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PART 1 GENERAL

1.1 DESCRIPTION

A. Purpose

1. This section covers electrical main meters for use on the UW Seattle campus, power distribution systems.

1.2 QUALIFICATIONS

A. Approved manufacturers

1. Electrical Service Meters
 - a. Electro Industries – Nexus 1262
 - b. Electro Industries – Shark 270 with V3 Switch Pack
 - c. No Substitutions Allowed
2. Test Blocks
 - a. GE – PK-2 #644120G3 & PK-2 #6422420G4
 - b. Marathon –
1500 c.
Buss –
15149-3
 - d. Or approved equal

1.3 RELATED SECTIONS

- A. 01 91 00 – General Commission Requirements
- B. 26 08 00.11 – Electrical Meter Integration and Commissioning

1.4 REFERENCES

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

1. National Electrical Testing Association – NETA
2. National Fire Protection Association – NFPA
3. National Electrical Code - NEC
4. ANSI C12.20 – Accuracy
5. ANSI/IEEE C37.90.1 – Surge Withstand
6. ANSI C62.41 – Surge
Immunity 7. IEC 1000-4-2
– ESD
8. IEC 1000-4-3 – Radiated Immunity
9. IEC 1000-4-4 – Fast Transient
10. IEC 1000-4-5 – Surge Immunity
11. IEC 1000-4-6 – Conducted Immunity

12. IEC 60068-2-6 – Vibration (Sinusoidal)
13. IEC 60068-2-27 – Shock Test
14. IEC 695-2-1 – Resistance to heat & Fire
15. IEC 68-2-1 – Cold Test
16. IEC 68-2-2 – Dry Heat
17. IEC 68-2-30 – Damp Heat
18. State and local codes and ordinances

B. Attachments and Details

1. Attachment #1 – Electrical Meter Schematic

1.5 COORDINATION

- A. Coordinate design of building electrical system, risers, switchboards, and panelboards in accordance with Attachment #1 – Electrical Meter Schematic and with Campus Utilities and Operations Power Systems Manager.
- B. Coordinate pre-installation meeting to validate installation details with the Campus Utilities and Operations Staff.
- 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:

- Location: Room name and number
 - If using an existing biscuit jack, include the Outlet ID (label on the data outlet).
- Device Type: For example, Electrical Meter, CCW Meter, Data Collection
 - Controller, etc.
- IDF Room: IT service origination for data jack, if known.
- Panel Name: Device enclosure name or label.
- 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.

- G. Coordinate Operations and Maintenance training times with the Campus Utilities and Operations.

1.6 SUBMITTALS

- A. Submittals shall only be approved by Campus Utilities and Operations (CEUO)
 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 a completed “Worksheet: Mechanical Meter Schedule” form per Specification 23 08 00.11 and add to Submittals.
 4. Submit electrical main metering as a separate submittal
 5. Submit detailed maintenance manuals and drawings, which include catalog information indicating the complete electrical and mechanical characteristics.
 6. Submit dimensioned cross-sectional drawings (manufacturer’s data sheets are acceptable).
 7. Submit finished meter tests – Manufacturer’s Certified Test Reports showing compliance with ANSI C12.20 accuracy tests
 8. 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.
 9. 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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- 11. (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.

1.7 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.
- E. As-Built drawings of meter topology.

1.8 MEETINGS

- A. Pre-installation conference
 - 1. The Contractor shall request a pre-installation conference with the UW Campus Utilities and Operations.
 - 2. UW High Voltage Shop shall be included in pre-installation meeting for projects with medium and high voltage work.
 - 3. 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 electrical 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 ELECTRIC SERVICE METER

- A. The following shall apply to the main electric meters at the main building service:
 - 1. Power meter shall be multi-function 3 phase, solid-state, socket-mount design.
 - a. Meter shall be capable of connection to three-phase, four-wire or three-phase, three-wire circuits.
 - b. Meter shall support meter form factors 9S.

