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PART 1 GENERAL

1.1 DESCRIPTION

A. Purpose

1. The purpose of this section is to specify the project's (Contractor, Test Engineer, and Commissioning Agent responsibilities and participation in the electrical meter startup and commissioning process.
2. Once electrical meter startup and commissioning is complete, the Owner's System Integrator will perform the meter integration.

B. General

1. Commissioning support is the responsibility of the Contractor (including subcontractors and vendors).
 - a. The commissioning process requires Contractor participation to ensure all portions of the work have been completed in a satisfactory and fully operational manner. The Contractor is responsible to provide all support required for start-up, testing, and commissioning.
2. Work of this section includes the following:
 - a. Start-up and testing of the equipment
 - b. Assistance in testing, adjusting and balancing
 - c. Operating equipment and systems as required for commissioning tests
 - d. Provide Testing Plans to the Owner for review and approval prior to commissioning.
 - e. Providing qualified personnel for participation in commissioning test, including seasonal testing required after the initial commissioning
 - f. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process, which fulfill contract and warranty requirements
 - g. Providing operation and maintenance information and as-built drawings to the Owner for verification.
 - h. Providing training for the systems specified in this Division with the Owner's Representative.

1.2 QUALIFICATIONS

- A. Vendor and contractors performing work under this section must demonstrate experience and ability to perform this work in accordance with the reference standards.
- B. Contractors should have prior success in integrating Modbus or BACnet communications devices.

1.3 RELATED SECTIONS

- A. All start-up and testing procedures and documentation requirements specified within Division 26.
- B. 01 91 00 – General Commission Requirements
- C. 26 27 13 - Electrical Sub-Meter Specification
- D. 26 27 13.11 - Electrical Meter Specification

1.4 REFERENCES

- A. Applicable codes, standards, and references – All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein:
 - 1. International Electrical Testing Association - NETA
 - 2. National Electrical Manufacturer's Association - NEMA
 - 3. American Society for Testing and Materials - ASTM
 - 4. Institute of Electrical and Electronic Engineers - IEEE
 - 5. American National Standards Institute - ANSI
 - 6. National Electrical Safety Code - C2
 - 7. State and local codes and ordinances
 - 8. Insulated Power Cable Engineers Association - IPCEA
 - 9. Association of Edison Illuminating Companies - AEIC
 - 10. Occupational Safety and Health Administration - OSHA 29CFR Part 1910.269
 - 11. National Fire Protection Association - NFPA
 - a. ANSI/NFPA 70: National Electrical Code
 - b. ANSI/NFPA 70B: Electrical Equipment Maintenance
 - c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
 - d. ANSI/NFPA 78: Lightning Protection Code
 - e. ANSI/NFPA 101: Life Safety Code
 - f. NFPA 99: Health Care Facilities
- B. All inspections and tests shall utilize the following references:
 - 1. Project design drawings and specifications
 - 2. Shop drawings and submittals
 - 3. Approved manufacturer's instruction manuals applicable to each particular apparatus
 - 4. Applicable NETA acceptance testing work scope sections per NETA ATS 1999

1.5 COORDINATION

- A. Coordinate the completion of all electrical testing, inspection, and calibration prior to the start of commissioning activities.

- B. Coordinate factory field-testing and assistance per the requirements of this section.
- C. The Contractor shall coordinate and cooperate in the following manner:
 - 1. Allow a minimum of 15 working days before final commissioning dates to complete electrical testing, inspection, and calibration to avoid delays in the commissioning process.
 - 2. Ensure that all metering is properly programmed and connected to the UW network prior to commissioning.
 - 3. During the commissioning activities, provide labor and material to make corrections when required, without undue delay.

