

SECTION 26 24 16

~~~ PROJECT NOTE ~~~~~

ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS.

REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ END OF PROJECT NOTE ~~~~~

PANELBOARDS

~~~ PROJECT NOTE ~~~~~

SELECT POWER DISTRIBUTION AND LIGHTING / APPLIANCE PANELBOARDS TO BE UTILIZED WITHIN SCOPE OF PROJECT.

~~~ END OF PROJECT NOTE ~~~~~

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Revision E with Supplement 1, 2013.
- B. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000, with Errata (2008).
- E. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- F. NEMA PB 1 - Panelboards; 2011.
- G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- I. NFPA 70E - Standard for Electrical Safety in the Workplace; 2017.

- J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- L. UL 67 - Panelboards; Current Edition, Including All Revisions.
- M. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- N. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- O. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- P. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- Q. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.
- R. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by the City of Chicago Electrical Code.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect/Engineer of Record of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

*~~~ PROJECT NOTE ~~~~~
EDIT BELOW TO INCLUDE/EXCLUDE TRIP CURVES FOR DEVICES.
~~~ END OF PROJECT NOTE ~~~~~*

### 1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
  - 1. Include characteristic trip curves for each type and rating of overcurrent protective device.

*~~~ PROJECT NOTE ~~~~~  
EDIT BELOW IF SERIES RATING IS NOT APPLICABLE FOR PROJECT SCOPE.*

*~~~ END OF PROJECT NOTE ~~~~~*

- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
  - 2. Include wiring diagrams showing all factory and field connections.
  - 3. Clearly indicate short circuit current ratings.
  - 4. Include documentation of listed series ratings.

- D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
  - 1. Panelboard Schedules: For installation in panelboards. Submit final typewritten versions after load balancing.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.
- I. Maintenance Materials: Furnish the following for Board's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Panelboard Keys: Six (6) spares of each different key.
  - 3. See Section 26 28 13 - Fuses for requirements for spare fuses and spare fuse cabinets.

#### **1.05 QUALITY ASSURANCE**

- A. Conform to the City of Chicago Electrical Code.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through on source from a single manufacturer.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three (3) years documented experience.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the City of Chicago Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Comply with NEMA PB 1.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

#### **1.07 FIELD CONDITIONS**

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
  - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
  - 2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.
- B. Altitude: Not exceeding 6600 feet.
- C. Interruption of Existing Electrical Service: Do not interrupt electric service to facilities occupied by Board or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Architect/Engineer of Record and Board's Representative not fewer than seven (7) working days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Architect/Engineer of Record's and Board's Representative written permission.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens Industry, Inc: www.usa.siemens.com.

### **2.02 PANELBOARDS - GENERAL REQUIREMENTS**

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Short Circuit Current Rating, Fully Rated:
  1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73 - Power System Studies.
  2. Listed series ratings are acceptable, except where not permitted by motor contribution according to the City of Chicago Electrical Code..
  3. Label equipment utilizing series ratings as required by the City of Chicago Electrical Code.

~~~ **PROJECT NOTE** ~~~~~  
EDIT BELOW TO REMOVE IF PANELBOARD IS NOT USED FOR SERVICE ENTRANCE.
~~~ **END OF PROJECT NOTE** ~~~~~

- C. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
  3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
  5. Split Bus: Vertical buses divided into individual verticals.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
    - c. Kitchen Areas: NEMA 250, Type 4x, stainless steel.
    - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
    - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
  3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.

- b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
    - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
  4. Lockable Doors: All locks keyed alike unless otherwise indicated.
  5. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
  6. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
  7. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panels.
  8. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- I. Comply with NFPA 70E for arc flash labels.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00 - Surge Protective Devices, list and label panelboards as a complete assembly including surge protective device.
- L. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2, Class 2.
  1. Ampere Rating: Not less than ampere rating of panelboard bus.
  2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
  3. Coil Voltage: As required for connection to control system indicated.
  4. Combination controller equipped for panelboard mounting and including the following accessories:
    - a. Individual control-power transformers.
    - b. Fuses for control-power transformers.
    - c. Indicating lights.
    - d. Seal-in contact.
    - e. Two convertible auxiliary contacts.
    - f. Push buttons.
    - g. Selector switches.
    - h. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
    - i. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.
- M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
  1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
  2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
    - a. Use zero sequence ground fault detection method unless otherwise indicated.
    - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
    - c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
- N. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