Form	Rated Voltage	Type
9S	0 to 277 V L- N	3 E, 4 W, Wye

- 2. Voltage and current inputs to the meter shall conform to the following at a minimum:
 - a. Meter shall be a Class 20, transformer rated design.
 - b. Monitor shall accept input of three (3) independent voltage inputs and

- three (3) independent current inputs of the stated capacity.
- c. Voltage inputs shall be rated for connection to circuits from 0 to 480 Volts AC line-to-neutral or 0 to 600 Volts AC line-to-line and shall be auto-ranging over this range.
 - d. Voltage input shall be optically isolated to 2500 volts AC. Shall meet or exceed IEEE 37.90.1 (Surge Withstand Capability). Communication ports shall be isolated from each other to 1000 Volts.
 - e. Current inputs shall have a continuous rating of 120% of Class Current and a 1-second over-current rating of 500 %.
3. Power meter shall measure and report the following quantities at a minimum:
- a. Voltage, both phase to neutral and phase to phase, for all three phases; Phase angles for each voltage relative to each other.
 - b. Current, phase A, B, C, and N-calculated; Phase angles for each current relative to voltages.
 - c. Watts (total and per phase), VARs (total and per phase), VA (total and per phase), Power Factor (total and per phase) and Frequency.
 - d. Accumulated Watt-hr, VA-hr, and VAR-hr; Watt-hr received; Watt-hr delivered. VAR-hr and VA-hr reading shall be accumulated and stored for each of the 4 quadrants of power.
 - e. Power demand shall be simultaneously calculated using five (5) different averaging methods: Fixed Window (Block) Average, Sliding Window (Rolling Block) Average, Thermal Average, Predicted Average, and Cumulative Demand.
 - f. Power meter shall provide time-stamped maximum and minimum readings for every measured parameter and provide coincident VAR readings for all maximum Watt readings with time/date stamp.
4. The power meter shall compensate for errors in current transformer and potential transformer.
- a. Errors shall include voltage, multipoint current, multiphase angle, and better than .01% resolution.
5. Meter shall include an integrated LCD display with multiple display modes. The display shall be fully customizable by the user.
- a. Display shall at least support simultaneous Normal, Test, Diagnostic, and Time-of-Use modes.
 - b. Normal Mode shall have fully customizable screens.
 - c. Test Mode shall provide access to Wh (delivered and received), VARh (delivered and received), VAh (delivered and received), and instantaneous demand. When operating in test mode the stored readings from Normal Mode shall not be impacted or compromised.
 - d. Diagnostic Mode shall provide access to all voltages and currents, a real-time phasor diagram, and real-time harmonics of each voltage and current to the 40th order. Viewing harmonics to the 128th order shall be

available through a connected computer.

- e. Time of Use mode shall provide access to kWh and kW for each TOU register and total, kVARh and kVAR for each TOU register and total and kVAh for each TOU register and total.
- 6. Power meter shall provide multiple digital communication ports and support multiple open protocols.
 - a. Meter shall include an Optical port for communication to external devices such as handheld readers that supports speeds of up to 57,600 bps.
 - b. Meter shall have a second port configured as a 10/100BaseT Ethernet port.
 - c. Meter shall communicate using Modbus TCP/IP protocols as standard configuration. All instantaneous data, logged data, and event data, information shall be available using these open protocols. The meter shall also provide means for custom modbus mapping.
 - d. Meter shall include DNP 3.0 Level 2 protocol for communication to SCADA systems. All instantaneous data and average data shall be available using DNP 3.0 Level 2 protocol. User shall be able to custom map data into DNP protocol using Windows based software.
- 7. The meter shall internally record and store Time of Use data.
 - a. The following Time of Use parameters must be included:
 - a. Bi-directional consumption and demand
 - b. Eight (8) TOU Schedules
 - c. Twenty (20) Year Calendar
 - d. Four (4) seasons per year.
 - b. The meter must provide the following TOU information for all rates in real-time:
 - a. Current month accumulations
 - b. Previous month accumulations
 - c. Current season accumulations
 - d. Previous season accumulations
 - e. Total accumulations to date
 - f. Programmable Freeze Registers
 - g. Cumulative Demand
- 8. Meter shall be equipped with four (4) form C pulse output channels that can be configured for operation as KYZ pulse outputs or End of Interval pulse outputs.
- 9. Meter shall be equipped with eight (8) pulse input channels for data collection from other meters.
- 10. Power meter shall be equipped with non-volatile RAM for recording logs and programming information.

