READ THIS FIRST

Notice to the Design Engineer, please refer to the Port of Seattle, Facilities and Infrastructure standards for reference before editing this specification.

This Project Spec Document may need additional modifications to suit your project. It is recommended that you proofread each section, paying attention to any “Notes” boxes such as this one--you should remove these “Notes” sections as you go. Also, do a search for all bracket characters “ [ ] “ as they are used to show you areas containing options or project specific details (you can use Microsoft Word’s Find feature {Ctrl-F} to jump to an open bracket “ [ “ character quickly). Again, these bracket characters should be removed.

It is important that every paragraph be numbered to allow for easy referencing. If you use the document’s built in styles and formatting your outline should be fine (turn on the formatting toolbar by going to View > Toolbars > Formatting). Most paragraphs will use the style “Numbered Material” and can be promoted (Shift) or demoted (Shift-Tab).

You should not have to manually enter extra spaces, carriage returns or outline characters such as A, B, C, or 1.01, 1.02; the formatting will do this for you. The entire document is 11 pt. Arial. If you paste items in, you may need to reapply the “Numbered Material” format.

1. GENERAL
   1. SUMMARY OF WORK
      1. The extent and location of “Electrical Power Metering” Work is shown in the Contract Documents. This section includes the components for power metering and monitoring. Electrical Power Metering requirements specified in this section may be supplemented by special requirements of systems described in other sections.
   2. GOVERNING CODES, STANDARDS AND REFERENCES
      1. NFPA 70: National Electrical Code (NEC)
      2. NFPA 70 E: Standard for Electrical Safety in the Workplace
      3. Underwriters Laboratories, Inc.
      4. IEEE 802.3
   3. SUBMITTALS
      1. Submit materials data in accordance with of Section 01 33 00 - Submittals. Furnish manufacturers’ technical literature, standard details, product specifications, calibration reports, and installation instructions for all products.
      2. Submittals shall include the following:
         1. Submit product data for the following:
            1. Attach copies of approved Product Data submittals for products (such as switchboards and switchgear) that describe power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.
            2. Provide technical data sheets, installation manuals and user documentation manuals that describe the product installation and operation, physical data, electrical characteristics and connection requirements of the power monitoring equipment and cabinet components.

Shop Drawings and Seismic Qualification Certificates are for meters in separate enclosures. Remove 2 & 3 if project meters are incorporated into switchgear/panels.

* + - 1. Shop Drawings: For power monitoring and control equipment. Include plans, elevations, sections, details, and attachments to other work.
         1. Enclosure types and details.
         2. Project specific cabinet layout, including location of all devices, terminal blocks and wireways.
         3. Project specific wiring and schematic diagrams, clearly identifying internal and field wiring connections and requirements.
         4. Project specific system diagram, identifying all network interface devices.
      2. Seismic Qualification Certificates: Submit certification that meters, accessories, and components will withstand seismic forces defined in Section 26 05 48 "Seismic Controls for Electrical and Communication Work." Include the following:
         1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
         2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
         3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
      3. Field quality-control reports.
      4. Operation and Maintenance Data: For power monitoring and control units, to include in emergency, operation, and maintenance manuals. In addition to items specified in [Section 01 78 23.13 "Aviation Operations and Maintenance Documentation”] [Section 01 78 23.13b “Seaport Operations and Maintenance Documentation”]," include the following:
         1. Manufacturer's system installation and setup guides, with data forms to plan and record options and setup decisions.
         2. Operating and applications software documentation.
         3. Software licenses.
         4. Software service agreement.
      5. Software and Firmware Operational Documentation:
         1. Self-study guide describing the process for setting equipment's network address; setting Owner's options; procedures to ensure data access from any PC on the network, using a standard Web browser; and recommended firewall setup.
         2. Device address list and the set point of each device and operator option, as set in applications software.
  1. QUALITY ASSURANCE
     1. Instrument Certifications
        1. Certified to UL 22CZ
        2. CE marked.
        3. Safety: UL 61010-1 3rd edition
        4. Accuracy: ANSI C12.20 Class 0.2 (0.2%), IEC/EN60687 0.2(.2%) for revenue meters.
        5. Electromagnetic Compatibility: FCC Part 15 Subpart B Class A Radiated and Conducted.
        6. IEC Environmental: IEC 60529, 60255-21-1, 60255-21-2, 60255-21-3, 68-2-6
  2. WARRANTY
     1. The power metering instrument is warranted by the vendor against manufacturing defects for a period of one year.
     2. The power metering software is warranted by the vendor against manufacturing defects for a period of one year.
     3. Warranty service may be performed by the manufacturer or authorized service representative.
     4. The vendor provides technical support service. These services include the following:
        1. Technical consultation via telephone for up to three hours per month for the duration of the warranty period.
        2. Free upgrades to new firmware for the power metering instruments for the duration of the warranty period.
        3. Free upgrades to new software releases for the duration of the warranty period.
     5. The vendor manufactures functionally equivalent replacement units for power metering instruments for a period of not less than ten years following the installation of the original equipment.
  3. DELIVERY, STORAGE AND HANDLING
     1. Deliver PM system components in shipping splits in sizes that can be moved past obstructions in delivery path.
     2. Deliver PM system components in fully enclosed vehicles after specific environmental conditions have been permanently established in spaces where components are to be placed.
     3. Store PM system components indoors in clean, dry space with uniform temperature controlled within manufacturer’s ambient temperature and humidity tolerances for non-operating equipment to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances and physical damage.
  4. COORDINATION
     1. Coordinate features of distribution equipment and power monitoring and control components to form an integrated interconnection of compatible components.
        1. Match components and interconnections for optimum performance of specified functions.
        2. Coordinate Work of this Section with those in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