- O. Provide the following features and accessories where indicated or where required to complete installation:
  - 1. Feed-through lugs.
  - 2. Sub-feed lugs.
- P. Circuit Monitors for panelboard Circuit Breakers
  - 1. Provide space and voltage taps in each panel with electrical submetering equipment.
    - a. Voltage taps will be designed for 14 to 12 gage wire.
    - b. To determine space requirements use Veris H8053 with 3 current transformers.
    - c. The submeter maybe field or factory installed. The Division 24 BAS system installer will provide submeter.
    - d. If indicated on the drawings, two sets of submeters will be provided. For example, if a panel to be monitored includes both lighting and plug loads.
- Q. Phase and Ground Buses:
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
  - 3. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors and insulated from box.
  - 4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
  - 5. Split Bus: Vertical buses divided into individual verticals.
  - 6. Integral TVSS or provision for the connection of the remote TVSS.
- R. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

~~~ **PROJECT NOTE** ~~~~~  
EDIT BELOW TO EXCLUDE IF "POWER DISTRIBUTION PANELBOARDS" ARE NOT UTILIZED WITHIN PROJECT SCOPE.
~~~ **END OF PROJECT NOTE** ~~~~~

### **2.03 POWER DISTRIBUTION PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
  - 2. Main and Neutral Lug Type: Compression.
- C. Bussing:
  - 1. Phase and Neutral Bus Material: Copper.
  - 2. Ground Bus Material: Copper.
- D. Circuit Breakers:

~~~ **PROJECT NOTE** ~~~~~  
SELECT CIRCUIT BREAKER OR FUSED SWITCH
~~~ **END OF PROJECT NOTE** ~~~~~

- 1. Main Overcurrent Protective Devices: Circuit breaker or Fused switch.
- 2. Provide bolt-on type or plug-in type secured with locking mechanical restraints for circuit breaker frame sizes 125A and smaller.
- 3. For Circuit-Breaker Frame Sizes Larger than 125A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- 4. Provide thermal magnetic circuit breakers unless otherwise indicated.
- 5. Provide electronic trip circuit breakers where indicated.

6. Fused switches where indicated on the Drawings.
- E. Enclosures:
  1. Provide surface-mounted enclosures unless otherwise indicated.
  2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Provide clear plastic circuit directory holder mounted on inside of door.
- F. Emergency Distribution Panelboards: Modify handles for fusible switch assemblies in compliance with applicable codes.

#### **2.04 LIGHTING AND APPLIANCE PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
  2. Main and Neutral Lug Type: Compression.
- C. Bussing:
  1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  2. Phase and Neutral Bus Material: Copper.
  3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
  1. Provide surface-mounted or flush-mounted enclosures as indicated.
  2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Provide clear plastic circuit directory holder mounted on inside of door.
- F. Emergency and Exit Lighting Branch Circuit Panelboards: Provide overcurrent protective devices Type S plug fuses within panelboards in compliance with applicable codes.

**~~~ PROJECT NOTE ~~~~~**  
*EDIT BELOW TO EXCLUDE FUSIBLE SWITCHES IN DISTRIBUTION AND LIGHTING/APPLIANCE  
PANELBOARDS IF NOT REQUIRED IN PROJECT SCOPE.*  
**~~~ END OF PROJECT NOTE ~~~~~**

#### **2.05 OVERCURRENT PROTECTIVE DEVICES**

- A. Fusible Switches:
  1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
  2. Fuse Clips: As required to accept indicated fuses.
  3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
  4. Conductor Terminations:
    - a. Provide mechanical lugs unless otherwise indicated.
    - b. Lug Material: Copper, suitable for terminating copper conductors only.
- B. Molded Case Circuit Breakers:
  1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  2. For Circuit-Breaker Frame Sizes 125A and Smaller: Bolt-on circuit breakers.