1.6 UW NETWORK INTEGRATION

- A. 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.
- B. 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).
- C. Integration shall be completed after the project has successfully completed installation and the owner’s System Integrator, with contractor support, has completed metering startup with all issues corrected by contractor.
- D. Owner’s System Integration (SI) contractor shall program the Owner’s aggregation software to read the installed mechanical metering equipment. Contractor shall coordinate this work with the Owner and Owner’s SI contractor to ensure all programming is complete prior to commissioning.
- E. Integration is dependent on project prioritizing early service activation of IT closets and MDF rooms that provide Facilities Network (Facnet) service to devices as well as requesting static, private IP Addresses from UW Facilities IT for these devices. Integration cannot proceed without network activation and IP addresses assigned.

1.7 SUBMITTALS

- A. General
 - 1. Submittals shall be in accordance with all Contract Documents and Division 01 Specification Sections.

2. Contractor shall provide information required on form 26 08 00.11 Worksheet #1 Electrical Meter Schedule and submit to Owner for every meter/sub-meter installed.

1.8 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.

1.9 SCHEDULE

- A. Complete and make fully functional all phases of electrical work pertinent to the Commissioning Tests, prior to the testing date.
- B. Include and schedule all aspects of meter installation, startup, commissioning, and integration outlined in this specification and related sections in the project's CPM Schedule as well as look-a-head schedules and planners. Project must provide adequate amount of time to complete all the tasks outlined in a timely manner, including deficiency resolution by the project's contractors. Failure to provide adequate time or account for this work in the project schedule may result in delays to the project that shall not be borne by the owner, owner's system integrator, or any of the owner's consultants

1.10 MEETINGS

- A. Attend Commissioning Meetings as required by the Owner.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide test equipment as necessary for start-up and commissioning of the electrical equipment and systems.

2.2 TEST EQUIPMENT - PROPRIETARY

- A. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment.
 1. Manufacturer shall demonstrate its use and assist the Contractor in the commissioning process.
 2. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.
- B. Identify the proprietary test equipment required in the test procedure submittals and in a separate list of equipment to be included in the Operations and Maintenance Manuals.

PART 3 EXECUTION

3.1 REQUIREMENTS

- A. Responsibilities Matrix:

Activity	Performed by Contractor	Performed by Test Engineer	Performed by Commissioning Agent	Owner	System Integrator (SI)
Installation of equipment per manufactures requirements and project specifications	Execute	Verify	Backcheck		
Startup Data Collection Controller and metering devices	Execute			Support	
Program PLC			Verify	Execute	Support
Deficiency Resolution	Execute	Verify	Backcheck		
Metering Functional Performance Testing (FPT) – Commissioning	Support	Support	Execute	Support	Support
Integrate metering points into UW Energy Management Database	Support		Support	Execute	Support
Metering Point to Point Checkout – Field device to UW Meter Management System		Support	Support	Execute	Support

B. Work prior to Commissioning:

1. Complete all phases of work so the system can be started, tested, adjusted, balanced, and otherwise commissioned.
 - a. Contractor has primary start-up responsibilities with obligations to complete systems, including all sub-systems so they are fully functional.
 - b. This includes the complete installation of all equipment, materials, conduit, wire, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.
2. Complete all equipment programming prior to commissioning.
 - a. Electrical Meters
 - 1) Meters shall be programmed prior to connecting the meter to the facility network.
 - 2) Meter program parameters shall be approved by the Owner or the System Integrator.
 - 3) All wiring shall be approved before being connected to the Owner's facility network.
 - b. Aggregation Software
 - 1) Aggregation software shall be programmed by the SI.
 - 2) Aggregation software program parameters shall be approved by the Owner.
3. A commissioning plan will be developed by the Owner's Representative and approved by the Owner.