1. PRODUCTS

A. If only one product is acceptable (single or sole source product), obtain an approved Competition Waiver and submit to the CPO Construction, Contract Administrator. The language shall read as: “Manufacturer Name, Product # XXXXX, No Equal.” Refer to CPO-6 Competition Waiver Policy for more information.

B. If a Competition Waiver is not approved or more than one product is acceptable, this section must list a minimum of 2 products plus the language “Or Approved Equal,” along with salient characteristics. Refer to CPO Construction’s Salient Characteristics Guidelines for more information.

* 1. MANFACTURERS
     1. Power meters: EATON No Equal. Meters are specified by application as follows:
        1. Medium Voltage Unit Substations and Switchgear(5-15kV):
           1. Main Breakers: PXM 8000.
           2. Feeder Breakers: PXM 6000.
        2. Low Voltage Power Center (600V or less)
           1. Main Breakers: PXM 6000
           2. Feeder Breakers: PXM 2280
        3. Low Voltage Switchboards and Distribution Boards larger than 1200A:
           1. Main breaker shall be metered by PXM 2280 installed at power center feeder breaker
           2. Feeders shall be metered via multipoint meters PXMP or PXM 2280 meters.
        4. Low Voltage Panelboards rated less than 225A
           1. PPX BCM Branch Circuit Monitoring shall be installed on all new 208V panelboards rated less than 225A.
     2. Cabinet: Per section 26 27 16 “Cabinets and Enclosures”
     3. Current Transformers:
        1. 250A and smaller: ITI 2DARL
        2. Larger than 250A: ITI 5DARL
        3. Or Approved Equal.
     4. Shorting Block:
        1. Marathon Special Products 1506SC
        2. Or Approved Equal.
     5. For PX MPM Series and PX BCM Series Meters
        1. Dent Instruments
        2. Eaton
        3. Or Approved Equal.
     6. Fused Disconnect:
        1. Marathon Special Products FDS-30-C-1 (single pole)
        2. FDS-30-C-3 (three poles)
        3. Or Approved Equal.
     7. Meter Cabinet
        1. Eaton
        2. Or Approved Equal
     8. Power Gateway
        1. Eaton Power Gateway 900 series. No Equal
     9. Network Switch
        1. Network switch(es) shall be furnished and installed by Port of Seattle ICT.
     10. Power Supply
         1. Eaton ELC-PS02
         2. Eaton PSG60N24RP.
         3. No Equal.
  2. SYSTEM REQUIREMENTS
     1. Surge Protection: For external wiring of each conductor entry connection to components to protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads.
        1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Section 26 43 13 " Surge Protective Devices for Low-Voltage Electrical Power Circuits."
        2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Comply with requirements as recommended by manufacturer for type of line being protected.
     2. Addressable Devices: All transmitters and receivers shall communicate unique device identification and status reports to monitoring and control clients.
  3. POWER METERS
     1. [Separately mounted,] permanently installed instrument for power monitoring.
        1. Meter shall support 3-element wye, 2.5 element wye, 2 element delta, 4 wire delta systems.
        2. Surge withstand shall conform to IEEE C37.90.1 and ANSI C62.41 (6 kV).
        3. The meter shall be user programmable for voltage range to any CT or PT ratio.
        4. Meter shall have a burden of not more than 0.01 VA per phase maximum at 10 amps.
        5. All inputs and outputs shall be galvanically isolated to 2500 VAC.
        6. [NEMA 12] faceplate rating shall be available for power meter.
     2. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
        1. Indoor installation in spaces that have environmental controls to maintain ambient conditions of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.
        2. Outdoor installation:

Engineer to add environmental conditions for the project

* 1. MULTI-POINT METERING

Multi-point Metering only for use on new panelboards and switchboards.

