the building energy management system network-level controller, via multiple Belden # 9841 cables, run in ¾" conduit.
- B. See Section 26 09 04-Thermal (BTU) Meter Interconnection Detail for typical meter interconnection wiring connections.

1.10 GAS METERING:

- A. Provide metering of natural gas services for new building construction and mechanical systems renovations of existing buildings that will have significant natural gas loads. Exceptions are for gas supplies to building emergency generators.
- B. Gas metering shall be comprised of a utility company natural gas meter incorporating a pulse output if not already present.

1.11 GAS METERING INSTALLATION REQUIREMENTS

- A. Pulse outputs from the gas meters shall be wired back to the nearest accessible building electrical meter “DI-type” input via a Belden # 9841 cable, run in ¾” conduit.
- B. Outputs for remote reading of gas meters by the gas company and third-party suppliers shall be via a dedicated telephone line connection to the meter.
- C. See Section 26 09 05-Gas Meter Interconnection Detail for typical meter interconnection wiring connections.

1.12 EMERGENCY GENERATOR METERING AND ALARM MONITORING:

- A. Monitoring of building emergency generators shall be provided through the Campus Metering System. Generators and transfer switches for critical Research buildings shall also be monitored through the Building Automation System.
- B. The following generator applications shall be provided with a dedicated generator power meter and input/output controller for supervisory monitoring and remote control of the generator and associated automatic transfer switches:
 - 1. Generators of large size (over 150 KW),
 - 2. Generators used for the “Demand Response” program,
 - 3. Generators for the support of critical Research and computing infrastructure projects.
- C. All other generators shall be connected to the building electric meter for supervisory monitoring and remote control of the generator and associated automatic transfer switches. The building power meter may require an auxiliary input/output controller for this function, depending upon the complexity of the emergency power system.

1.13 EMERGENCY GENERATOR METERING AND ALARM MONITORING INSTALLATION REQUIREMENTS:

- A. Generator power meter shall be set up to perform the following:
 - 1. Monitor generator load via generator-mounted current transformers and generator voltage inputs.
 - 2. When so required for load-shed purposes, the meter shall be programmed to provide a minimum of (4) user-programmable dry contact outputs to the BAS system or other system, to enable the BAS to enable various load shed sequences as may be required.
 - 3. Programmed to allow for remote activation of transfer switch control via discrete contact outputs to each controlled transfer switch.

4. Monitor the following status points from each connected transfer switch:
Load (amps, KW and KVA), voltage, and transfer switch position (load connected to normal, load connected to Emergency),
 5. Monitor the generator run status and alarm status panel alarm points.
 6. Meter monitoring shall be via MODBUS (RS 485) connection to each transfer switch and generator.
- B. Building Electric meter, when configured for generator monitoring, shall be set up to perform the following:
1. Monitor generator load via Modbus communications link to the generator control panel and internal generator metering.
 2. Programmed to allow for remote activation of transfer switch control via discrete contact outputs to each controlled transfer switch.
 3. Monitor the following status points from each connected transfer switch:
Load (amps, KW and KVA), voltage, and transfer switch position (load connected to normal, load connected to Emergency),
 4. Monitor the generator run status and alarm status panel alarm points.
 5. Meter monitoring shall be via MODBUS (RS 485) connection to each transfer switch and generator.
- C. Programming within the campus metering system for generator metering to include:
1. Setup of trend logs for meter interval data and System status alarm points,
 2. Setup of custom graphic display screens denoting system status points and setup of password protected, remote system start-stop and transfer switch control from the campus head end.
 3. Setup of email notification alerts for generator run alarms.
 4. The Contractor is responsible to coordinate this programming effort with Siemens, the generator supplier and transfer switch supplier.
- D. See Section 26 09 06 - Large Emergency Generator Metering & Load Shed Interconnection Detail, and Section 26 09 07 – Small Emergency Generator Metering Interconnection Detail, for typical interconnection wiring requirements to the campus Ethernet, emergency generator and automatic transfer switch(es).

PART 2 – PRODUCTS

2.1. ELECTRIC METERS:

- A. Siemens 9610 and 9510:
1. Measure voltage/current per phase, average, unbalance, real power, reactive power, apparent power, power factor, energy, and harmonics up to the 63rd order; monitor voltage sag / swells; capture, display and store

phasor representations of the system; store data onboard for 2-week period minimum.

2. Provide with Ethernet port, (2) Ethergate Modbus connections and minimum of 10 MB of on-board memory.

B. Siemens PACS 4200:

1. Measure voltage/current per phase, average, unbalance, real, reactive and apparent power; power factor, energy and harmonics up to the 15th order store data onboard for 2-week period minimum.
2. Provide with Ethernet port and (2) Ethergate Modbus connections.

C. Where required, furnish meter, installed and prewired complete within a common 20" X 20" (nominal) Nema 4/12 Enclosure.

D. Generator power meter (Siemens 9360):

1. Provide with Ethernet connection, (2) Ethergate connections for Modbus Communications, expanded on-board memory for data logging, and minimum of 4 assignable output contacts for system control.
2. Provide with an additional Input/Output controller, Siemens Model S7io, incorporating digital inputs for equipment status, serial communications capacity for transfer switch and generator status monitoring and digital outputs for transfer switch load shed and manual transfer functions, and generator remote start/stop.
3. Meter, 120VAC power supply and Input/Output controller shall be furnished, installed and prewired complete within a common Nema 4/12 Enclosure for field installation. Factory-prewired LED's shall be provided to illuminate when remote load transfer and generator start/stop functions are active for troubleshooting purposes.

2.2. THERMAL METERS:

A. Ultrasonic-type liquid BTU meter, single and dual-channel:

1. GE Panametrics, model DF868 series
2. Flexim Instruments model 7407
3. Communicate with the electric meter via Modbus interface. Required data includes flow and temperature of the supply and return water, net water flow, instantaneous building BTU consumption, net and peak BTU demands.
4. Flow meter shall have the capability to log all measured and calculated values for up to three months. Meter shall be provided with the following outputs:
 - a. Modbus output,
 - b. (3) programmable 4-20mA outputs, for water flow and BTU consumption, for connection(s) to the building automation system.
5. Flowmeter temperature sensors may be either insertion-type for use in thermowells, or surface-contact type.

6. Flowmeter flow sensors may be surface contact-type or insert-type spool pieces. Spool pieces shall match pressure rating of the measured process line.
7. Flowmeter surface-contact type sensors and conductive coupling grease shall be suitable for the temperature rating of the process being measured: note that High Temperature Hot Water systems are rated at 350F continuous. Sensors shall be designed to minimize or eliminate the need for Preventive Maintenance of the couplant grease.

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL:

- A. All equipment and components shall be installed in compliance with manufacturers' recommendations. Consult manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- B. The contractor shall clean all dirt and debris from the inside and the outside of the equipment after completion of the installation.
- C. System wiring and labeling shall conform to Division 26 requirements of the Brown Standards and applicable NEC requirements.

3.2 TESTING AND REPORTS:

- A. Test Metering system to verify that all metered values recorded into the campus metering system match locally-verified values utilizing portable testing equipment for thermal, electric, generator and gas pulse meters.
- B. Test input/output controls for generator installations to ensure proper system operation and data logging.

3.3 DOCUMENTATION AND TURNOVER MATERIALS:

- A. Contractor to provide as-built documentation package before final system testing; the documentation package shall include all information needed to allow the University to perform additions, modifications, maintenance and repair of the system.

END OF SECTION