SECTION 26 24 16
PANELBOARDS

PART 1 - **GENERAL**

1.1 DESCRIPTION

A. Provide panelboards in accordance with the Contract Documents.

B. Panelboards include both branch panelboards and distribution panels.

1.2 QUALITY ASSURANCE

A. Panelboards shall be of the same manufacturer as the switchboards.

B. Panelboard interrupting capacities associated with the normal power distribution system may be based on a series-rated protection system where the short circuit interrupting rating (as indicated in the final short circuit submittal) is based on a combination of two or more overcurrent protection devices which are connected in series, and in which the rating of the downstream device(s) in the combination is less than the series rating. Series-rated panelboards, where connected to the emergency power system, are not permitted.

1.3 REFERENCE STANDARDS

A. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section where cited below:

B. NEMA – National Electrical Manufacturers Association
   1. NEMA PB 1 Panelboards
   2. NEMA AB 1 Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures

C. UL – Underwriters Laboratories Inc.
   1. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations
   2. UL 67 Standard for Panelboards
   3. UL 98 Enclosed and Dead-Front Switches
   4. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

D. Federal Specifications
   1. W-P-115C Panel, Power Distribution
   2. W-C-375 Circuit Breakers, Molded Cast; Branch Circuit and Service
   3. W-S-865-C Switch, Box, (Enclosed) Surface-Mounted

1.4 SUBMITTALS

A. General:
   1. Manufacturer’s product data sheets, electrical ratings, and installation instructions.
   2. Support locations and types.

B. Branch Panelboards:
   1. Detailed description and layout of each panelboard, showing physical dimensions, circuit breaker ratings and layout, identification nameplate, and cable lugs.

C. Distribution Panels:
   1. Dimensioned layout and elevation drawings showing physical dimensions and housekeeping pads.
   2. Detailed description and layout of each distribution panel, showing overcurrent protection device ratings and layout, identification nameplate, and cable lugs, and fuse clip sizes.

D. Seismic restraint calculations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cutler Hammer, Siemens, Square D, or equal.

B. Note that equipment layouts are based upon Square D equipment. If alternate manufacturer is selected, it is the Contractor's responsibility to confirm equipment fits within the spaces provided.

2.2 RATINGS

A. Panelboards shall be of the ratings and configurations shown on the Drawings.

B. Panelboards and overcurrent protection devices shall have a minimum short circuit rating as specified herein or greater where indicated on the Drawings.

C. Branch Panelboards:
   1. Branch panelboards are identified with the designation LP (120/208V) or LPH (277/480V) as shown on the Drawings. Branch panelboards for mechanical equipment are identified with the designation MP as indicated on the Drawings.
   2. Maximum allowable physical dimensions: 22 inches wide by 6 inches deep.
   3. Panelboard enclosure dimensions shall be sufficient to accommodate future addition of current transformers within panel interior for separate metering of all individual branch circuit loads, without modification to panel enclosure. Coordinate with manufacturer to confirm space requirements for future panel metering.
   4. Branch panelboards (LP and MP): 10,000 RMS symmetrical amperes minimum interrupting capacity unless noted otherwise.
   5. Branch panelboards (LPH): 14,000 RMS symmetrical amperes minimum interrupting capacity unless noted otherwise.

D. Distribution Panels:
   1. Distribution panels are identified with the designation DPL (120/208V or 208V) or DPH (277/480V or 480V) as shown on the Drawings.
   2. Maximum allowable physical dimensions: 44 inches wide by 12 inches deep per section.
   3. Distribution panel enclosure dimensions shall be sufficient to accommodate future addition of current transformers within panel interior for separate metering of all individual branch circuit loads, without modification to panel enclosure. Coordinate with manufacturer to confirm space requirements for future panel metering.
   4. Distribution panels (DPL): 42,000 RMS symmetrical amperes minimum interrupting capacity unless noted otherwise.
   5. Distribution panels – circuit breaker type (DPH): 42,000 RMS symmetrical amperes minimum interrupting capacity unless noted otherwise.

2.3 CONSTRUCTION

A. Enclosures shall be corrosion resistant galvanized (zinc finished) sheet steel. Fronts shall be cold rolled steel, finish coated with ANSI 61 gray enamel over a rust inhibitor. Panel locks shall be keyed alike. Recessed flush-mounted panels shall have overlapping front.