* + 1. Manufacturer shall:
       1. Install multi-point metering (MPM) in Switchboard and Panelboards at the factory.
       2. Pre-wire current sensors and interface modules to MPM.
       3. Pre-wire metering voltages and control power connections.
       4. Install optional color HMI where applicable on hinged door.
  1. BRANCH CIRCUIT MONITORING
     1. Power Xpert Branch Circuit Monitor (PXBCM)
        1. Where shown on the drawings, supply a UL listed microprocessor-based Branch Circuit Monitoring System (PXBCM). This system shall consist of meter base, and meter module(s) as described below.
        2. The Branch Circuit Monitoring shall have the following ratings
           1. PXBCM as a component shall have a NEMA 1 rating. When installed in an enclosure it shall have the same rating as its enclosure NEMA [1] [3R] [4] [4X] [12].
        3. PXBCM Meter Base
           1. Each PXBCM-MB Meter Base shall support connection of up to 4 Meter Modules in either a MMS Strip or MME External configuration monitoring a total of up to 100 single-phase two-wire AC loads, 48 single-phase three-wire AC loads or 32 three-phase four-wire AC loads or combinations not to exceed 25 poles per meter module.
           2. The PXBCM-MB shall be equipped with four meter module ports. Each port shall provide control power and communications to either a PXBCM-MMS Meter Module Strip or a PXBCM-MME Meter Module External with a maximum cable length of 28ft between each Meter Base and each Meter Module.
           3. Each PXBCM-MB shall support connection to up to 4 PXBCM-MMS Meter Module Strip or 4 PXBCM-MME Meter Module External, or a combination of up to 4 total PXBCM-MMS and PXBCM-MME each meter module with independent single or three phase voltage metering circuits with inputs up to 277V L-N and 480V L-L.
           4. PXBCM-MB Power Supply shall be rated for 100-277VAC L:N +/-10% CAT III, 47-63 Hz , 6W.
           5. The PXBCM-MB shall include a 3 terminal RS-485 serial port for Modbus RTU communications and an RJ-45 port for Ethernet communications. The Ethernet port shall support Modbus TCP communications as well as an Embedded WEB server.
           6. The PXBCM-MB embedded WEB server shall support device configuration for to up to 4 PXBCM-MMS Meter Module Strip or 4 PXBCM-MME Meter Module External, or a combination of up to 4 total PXBCM-MMS and PXBCM-MME and display of up to 100 points of metering data. It shall be possible to save device configuration information to a file for archiving and for uploading to PXBCM.
           7. The PXBCM-MB shall support connection to a pre-configured HMI via RS-485 serial port. The HMI shall not require configuration.
           8. The PXBCM-MB shall be equipped with LED’s to indicate communications activity and Device/Alarm Status. An LED shall also indicate if Ethernet is configured for DHCP (automatically assigned IP address) or Fixed IP (manually assigned IP address). The PXBCM-MB shall be equipped with 2 rotary switches to assign Modbus Slave ID 1-99.
           9. The PXBCM-MB shall be equipped with security mode switches to enable the device to operate in a secure mode to prevent tampering with device configuration and resets over comms.
           10. The PXBCM Meter Base shall automatically sense the type of PXBCM Meter Module connected to each of its four meter module ports.
           11. The Configuration Wizard shall support naming and configuration of up 100 virtual meters by assigning 1-3 channels of current to 1, 2 or 3 pole meters. Virtual meters shall aggregate the channel data assigned to each virtual meter and report the aggregated virtual meter values for:

Forward and Reverse Energy

Watts, VA, Average Amps and Power Factor

Average and Peak demand for Watts and VA

* + - 1. PXBCM-MMS Meter Module Strip
         1. PXBCM-MMS Meter Module Strips shall be available in configurations to mount on either the left or right of a panelboard and contain 9, 15, or 21 CTs. Four additional 333mV connections shall be provided on each PXBCM-MMS for Auxiliary 333mV CT connections which can be used to monitor the panel mains or branch circuits. The MMS shall include both load current and voltage metering circuits providing meter data to the Meter Base.
         2. The PXBCM Meter Module Strip shall be available with either 9 CT’s, 15 CT’s or 21 CT’s per assembly for factory assembly into Panelboards with 18, 30 or 42 poles. PXBCM MMS CT’s shall have be rated for up to 100A continuous current monitoring and designed to mount in an Eaton PRL-1a, PRS-2a or PRL-3e Panelboard with one inch breaker pole spacing.
         3. PXBCM Meter Module Strip one inch center CTs shall have a window opening sufficient for insulated Aluminum conductor rated for 100A capacity.
         4. The PXBCM Meter Module Strip shall support direct connection of one set of 3 phase nominal metering voltage inputs up to 277V L-N and 480V L-L voltages and shall be rated as Cat III.
         5. The PXBCM MMS shall be UL approved for mounting to the panelboard interior with no interference. Strip placement shall line up 1 inch center CT’s with breaker poles and not impede the normal routing of branch circuit conductors in the panel enclosure.
         6. The PXBCM MMS shall connect to the PXBCM MB using factory supplied cables.
      2. PXBCM-MME Meter Module External

For retrofit applications.

* + - * 1. The PXBCM Meter Module external shall support 25 channels of current using external 333mV current sensors connected to terminal strips on the PXBCM-MME.
        2. The PXBCM Meter Module External shall support direct connection of one set of 3 phase nominal metering voltage inputs up to 277V L-N and 480V L-L voltages and shall be rated as Cat III.

HMI Display is optional, remove if not required for the project.

* + - 1. HMI Display shall display data for all configured sub-meters.
         1. HMI configuration shall not be required for each sub-meter. The HMI shall discover the configuration information automatically.
         2. Displayed information for up to 100 circuits shall include:

Sub-meter name

Current

Voltage

Energy consumption

Demand

Power factor

Aggregated power and energy readings for any 1, 2, or 3 pole meters

* 1. CURRENT TRANSFORMERS
     1. Ratios as indicated; burdened and c-200 minimum accuracy class suitable for connected relays, revenue grade meters, and instruments unless otherwise identified.
        1. Solid core type.
        2. CT shall be minimum 1% accurate from 1% to 100% of the maximum full scale rating from -15°C to 60°C.
        3. CT shall have #12 AWG UL 1015 rated twisted pair leads which shall be limited to the minimum length necessary to complete the circuit to the power meter.
        4. Aperture of CT shall be adequate to accommodate the outside diameter of the conductors.
     2. All secondary wiring connected to the CTs shall be a minimum of #12 AWG copper and should be limited to the minimum length necessary to complete the circuit to the power meter. Short length of smaller conductors in switch boards may be utilized provided the additional burden imposed by these conductors is negligible when compared to the overall circuit burden.
     3. For PXM 2000 Series and 6000/8000 Series Meters
        1. All CTs shall be provided with 5A secondaries at the primary rated current.
           1. For panelboard (up to 400A bus) with multi-point metering application, CTs shall be small, compact, and mountable to the support frame of the panelboard.
        2. CT output shall be 0-5A proportional to the maximum full scale amperage rating.
        3. Current transformer shorting blocks (CTSB) shall be provided on the secondary of the current transformers to ensure that the secondary is automatically short circuited when the load is removed.
     4. For PX MPM Series and PX BCM Series Meters
        1. Provide 100mA output CTs for circuits rated up to 400A
        2. Provide split core 333mV output CTs for circuits rated 400A-2000A.
  2. FUSED DISCONNECT
     1. Disconnect switch that de-energizes fuses without shutting down. Safety type fuse holders for fusing.

