SECTION 26 27 13
ELECTRICITY METERING

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes electronic meters including test switch and instrument transformers as specified herein and shown on the Drawings. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. References
   4. Submittals
   5. Operation and Maintenance Data

C. PART 2 - PRODUCTS
   1. Utility Metering
   2. Electronic Meter at Main Electric Service (Non-Utility Metering)
   3. Meter Test Switch
   4. Sub-Meter(s)
   5. Meter Interface Gateway
   6. Provisions for Sub-Meters
   7. Accessories
   8. Current Transformers
   9. Potential Transformers

D. PART 3 - EXECUTION
   1. Installation
   2. Construction Verification Items
   3. Agency Training

1.2 RELATED WORK

A. Electrical bid drawings and addendum

B. Existing Switchboards

C. Existing Panelboards

D. Existing Transformers

1.3 REFERENCES

A. ANSI C57.13 – Instrument Transformers

1.4 SUBMITTALS

A. Provide product data showing model numbers, dimensions, mounting requirements, and parameters measured and displayed.

1.5 OPERATION AND MAINTENANCE DATA

A. Provide All operations and maintenance data required to operate, maintain and trouble-shoot power meter.

PART 2 - PRODUCTS

2.1 ELECTRONIC METER –" DPMH" (NON-UTILITY METERING)

A. Electronic meter with digital display (LED or LCD), shall accept input from standard current transformers with secondary rated for 5 amperes. Meters for systems operating at 480V and below shall measure circuit potential without the use of external potential transformers. Meter shall be suitable for connection to a three-phase, four-wire wye system or a three-phase, three-wire delta system.

B. Meter accuracy shall be 0.1% or better of actual reading for voltage and amperes, and 0.2% of actual reading for power and energy functions

C. Meter shall display actual numeric values without requiring the use of a multiplier. Meter shall measure and display the following:

1. Current: per phase
2. Voltage: phase-to-phase and phase-to-neutral
3. Real Power (kW): three-phase total
4. Reactive Power (kVAR): three-phase total
5. Apparent Power (kVA): three-phase total
6. Power Factor: three-phase
7. Real Energy (kWh): three-phase total
8. Maximum Demand:
9. Real Power (kW): three-phase total
10. Apparent Power (kVA): three-phase total
11. Harmonics Component Magnitudes (e.g. 3rd, 5th, 7th, etc) with access to current Wave forms
12. % THD
13. K-factor

D. All meter potential leads and control power leads shall be fuse protected. Provide a fused disconnecting device or circuit breaker with downstream fuses in the main switchboard or panelboard for protection of the meter potential leads and control power leads. Fuses shall be sized per manufacturer's recommendations.

E. The meter shall have upgrade capability to make the required changes in the field

F. The meter shall include RS485 and USB communication ports as required to interface with BacNet protocol.

G. The meter shall have I/O expandability.

H. The meter shall come pre-wired, UL approved, in compliance with color code in NEMA 1 enclosure. The enclosure shall come with the voltage fuses and shorting block for use with current transformers.

I. Self-enclosed power meter shall be equal to Electro Industries – ENCHSHK250-120277-10-V3-D2-100S-INP-X. Equal performing models from Siemens, Square D, or General Electric.

J. Provide a Meter Interface Gateway device to for interface to the Existing Building Automation System (BAS).

K. The electrical contractor shall be responsible for providing all communication wiring between the meter and the interface gateway and shall provide Ethernet communication wiring from the interface gateway to the IT closet.

L. This contractor shall be responsible for data wiring and jack termination as to match the specifications requirements of existing building network system

M. except that a data jack is not needed and a patch cord can be used between the utilizing equipment and the network switch port.

2.2 SUB-METER(S) - DPM

A. Electronic meter with digital display shall accept input from standard current transformers secondaries rated for 5 amperes. Sub-meters may use 0-2V Current Sensors or 0-0.333V Current Transducers in lieu of Current Transformers. Meter shall be suitable for connection to a 480V and below three-phase, four-wire wye system. Meter specification is based on Electro Industries ENCMP200-Y-60-10-V2-WIFI-MDSN-X or equal.