B. Doors for branch panelboards shall be one-piece bolt-on front with a lockable hinged door over the overcurrent protection devices.

C. Space for future devices shall include all necessary bus supports, and connections.

2.4 BUS SYSTEM

A. Bus bars shall be sequence phased, rigidly supported by high-impact resistant, insulated supporting bus assemblies to prevent vibration and resulting damage when subjected to stress, vibration, or short circuits. Solderless terminations shall be suitable for either copper or aluminum wire or cable.

B. Bus bars shall be of the ampere rating shown on the Drawings. Bus bars shall be plated aluminum or copper sized in accordance with UL standards to limit temperature rise on any current-carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.

C. Neutral bus shall be full size. Neutral bus shall be 200 percent rated when supplied from an oversized neutral conductor. Neutral bus shall be capable of terminating one conductor per pole position minimum.

D. Provide a copper equipment ground bus in each panelboard. In addition to the equipment ground bus, provide a copper isolated ground bus when supplied from a feeder that includes an isolated grounding conductor. Each ground bus shall be capable of terminating one conductor per pole position minimum.

2.5 OVERCURRENT PROTECTION DEVICES

A. Overcurrent Protection Device Types:
   1. Branch panelboards (LP, LPH, and MP): Molded case circuit breakers.
   2. Distribution panels (DPL): Molded case circuit breakers.
   3. Distribution panels (DPH): Molded case circuit breakers or fusible switch units as indicated on Drawings.

B. Molded Case Circuit Breakers:
   1. Completely sealed enclosure. Toggle type operating handle. Trip ampere rating and ON/OFF indication clearly visible.
   2. Bolt-on type. Plug-in type is not permitted.
   3. Thermal-magnetic trip-free, trip-indicating, quick-make, quick-break, with inverse time characteristic. Single-handle and common tripping on multi-pole breakers. External handle shall be suitable for locking in the OFF position.
   4. Silver alloy contacts with auxiliary arc-quenching devices.
   5. Breakers for lighting circuits shall be SWD rated.
   6. Breakers for mechanical equipment shall be HACR rated.
   7. Breakers serving outlets within dwelling unit bedrooms, family rooms, dining rooms, parlors, libraries, dens, sunrooms, recreation rooms, closets, hallways, and similar rooms shall be AFCI type.
   8. Provide main breakers in panelboards served from transformers.
   9. Shunt-trip breakers shall be supplied with 120V AC coils.

C. Fusible Switch Units:
   1. Quick-make, quick-break, dead-front type. Each switch shall be a self-contained unit, externally operated from the front.
   2. Defeatable interlock to prevent opening the door when the switch is in the ON position.
   3. Switches shall be equipped with rejection type clips suitable for UL Class R fuses up to 600A, suitable for UL Class L fuses above 600A.
   4. Handle shall be capable of being padlocked in the OFF position.

2.6 MAIN METERING AND SUB-METERING PANELS

A. Integral meter module shall house the meter terminal board and meter protective device. All metering components shall be integral to the panelboard enclosure.
   1. The meters shall be manually readable using local Liquid Crystal Display (LCD) via push-button and automatically readable utilizing Frequency Hopping Spread Spectrum Power Line Carrier Communication.

2. The metering system shall consist of the GE EPM4000 by GE or MiniCloset by Quadlogic & Transponder(s), or equal.
3. The meter(s) shall be able to meter 2-pole, single phase or 3-pole, three phase circuits. Each panelboard shall be capable of accommodating up to 2 meters per panel for a total of twenty-four (24) 2-pole, single phase circuits.

B. A circuit breaker shall be provided at the metering location to allow safe access to metering components without powering down the entire panel.

C. The meter housing shall be integral to the panel interior with isolation from the main bus.

D. The meter shall be accessible through the same door as the branch devices.

E. Current transformers shall be solid core type and individually mounted in the wire gutter space on insulated factory-assembled mounting brackets. Hanging current transformers from the load cables is not acceptable.