METER CABINET

* + 1. Meter enclosure including control power transformers, fusible disconnect, terminal blocks, CT shorting blocks and lock for enclosure. Factory assembled and UL listed as an assembly.
       1. Enclosure:
          1. NEMA 12 for indoor applications; NEMA 3R or 4X in indoor or outdoor applications where dust, water or corrosive chemicals are present.
          2. Provide hinged door with lock.
          3. Operating temperature: -20°C - +40°C.
          4. Size per project requirements.
       2. Meter fusing.
       3. Fused control power transformer (where required) – minimum 100VA.
       4. Fusible disconnect for primary voltage.
       5. CT shorting block assembly. Schneider VTFB-6 or approved equal.
       6. PX Gateway (for multiple meter enclosure only).
       7. Gateway power supply.
       8. Network switch..
       9. Sized for future control power UPS.
  1. POWER GATEWAY
     1. Power gateway for tie-in of multiple existing meters to power monitoring system.
  2. NETWORK SWITCH
     1. Network switch takes inputs from meters and power gateway. Switch output to nearest Port telecom room.
     2. Network switch shall be furnished and installed by POS ICT.
  3. POWER SUPPLY
     1. 95 to 240 VAC (± 10%) at 47 to 440 Hz, 120 to 310 VDC, 0.2A worst case loading (12W) at 100 VAC, 25°C.
  4. LAN CABLES
     1. Unshielded Twisted Pair Cables: Category 6 as specified for horizontal cable for data service in Section 27 15 00 "Communications Horizontal Cabling."
  5. CONTROL-VOLTAGE WIRING
     1. Comply with Section 26 05 23 "Control Signal Transmission Media."
     2. Low-Voltage Control Cable: Multiple conductor, color-coded, No. 20 AWG copper, minimum.
        1. Sheath: PVC; except in plenum-type spaces, use sheath listed for plenums.
        2. Ordinary Switching Circuits: Three conductors unless otherwise indicated.
        3. Switching Circuits with Pilot Lights or Locator Feature: Five conductors unless otherwise indicated.
        4. Provide flexible SIS conductors for #8 AWG and smaller for conductors across enclosure hinges.

1. INSTALLATION
   1. EXAMINATION
      1. Prior to installation, contractor shall perform a plan-in-hand site visit with an F&I Electrical Engineer and a representative from the Port AVM Electric Meter shop.
         1. Site visit will include verification of the following:
            1. Meter type and CTs to be installed
            2. Meter location.
            3. Meter wiring requirements, including CT locations, meter source power, meter reference voltage, fused disconnect location and wiring method, control power transformer (if needed) location and wiring method.
         2. Electrical shut-down required for project connection will not be approved until site walk has been completed to the satisfaction of the electric shop.
      2. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
         1. Proceed with installation only after unsatisfactory conditions have been corrected.
   2. EQUIPMENT INSTALLATION
      1. Install power metering cabinets and accessories according to contract drawings.
      2. Comply with mounting and anchoring requirements in Section 26 05 48 “Seismic Controls for Electrical and Communication Work”.
      3. Standard Mounting Height: Top of trim is 72 inches above top of floor or housekeeping pad, unless otherwise indicated.
      4. Mounting: Plumb and rigid without distortion of box.
      5. Provide terminal blocks in cabinet. Comply with terminal block requirements in Section 26 05 33 “Raceways and Boxes”.
      6. Install fusible disconnect that de-energizes fuse holder without de-energizing meter control power and reference voltage input.
      7. Install safety-type fuse holders for fusing.
      8. CT securing and supporting: Securely support CTs so that transformer leads are not bearing weight and are not under pressure.
      9. Where identified on Contract documents, install metered circuits for branch load revenue metering purposes in accordance with power monitoring and data gathering system requirements. Provide power wiring between CT terminal in panelboards and switchboards and external metering cabinets.
   3. CONNECTIONS
      1. Connect all wiring as identified on contract drawings. All power supply and communications wiring connections must be performed in accordance with guidelines set out in the product documentation.
      2. Where meter is mounted into an opening cover or door of enclosure, wiring is to be routed and secured neatly and in a workmanlike manner to accommodate opening and closing of door.
      3. Tighten electrical connections and terminals according to manufacturer’s published torque tightening values. If manufacturer’s torque values are not available, use those specified in UL 486A and UL 486B.
      4. All current and voltage sensing connections to PM instruments must be made using appropriately rated CT shorting blocks.
   4. CABLING
      1. Comply with NECA 1.
      2. Install cables and wiring according to requirements in Section 27 15 00 "Communications Horizontal Cabling."
      3. Wiring Method: Install wiring in raceway and cable tray. Conceal raceway and wiring except in unfinished spaces.
      4. Install cables without damaging conductors, shield, or jacket.
   5. IDENTIFICATION
      1. Identify components and power and control wiring according to Section 26 05 53 "Electrical Identification."
      2. Label each power monitoring and control module with a unique designation.
      3. Label each cabinet with engraved laminated plastic nameplate with panel designation, power source, source location and voltage.
      4. Label each meter with engraved laminated plastic nameplate with source panel and circuit designation), Maximo equipment identification number (EQ ID), and tenant space number, if applicable.
         1. Maximo equipment identification number shall be provided by POS Aviation Maintenance. Serial number of meter is required to be submitted prior to issuance of EQ ID number.
   6. GROUNDING
      1. Comply with requirements in Section 26 05 26 “Grounding and Bonding for Electrical Systems”.
      2. Comply with IEEE 1100, "Recommended Practice for Powering and Grounding Electronic Equipment."
      3. Install equipment grounding connections to cabinets.
   7. FIELD QUALITY CONTROL
      1. Meters shall not be energized prior to inspection. Schedule inspection through the Port Resident Engineer. Meter inspection shall take place at least three weeks prior to punch walk.
      2. Contractor shall prepare for acceptance tests as follows:
         1. Test insulation resistance for each component, connecting supply, feeder and control circuit.
         2. Test continuity of each circuit and all ground connections. Megger with all circuit breakers open and then with all circuit breakers closed.
         3. Verify continuity of equipment grounds and bonding jumper.
         4. Verify correct phasing and orientation of CTs.
      3. For large meter cabinet installations (more than four meters) provide the following:
         1. Manufacturer's Field Service: Engage a factory-authorized service engineer to inspect components, assemblies, and equipment installations, including connections, pre-testing, testing, programming and commissioning.
            1. Meters shall be configured, programmed, tested and commissioned by a certified integrator with 5 years’ experience on Port approved meters.
            2. Perform inspections and tests listed in NETA ATS and certify compliance with test parameters.
            3. Verify that electrical wiring installation complies with manufacturer’s submittal and installation requirements in Division 26 sections.
            4. Complete installation and startup checks according to manufacturer’s written instructions.
            5. Manufacturer’s certification of proper installation is required.
      4. For meter installations of single meters or cabinets containing four meters or fewer, provide the following:
         1. Tests and Inspections:
            1. Electrical Tests: Use caution when testing devices containing solid-state components.
            2. Continuity tests of circuits.
            3. Operational Tests: Set and operate controls at workstation and at monitored and controlled devices to demonstrate their functions and capabilities. Use a methodical sequence that cues and reproduces actual operating functions as recommended by manufacturer. Submit sequences for approval. Note response to each test command and operation. Note time intervals between initiation of alarm conditions and registration of alarms at central-processing workstation.