B. Meter accuracy shall be 0.5% of actual reading (not full scale measurement).

C. Meter shall display actual numeric values without requiring the use of a multiplier. Meter shall measure and display the following:

1. Current: per phase
2. Voltage: phase-to-phase and phase-to-neutral
3. Real Power (kW): three-phase total
4. Reactive Power (kVAR): three-phase total
5. Apparent Power (kVA): three-phase total
6. Power Factor: three-phase
7. Real Energy (kWh): three-phase total
8. Maximum Demand:
9. Real Power (kW): three-phase total
10. Apparent Power (kVA): three-phase total
11. % THD - Optional

D. Provide Meter Interface Gateway per the paragraph included in this specification section.

E. Provide additional fusible disconnect switch(es)/circuit breaker(s) and enclosures per the PROVISIONS FOR SUB-METERS paragraph included in this specification section.

2.3 MULTI-POINT SUB-METERING SYSTEM:

A. Where multiple sub-meters are desired in a common location, the following multi-point sub-metering system may be used:

1. The Unit shall consist of either of two circuit configurations: 8 multifunction electrical measuring points (meters) for 3 phase power systems. The Unit's meters shall perform to spec in harsh electrical applications in high and low voltage power systems.
2. Meter accuracy shall be 0.5 % of actual reading (not full scale measurement).

3. The Unit shall have optional data-logging memory of up to 32MB. With data-logging, the Unit shall support:
    a. Two pre-configured Historical logs: Log 1 for trending Voltage and Frequency, Log 2 for trending Energy use over time.
    b. An Alarm/Limits log that records the state of the 16 limits that can be programmed for the meter
    c. A System Events log to store events that happen in, or to the meter, including Startup, Reset commands, Log retrievals, and attempts to log on with a password.
    d. An I/O Change log to record changes in the inputs and outputs of the Relay Output/Status Input board.
4. The Unit shall offer the following communication ports.
    a. Com 1 shall support RS485 and optional RJ45 Ethernet/802.11b Wi-Fi. It shall support Modbus RTU, Modbus ASCII, and Modbus TCP; and baud rates from 9,600 to 57,600.
    b. Com 2 shall be a USB Serial port. It shall support Modbus ASCII and a baud rate of 57,600.
    c. Com 3 shall support RS485. It shall support Modbus RTU and Modbus ASCII; and baud rates from 9,600 to 57,600.
5. The Unit shall have a Relay Output/Status Input board.
    a. The board shall have 2 Relay Outputs for control applications. The relay outputs shall be able to be triggered by the user-programmed limits in the meters. The user shall be able to assign up to 16 limits, including below-and above-limit conditions for any value the meter measures.
    b. The Unit shall consist of an all-metal, NEMA 1enclosure.

2.4 METER INTERFACE GATEWAY

A. Provide a meter interface gateway to allow the meter(s), daisy-chained to a single interface location from (4) electrical rooms, to communicate with the existing BAS system protocol The interface gateway shall convert the meter data from the meter's native language to the BAS protocol.

B. If the meters can communicate with the BAS system without the use of an interface gateway, then no gateway is required.

C. Building Automation System (BAS) communication protocol:
    1. BACnet/IP. Meters that have internal BACnet/IP communication interface.
    2. The Main Electric Service meter and all Sub-meters shall have a BACnet/IP interface (either on-board or a separate gateway) to the BAS system.

D. Electrical contractor shall be responsible for providing all communication wiring between the meters, between the meters and the interface gateway, and between the gateway and the telecom switch. Coordinate with the facility IT staff.

E. BACnet/MSTP. Meters that have internal BACnet/MSTP communication interface.

F. The Main Electric Service meter] [and all Sub-meters shall have a BACnet/MSTP interface (either on-board or a separate gateway) to the BAS system.

G. The Division 23 Controls contractor shall be responsible for providing all communication wiring between the meters, between the meters and the interface gateway, and between the gateway and the BAS system. Coordinate with HVAC controls.

H. Manufacturers of gateway devices that can provide a BACnet interface for electrical meters with other native protocols: Industrial Control Communications, Inc. - Millennium Gateway Series, Real Time Automation – 460 Series, Delta Controls DSM-PWR, Field Server, Tridium, or Johnson Controls. All programming of the gateway device to provide the BACnet objects to the building automation system shall be included.