F. Ample wire bending space meeting NEC requirement shall be provided in the gutter for load cables.

G. Secondary CT wiring shall be bundled and out of the wire way for the load cables.

H. Current transformers shall be individually replaceable.

I. All current transformers shall be UL Listed or Recognized, and installed by the panel manufacturer.

J. The integrated panel shall be UL Listed by the panel manufacturer.

2.7 ELECTRONIC POWER METERING

A. Provide electronic power metering where indicated complying with all requirements below. Meter(s) shall be General Electric EPM 4000, Quadlogic Corp, or approved equal.

B. Sub-metering company shall be ista North America, Minol USA, National Water & Power or other sub-metering company as designated by the Owner or Owner's Representative.

C. Meter shall be configured for residential application and applied on 120/208V nominal systems or as indicated on the Drawings.
1. Commercial/Industrial Use (Kwh and Demand)
   a. 120/208V or 277/480V three phase – provided as 6, 8, 12, 14, or 16 – 3-phase metering circuits.

D. The Meter shall have the following Testing and Certification:
1. UL/CUL recognized
2. Meets or exceeds requirements of ANSI C1 and C12.16, ANSI/IEE C37.90.2. ANSI/IEEE C37.90.1, and Measurement Canada.

E. Each meter shall interface to the electrical load being measured with a direct voltage tap, up to 600 VAC, and with 0.1A or 5.0A secondary for split and solid core current transformers.

F. Monitoring:
1. Provide true RMS measurement of current, volts, %THD, kW, KVA, KVAR, kWh, power factor.
2. The meter shall have an accuracy of plus or minus 0.5 percent or better.
3. Where metering for commercial application, kW demand shall be measured and recorded every 15 minutes. Demand shall be recorded along with the time and date at which it occurs. The meter shall be classed as a mass memory interval meter (meters which record and store the energy use by time.) The demand interval shall be permanently programmed in each meter at the factory. Peak demands shall be capable of being read and reset by a remote system computer.

G. User Interface:

1. Reading shall be accessible on a local LCD display. The display shall consist of two rows of 16 characters on each row. The consumption reading shall be up to six (6) digits.
2. Provide an IEC type optical port capable of direct connection to a terminal or PC.

H. Each meter shall be equipped with a clock/calendar that automatically accommodates leap years. The clock/calendar shall be backed up by battery and continue operating during power outages. The time and date shall be automatically synchronized by the Scan Transponder(s) and capable of being reset by a remote computer.

I. Each meter shall be enclosed in a wall mountable, tamper resistant, rugged metal NEMA 1 enclosure with internal CT termination and shorting and fuse block.

J. Revenue-related metering parameters (i.e. demand intervals) shall be permanent and stored in each individual meter. It shall not be possible to change metering parameters through unauthorized access to the system.

K. Provide Phase Diagnostic Registers that include multipliers for amperage, voltage and watts, and line frequency. On a per phase basis Phase Diagnostics shall include voltage, VAR phase shift, accumulated kWh and kVARh, and instantaneous amps, watts, VAR's, VA's, phase angle (degrees displacement between current and voltage waveforms), and Power Factor.

L. Provide Event Diagnostic Registers that include time and date and the number of times the time has been changed, number of power downs, power ups and startups with time and date of last occurrence, and the number of times the accumulated peak demand has been reset, also with the time and date of the last occurrence. Meters that communicate by Power Line Carrier shall also include counts of properly received messages, rejected messages and the numbers of transmissions without replay.

M. On-board Memory Storage:
1. The meter shall maintain a minimum of 60-day log of daily Time-of-Use consumption, interval data and peak demand readings along with the time and date at which the daily peak demands occur. The consumptions recorded shall be the reading at the end of the Time-of-Use period of the end of the day. The peak demand recorded in the log shall be the peak demand for the Time-of-Use period for that day.
2. Each meter shall maintain a minimum of 60-day date logging capacity consisting of fifteen (15) minute or hourly demands with time and date stamp.

N. Control power for the meter shall be obtained via the monitored voltage connections. A separate control power input is not allowed.

