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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 mechanical meter startup and commissioning process.
2. Once mechanical 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 startup, 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. Vendors and contractors performing work under this section must demonstrate experience and ability to perform this work in accordance with the reference standards.

### **1.3 RELATED SECTIONS**

- A. All start-up and testing procedures and documentation requirements specified within Division 23 and Division 33.

- B. 01 91 00 – General Commission Requirements
- C. 23 05 19.11 – Steam Condensate Meter
- D. 23 05 19.21 – Central Cooling Water Meter
- E. 23 05 19.31 – Sewer Submeter
- F. 23 05 19.41 – Building Water Meter
- G. 23 05 19.51 – Hot Water Submeter
- H. 23 05 19.61 – Building Water Meter (standalone)
- I. 23 09 13.11 – Data Collection Controller
- J. 33 51 33 – UW Gas Meter

#### 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. American Water Works Association - AWWA
  - 5. American National Standards Institute - ANSI
  - 6. National Electrical Safety Code - C2
  - 7. State and local codes and ordinances
  - 8. Occupational Safety and Health Administration - OSHA 29CFR Part 1910.269
  - 9. National Fire Protection Association – NFPA
  - 10. National Electrical Testing Agency – NETA
- 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
- C. Attachments and Details
  - 1. 23 00 00 Attachment #1 – Mechanical Meter Schematic

#### 1.5 COORDINATION

- A. Project's Quality Control Plant – Proper verification prior to energizing.
- B. Coordinate the completion of all mechanical testing, inspection, and calibration prior to the start of commissioning activities.

- C. Coordinate factory field-testing and assistance per the requirements of this section.
- D. The Contractor shall coordinate and cooperate in the following manner:
  - 1. Allow a minimum of 15 working days before final commissioning dates to complete mechanical testing, inspection, and calibration to avoid delays in the commissioning process.
  - 2. 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](mailto: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:

- 1. Location: Room name and number
  - 2. If using an existing biscuit jack, include the Outlet ID (label on the data outlet).
  - 3. Device Type: For example, Electrical Meter, CCW Meter, Data Collection Controller, etc.
  - 4. IDF Room: IT service origination for data jack, if known.
  - 5. Panel Name: Device enclosure name or label.
  - 6. MAC Address: Format should follow standard convention (e.g., 00:05:e4:05:0D:d2).
- C. 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).
  - D. (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](mailto: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.

- E. 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.
- F. 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.
- G. 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 23 08 00.11 Worksheet #1 – Mechanical Meter Schedule
- 3. Refer to related sections for submittal requirements by meter type.

## 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 mechanical and 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 mechanical 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		
Wiring Point to Point (P2P) Checkout	Execute	Verify	Backcheck		
Startup Data Collection Controller and metering devices	Support			Verify	Execute
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	Verify	Execute
Metering Point to Point Checkout – Field device to UW Meter Management		Support	Support		Execute

System					
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B. Work prior to startup

1. Contractor to complete systems, including all sub-systems so they are fully functional.
2. This includes the complete installation of all equipment, materials, conduit, wire, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.
3. Once equipment is installed in accordance with project specifications and owner's requirements and has been verified by Test Engineer and backchecked by Commissioning Agent, contractor shall request startup of metering equipment by Campus Utilities and Operations.
4. Prior to scheduling startup, contractor shall provide complete copies of Point to Point (P2P) checkout documents for all devices connected to Data Collection Controller and any other metering device requiring field terminations.
5. ~~Campus Utilities and Operations or representative will perform startup of metering equipment, programming of IP addresses, and communication verification.~~

C. Work prior to Meter Functional Performance Testing (FPT) / Commissioning:

1. Contractor shall address all issues identified during startup of metering devices.
2. Once issues have been corrected, verified by Test Engineer, and backchecked by Commissioning agent, contractor's commissioning of metering devices can proceed.
3. Complete all phases of work so the system can be started, tested, adjusted, balanced, and otherwise commissioned.
4. Complete all metering programming prior to commissioning, including programming of required IP addresses in devices.
5. Meter programming parameters shall be approved by the Owner or the SI
6. A commissioning plan will be developed by the project's Commissioning Agent or Test Engineer 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 mechanical meter's programming parameters:
      - (a) Verify flow rates
      - (b) Verify temperature readings
      - (c) Verify wiring configuration
      - (d) Verify display screens are in accordance with Owner's requirements
    - 3) Verify meter readings
      - (a) Contractor shall provide personnel support the verification of meter readings
    - 4) When applicable, Verify all meters are properly connected to the Data Collection Controller

- 5) Verify communication signals from the meters.
  - (a) 4-20 mA communication shall be tested by the test personnel sending a test 4 – 20 mA signal from the transmitter through the receiving device to verify correct wire terminations, and engineering scaling units. A Loop Check testing procedure shall be used and all testing results shall be documented.
  - (b) Confirm with SI that Modbus/TCP or BACNet/IP communication has been established between devices and aggregation software.
- 6) Coordinate with the UW Facilities OT team to verify communication between the meter and the Facilities network (FacNet)
- 7) Verify all meters are being read by the Owner's aggregation software
- 8) Verify new screens are created in the aggregation software for the new meters
- b. Standards used in instrument testing must be traceable to the International System of Units (SI) 5. The SI is used by the International Bureau of Weights and Measures (BIPM) to ensure worldwide unification of measurements. The traceability of the standards are maintained by an unbroken chain of calibrations or comparisons linking them to the relevant SI unit of measurement. The test equipment shall display the calibration date, and the calibration due date.
- c. Calibration/test personnel should be trained, qualified, field-experienced metrologists or technicians well-versed in the practices, considerations, and terminology of the user's industry.
- d. 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.
- e. If Contractor-initiated system changes have been made that alter the commissioning process, the Contractor will notify the Owner's Representative for approval.
7. 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. Mechanical meters
  - b. Data Collection Controller
  - c. Communication cable
  - d. Power cables
8. Normal start-up services required to bring each system into a fully operational state:
  - a. These include cleaning, testing, control sequences of operation, full and part load performance, etc.
  - b. The Contractor will not begin the commissioning process until each system is complete
9. 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 General Contractor and 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.
- D. Work prior to Integration
  - 1. Complete all items outlined in part C.
  - 2. Project to provide minimum two (2) weeks notice to owner and System Integrator to schedule System Integrator's work to integrate metering into Meter Management Aggregation Software.
  - 3. Project should allow for two (2) weeks for the System Integrator to integrate all metering, assuming all deficiencies and any other outstanding design or installation issues have been addressed previously.
  - 4. During 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 US Facilities OT to address the issue
  - 5. Note that any meters that fail to communicate and cannot be integrated will result in additional time for System Integration to be completed.
- E. Work prior to project Functional Performance Testing (FPT) and project Integrated Systems Testing (IST) of other building systems.
  - 1. Complete all meter functional performance testing (FPT) and allow for System Integrator (SI) to perform integration of metering.
  - 2. Provide minimum two (2) weeks notice to the System Integrator to provide support during the project's FPT or IST phases in which metering data is necessary to validate project's commissioning requirements.

### 3.2 PARTICIPATION IN COMMISSIONING

- A. Provide skilled technicians to start up all systems within Division 23 and Division 33.
  - 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. The additional Contractor time shall be made available for the subsequent commissioning periods until the required system performance is obtained.
- 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.
- C. Deficiencies that result in the owner's inability to complete the system integration or account for all energy required to be metered may result in potential delays to the project including inability to achieve substantial or final completion.
- D. Incorrect or improperly installed metering may result in the owner's inability to provide utility services to the facility, which may impact project substantial completion.

### 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.
- 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