I. The interface gateway shall transmit all of the measured values listed under the meter descriptions in this specification section.

2.5 PROVISIONS FOR SUB-METERS

A. OVERCURRENT PROTECTION FOR POTENTIAL LEADS AND CONTROL POWER LEADS

B. If the sub-meter(s) are located in the main switchboard, provide a fusible disconnect or circuit breaker in the metering section of the switchboard for the protection of the potential transformers or potential leads as required for the sub-meter(s). If the sub-meter(s) are located adjacent to a panelboard, then the contractor must provide a 3-pole 15 amp circuit breaker in that panelboard as required for the potential transformers or potential leads for the sub-meter(s).

C. All meter potential leads and control power leads shall be fuse protected. Provide fuses in the disconnecting device or downstream fuses from the circuit breaker for protection of the meter potential leads and control power leads. Fuses shall be sized per manufacturer’s recommendations.

2.6 ENCLOSURE(S)

A. If the sub-meters are located adjacent to the switchboard or panelboard, then:
   1. The meters shall be provided in a common meter enclosure.
   2. The meters shall be capable of being mounted in a common enclosure when there is more than one (1) meter.
   3. The metering enclosure shall be provided with separate wiring troughs for line voltage and low voltage wiring.
   4. The enclosure shall come equipped with a control power transformer.
   5. The enclosure shall come with voltage fuses and a shorting block for use with current transformers.
   6. The enclosure shall have a lockable door.

2.7 ACCESSORIES

A. Provide shorting block(s) for the CT leads.

2.8 CURRENT TRANSFORMERS

A. Current Transformers: ANSI C57.13; 5 amperes secondary, with primary/secondary ratio as shown on Drawings, burden and accuracy consistent with connected metering and relay devices, 60 Hz.

B. Sub-meters may use 0-2V Current Sensors or 0-0.333V Current Transducers in lieu of Current Transformers.

C. Mount and brace transformers to withstand 100,000-amp short circuit current.

2.9 POTENTIAL TRANSFORMERS

A. Provide potential transformers (PT's) only if required by the meter manufacturer. Most meters can measure 480V potential and below without the use of external PT's.

B. Potential Transformers: ANSI C57.13; 120 volt secondary, burden and accuracy consistent with connected metering and relay devices, 60 Hz.

C. Potential transformers on 480/277 volt systems shall be rated 277 – 120 volts, connected phase-to-neutral, and installed on each phase.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The meters shall be mounted at the locations nearest to power measuring equipment such as switchboard, panelboards, and transformers. Mounting height shall be 5'-6" or less from finished floor.

B. New meters installed in existing equipment:

1. All unused openings shall be covered with a metal closure plate painted to match the existing enclosure.
2. Any extension of wiring needed to accommodate the meters shall be done using terminal blocks and #10 AWG stranded copper wire, 600 volt type SIS insulation. Splices are not allowed.
3. Provide a separate enclosure for the new meter if adequate space is not available in the existing panels.

C. Dangerous voltage will develop in the open circuit secondary windings of energized current transformers. De-energize the current transformers by short circuiting the secondary windings before disconnecting or connecting instruments to current transformers.

D. Verify the proper operation of all meters. Compare the meter display readings to measurements taken with a clamp on amp-meter and hand held volt meter.

E. Provide all programming and field set-up of the meters required for measurement and communication of the electrical data.

F. All wiring shall be installed in EMT conduits, with suitable fittings, supporting hardware in compliance with NEC.

G. Conduit shall be installed parallel and perpendicular to the building structure.

H. Communications wiring within the occupied space shall be installed in conduit. Use plenum rated wiring, where observed the space having plenum ceiling.

3.2 CONSTRUCTION VERIFICATION

A. Final installation shall be approved by the electrical inspection department, meter equipment manufacturer, and the facility engineering department.

3.3 AGENCY TRAINING

A. Train the User's maintenance personnel to adjust, operate, and maintain systems.

1. Train User's management and maintenance personnel in interpreting and using metering displays and in configuring reports. Include troubleshooting, servicing, adjusting, and maintaining equipment. Provide a minimum of 8 hours' training.

2. Training shall include how to interpret power quality information such as but not limited to: K-Factor, Harmonics, %THD, and waveform capture.

END OF SECTION