O. Communications Interface:
1. All meters shall have as an option a local RS-485 serial port for direct connection to the terminal or PC.
2. Individual meters shall be capable of being equipped with a modem for direct connection to a telephone line if necessary.
3. Where indicated in the Drawings, the system shall communicate with a remote computer using one or more of the methods noted below.
    a. The meter shall communicate over the electrical power wiring to a Scan Transponder via bi-directional, frequency hopping, spread spectrum power line carrier communications. These signals shall be capable of passing through transformers rated 600 kVA or less. The Scan Transponder and each meter shall select the best available combination of phase, frequency range and baud rate for communication at any given time.
    b. RS-485. Two-wire dedicated interconnection unless a modem is to be used then a four-wire dedicated interconnection.
    c. Modbus RTU-485 communications for connection to HMI, SCADA, BAS systems.
    d. Provide four pulse inputs for each tenant meter, capable of reading dry contact, Form A

pulse inputs to automate the reading of other utilities such as gas, water or BTU's.

2.8 SCAN TRANSPONDER

A. Scan Transponders shall be installed where required to collect data from meters on a periodic basis and provide a centralized data access point.

B. A Scan Transponder shall be provided for every 240 electric metering points and one Scan Transponder shall be provided per electrical service and/or separately derived system at the site, except separately derived systems created by low-voltage transformers. Contractor shall provide required location, quantities and voltage connections for Transponders based on manufacturer's specifications and instructions.

C. Scan Transponder shall begin each communication with a meter with verification of clock and meter ID to ensure date integrity.

D. The Scan Transponder shall store downloaded meter values in flash memory and shall hold at least 30 days' worth of records.

E. All communication shall be direct between a Scan Transponder and each meter, and under the control of the Scan Transponder.

F. Multiple Scan Transponders shall be connected by Date Link (RS-485).

G. Where indicated on manufacturer's shop drawings, meter shall be connected to the Scan Transponder by Date Link (RS-485).

H. Where indicated on manufacturer's shop drawings, provide a modem on a Scan Transponder for phone line connection to remote computer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount panelboards 6 feet above finished floor to top unless otherwise noted.

B. Connect feed-through panels to main feeder by insulated parallel gutter taps (O.Z. Electrical Manufacturing Company Type PMX or PMX-C).

C. Where panelboards are mounted recessed flush in wall, maintain fire integrity of wall. Provide one empty ¾-inch EMT conduit stubbed up into nearest accessible ceiling location for every three spare or space positions.

D. Neatly arrange wiring and tie together in each gutter with Thomas & Betts nylon Ty-Raps or equal at minimum 4-inch intervals.

E. Provide plugs on open knockouts.

F. Where multiwire branch circuits are allowed, provide identified handle ties in accordance with Code for each grouping of single pole circuit breakers supplying the multiwire branch circuit.

3.2 SYSTEM TESTING

A. Contractor to provide third-party testing of power metering system and multi-utility metering wiring. The Owner's Sub-metering Service Company or manufacturer's qualified service organization can provide third-party testing.

B. Third-party testing shall include testing of Power Line Communications between power meters and Transponders.

C. Testing shall confirm that all power meters included in cross reference are properly communicating with the Transponders.

D. Testing shall confirm that remote connection system via phone line is complete.

E. Testing shall confirm that all Transponders on the RS-485 network are communicating properly.

3.3 POWER METER TESTING

A. Contractor shall provide third-party testing of power metering. Testing shall be performed prior to tenant occupancy through the following process:
   1. Have the installation contractor record the “cross reference” or the meter serial number (unique ID), meter point, to apartment/unit relationship.
   2. Check for power to the meter.
   3. Check the serial number inside the meter.
   4. Open the panel so that all CT’s are visible.
   5. Verify the CT ratio and write up the cross-reference information for the meter.
   6. Confirm the “cross reference”. This can be accomplished by having one technician turn on the unit or a known load in the respective unit on each phase (hair dryer, electric heater, electric stove, etc.).
   7. Have a second technician at the meter verify the meter’s phase diagnostics for the assigned apartments/units. Confirm that there is a significant increase on the load for each phase of the meter point.
   8. Once all phases have been checked and loads are still running, turn off the breaker serving the apartment and confirm that all loads in the apartment are disconnected.
   9. Document findings.

B. Test Results:
   1. Submit two draft copies of test results to the Owner for review.
   2. After approval by the Owner, submit the test results in two final printed copies and one computer-readable copy.

3.4 TOUCH UP AND CLEANING

A. Backboxes shall be clean, dry, and free of construction debris and fireproofing overspray prior to installation of panelboard interior.

B. Vacuum backboxes clean of debris after installation and wiring of branch circuits.

C. Repair and touch up paint damaged surfaces.

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