Coordinate testing required by this Section with that required by Sections specifying equipment being monitored and controlled.

Test LANs according to requirements in Section 27 15 00 "Communications Horizontal Cabling."

System components with battery backup shall be operated on battery power for a period of not less than 10 percent of calculated battery operating time.

Verify accuracy of graphic screens and icons.

Metering Test: Load feeders, measure loads on feeder conductor with a rms reading clamp-on ammeter, and simultaneously read indicated current on the same phase at central-processing workstation. Record and compare values measured at the two locations. Resolve discrepancies greater than 5 percent and record resolution method and results.

Record metered values, control settings, operations, cues, time intervals, and functional observations and submit test reports printed by workstation printer.

* + - * 1. Power monitoring and control equipment will be considered defective if it does not pass tests and inspections.
    1. Field Test Reports (Contractor and Field Service Engineer): Prepare a written report to record the following:
       1. Test procedures used.
       2. Test results that comply with requirements.
       3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
    2. Correct deficiencies and make necessary adjustments. Retest. Verify that specified requirements are met.
    3. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
    4. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.
    5. Remove and replace malfunctioning devices and circuits and retest as specified above.
  1. CLEANING
     1. On completion of installation, inspect interior and exterior of cabinets. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.
  2. TRAINING
     1. Train Port maintenance personnel to adjust, operate, and maintain systems. See Section 01 79 00 "Training."
        1. Train Port’s metering and maintenance personnel in interpreting and using monitoring displays and in configuring and using software and reports. Include troubleshooting, servicing, adjusting, and maintaining equipment. Provide training for a minimum of three shifts, with ten persons per shift. Course materials are to be submitted 30 days prior to the training date for review with copies provided to all participants on the day of training.
        2. Training Aid: Use approved final versions of software and maintenance manuals as training aids.
  3. ON-SITE ASSISTANCE
     1. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal occupancy hours for this purpose.

1. MEASUREMENT AND PAYMENT
   1. GENERAL
      1. No separate measurement or payment will be made for the Work required by this section. The cost for this portion of the Work will be considered incidental to and included in the payments made for the applicable bid items in the [Schedule of Unit Prices] [Lump Sum price bid for the Project].

End of Section

Revision History:

02/15/2021 New Section