- a. Meter shall include at least 2MB RAM.
 - b. In the event of loss of control power, data stored in memory shall be retained for at least 10 years.
 - c. Meter shall store all programming and set-up parameters in non-volatile memory. In the event of loss of control power, meter programming data stored in memory shall be retained for at least 10 years. No replaceable battery shall be required.
11. Meter shall record system events for security and anti-tampering.
- a. Events recorded shall include:
 - i. Power up & down
 - ii. Password access & modification
 - iii. Change of the programmable settings & run time
 - iv. Change of clock time by communication (Modbus or DNP)
 - v. Test Mode usage
 - vi. Meter resets (Logs, Max/Min, Energy)
12. Power meter shall be programmable by software supplied by the meter manufacturer.
- a. Software shall have a user-friendly, Windows compatible interface.
 - b. Software shall operate on Windows 10 operating systems.
 - c. Software shall include capacity to program meter, download meter, and analyze downloaded data files.
 - d. Software shall store all data in an ODBC compliant database. Data based storage shall include all log and waveform data.
13. Power meter shall be appropriately constructed to provide long life in abusive physical and electrical environments.
- a. Meter firmware shall be held in flash RAM and shall be upgradeable through one of the communication ports without removing the unit from service.
 - b. Meter shall have a Lexan cover. An internal cover shall protect circuit boards and energized parts from UV damage or when the Lexan cover is removed for maintenance.
 - c. Meter shall operate successfully at temperature extremes from -40°C to $+85^{\circ}\text{C}$.
 - d. Meter shall operate with control power from 85 to 550 volts AC. Meter shall have a power supply option to operate with an external control power input of 85 to 275 Volts AC/DC.
 - a. Meter shall have a standard 4-year warranty.

2.3 ELECTRIC METERING CABINET

- A. A socket based electrical cabinet shall be supplied with the electric service meters.
 - 1. Electro Industries 9S4 Meter Enclosure or approved equal.

2. The metering cabinet shall be an UL Type 1 or an UL Type 3R steel enclosure with factory supplied knockouts.
3. The metering cabinet shall have a minimum dimension of 18" x 18" x 12".
4. The metering cabinet shall be provided in multiple configurations to support meter forms 9S.
5. The cabinet shall be lockable and provide for the application of a security seal.
6. The cabinet shall be provided with a 4-pole potential test block, a voltage fuse block, and appropriately sized fuses that are prewired to the socket base.
7. The cabinet shall be provided with a 6-pole current shorting test block prewired to the socket base.
8. Metering cabinet shall be painted ANSI Z55.1 gray finish.

PART 3 EXECUTION

3.1 REQUIREMENTS

A. General installation

1. Identification and Labeling
 - a. Reference section 26 05 53 Identification of Electrical 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 electrical meters 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) Metering cabinets hung improperly shall be properly secured and all paint scratches shall be touched up.
 - c. 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](#)

- d. 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.
 - e. 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.
 - f. 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.
 - g. 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. 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 installed if display is installed in direct sunlight.
4. System Phase Sequence is A-B-C.
5. UW Campus Utilities and Operations or UW Campus Utilities and Operations Representative will check the Contractor's work to ensure the accuracy of the connections.
- a. The Contractor shall arrange with the Campus Utilities and Operations for the times when their 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. In the event the connections cannot be made as specified, the Contractor shall make the necessary corrections at Contractor's own expense.
6. Install meters per manufacturer's recommendations.
7. 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:
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Refer to UW-IT Specification Drawing CNT-CI-2: [CNT-CI-2 Drawing](#)

8. 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.
9. The Milbank enclosure shall be mounted at an accessible height (4'-5') above the finished floor. Exceptions must be reviewed and approved by the

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Owner.

10. 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.
 11. 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.
- B. Mounting and electrical connections
1. In accordance with manufacturer's installation instructions.
 2. Install a dedicated 120V circuit from panelboard to provide power to the electrical meter in a dedicated RGC/IMC. (if required)
- C. UL Listing
1. The Contractor shall ensure that the metering installation is UL Listed.
- D. 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.

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