- a. Minimum requirements for the commissioning plan shall include the following:
 - 1) Verify meter part number
 - 2) Review of the electrical meter's programming parameters:
 - (a) Verify CT and PT ratios
 - (b) Verify wiring configuration
 - (c) Verify display screens are in accordance with Owner's requirements
 - 3) Verify meter readings
 - (a) Contractor shall provide personnel support and a calibrated digital multimeter for verification of meter readings
 - 4) Coordinate with the UW Facilities OT team to verify communication between the meter and the Facilities network (FacNet)
 - 5) Verify all electrical meters are being read by the Owner's Aggregation software
 - 6) Verify Owner's aggregation software power readings
 - (a) Contractor shall provide personnel support and a calibrated digital multimeter for verification of meter readings
 - b. If system modifications/clarifications are in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner.
 - c. If Contractor-initiated system changes have been made that alter the commissioning process, the Contractor will notify the Owner's Representative for approval.
4. The Contractor shall be responsible for the installation of all equipment prior to commissioning the system. The Contractor shall ensure at a minimum that the following equipment is installed:
 - a. Electrical meters
 - b. Communication cable
 5. Normal start-up services required to bring each system into a fully operational state:
 - a. These include cleaning, testing, phase rotation check, control sequences of operation, full and part load performance, etc.
 - b. The Contractor will not begin the commissioning process until each system is complete
 6. Before integration, System Integrator will coordinate with UW Facilities OT to confirm all meters are communicating over the Facilities Network (FacNet). If failures arise during integration, System Integrator will work with UW Facilities OT to address the issue(s).
 7. Commissioning is intended to begin upon completion of a system.
 - a. Commissioning may proceed prior to the completion of systems, or sub-systems, and will be coordinated with the Electrical Contractor and Electrical Testing Contractor.
 - b. Contractor shall coordinate with the SI to provide programming and configuration prior to commissioning.
 - c. Start of commissioning before system completion will not relieve Contractor from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING

- A. Provide skilled technicians to start up all systems within Division 26.
 - 1. Contractor will ensure that the qualified technician(s) are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustment, and/or problem resolutions.
- B. System problems and discrepancies may require additional Contractor time, redesign and/or reconstruction of systems and system components.
- C. The Owner's Representative reserves the right to judge the appropriateness and qualifications of the Contractor's technicians relative to each item of equipment or system. Qualifications of Contractor's technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to get the job done in a timely manner.
- D. Contractor shall remove and replace covers of electrical equipment, open access panels, etc., to permit Owner's Representative to observe equipment and controllers provided.
- E. Furnish ladders, flashlights, tools and equipment as necessary.

3.3 WORK TO RESOLVE DEFICIENCIES

- A. In some systems, misadjustments, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems.
 - 1. This work will be completed under the direction of the Owner's Representative, with input from the Contractor and equipment supplier.
 - 2. Whereas all members will have input and the opportunity to discuss the work and resolve problems, the Owner's Representative will have final jurisdiction over the work necessary to achieve performance.
- B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process.
 - 1. Experimentation to render system performance will be permitted.
 - 2. If the Owner's Representative deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Contractor shall schedule a meeting with the Owner to discuss the nature of the problem, expected steps to be taken, and the deadline for completion of activities.
 - 3. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem.
 - 4. Any costs incurred to solve the problems in an expeditious manner shall be the Contractor's responsibility.

3.4 SYSTEMS DOCUMENTATION

- A. In addition to the requirements of Division 1, update contract documents to incorporate field changes and revisions to system designs to account for actual constructed configurations.

1. All drawings shall be red-lined on two sets.
 2. Contractor as-built drawings shall include architectural floor plans, elevations and details, and the individual electrical systems in relation to actual building layout. Dimensions from a wall or permanent structure shall be shown for any equipment, conduit, cable, etc. installed in a different location than identified in the Contract documents.
 3. All IP and MAC addresses issued to electrical meters shall be documented and included in the red-line drawings.
- B. Maintain as-built red-lines as required by Division 1.
1. Red-lining of drawings at completion of construction, based on memory of key personnel, is not satisfactory.
 2. Continuous and regular red-lining is considered essential and mandatory.

END OF SECTION