3. For Circuit-Breaker Frame Sizes Larger Than 125A: Bolt-on circuit breaker; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
4. Interrupting Capacity:
  - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
    - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
    - 2) 14,000 rms symmetrical amperes at 480 VAC.
  - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
5. Conductor Terminations:
  - a. Provide mechanical lugs unless otherwise indicated.
  - b. Provide compression lugs where indicated.
  - c. Lug Material: Copper, suitable for terminating copper conductors only. Mechanical style, suitable for number, size, trip ratings, and conductor materials.
6. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
  - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 250 amperes and larger.
  - b. Provide interchangeable trip units where indicated.
7. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
  - a. Provide the following field-adjustable trip response settings:
    - 1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
    - 2) Long time delay.
    - 3) Short time pickup and delay.
    - 4) Instantaneous pickup.
    - 5) Ground fault pickup and delay where ground fault protection is indicated.
  - b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
  - c. Provide communication capability where indicated: Compatible with system indicated.
8. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
9. Provide the following circuit breaker types where indicated:
  - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
  - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
  - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
  - d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
  - e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
10. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting; Type HACR for heating, air-conditioning, and refrigerating equipment.
11. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
12. Do not use tandem circuit breakers.

13. Do not use handle ties in lieu of multi-pole circuit breakers.
14. Provide multi-pole circuit breakers for multi-wire branch circuits as required by the City of Chicago Electrical Code.
15. Provide the following features and accessories where indicated or where required to complete installation:
  - a. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage where indicated on drawings.
  - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
  - c. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
  - d. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
  - e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.
  - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - g. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
  - h. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
16. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front mounted, field-adjustable trip setting.

## **2.06 CIRCUIT MONITORS - FOR PANELBOARD CIRCUIT BREAKERS**

- A. Provide space and voltage taps in each panel with electrical submetering equipment.
  1. Voltage taps will be designated for 14 to 12 gage wire.
  2. To determine space requirements use Veris H8053 with three (3) current transformers.
  3. The submeter maybe field or factory installed. the Division 23 BAS system installer will provide submeter.
  4. If indicated on the Drawings, two (2) sets of submeters will be provided. For example, if a panel to be monitored includes both lighting and plug loads.

## **2.07 EMERGENCY DISTRIBUTION PANELBOARDS**

- A. Similar to distribution panelboards except with modified handles for fusible switch assemblies in compliance with applicable codes.

## **2.08 EMERGENCY AND EXIT LIGHTING BRANCH CIRCUIT PANELBOARDS**

- A. Similar to lighting and appliance panelboards in compliance with applicable codes.

## **2.09 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Factory test panelboards according to NEMA PB 1.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and the City of Chicago Electrical Code.
- D. Provide required supports in accordance with Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Install panelboards plumb.
- F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- G. Mount panelboards such that the top of trim is 74 inches above the finished floor, unless otherwise indicated.
- H. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- I. Provide minimum of four spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.
  - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
  - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- K. Install all field-installed branch devices, components, and accessories.
- L. Provide fuses complying with Section 26 28 13 - Fuses for fusible switches as indicated.
- M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- N. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by the City of Chicago Electrical Code.
- O. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73 - Power System Studies.
- P. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- Q. Provide filler plates to cover unused spaces in panelboards.
- R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also, provide for the following:
  - 1. Emergency and night lighting circuits.
  - 2. Fire detection and alarm circuits.
  - 3. Communications equipment circuits.
  - 4. Intrusion detection and access control system circuits.
  - 5. Video surveillance system circuits.
- S. Identify panelboards in accordance with Section 26 05 53 - Identification for Electrical Systems.

### **3.03 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 250 amperes. Tests listed as optional are not required.
  - 1. Perform insulation-resistance tests on all control wiring with respect to ground.
  - 2. Test functions of the trip unit by means of secondary injection.

- E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by the City of Chicago Electrical Code.
  - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- F. Test GFCI circuit breakers to verify proper operation.
- G. Test AFCI circuit breakers to verify proper operation.
- H. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- I. Correct deficiencies and replace damaged or defective panelboards or associated components.

### **3.04 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

### **3.05 CLEANING**

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

### **3.06 COMMISSIONING AND DEMONSTRATION**

- A. Training: Arrange and pay for the services of factory-authorized service representatives to demonstrate Panelboards and OCPD's and train Board's maintenance personnel.
- B. Conduct a minimum of one half (1/2) day of training in operation and maintenance as specified in Division 01 Section "Closeout Procedures". Include both classroom training and hands on equipment operation and maintenance procedures.
- C. Schedule training with at least seven (7) days' advance notice.
- D. Balancing Loads: After Preliminary Acceptance, but not more than two (2) months after Final Acceptance, conduct load-balancing measurements and make circuit changes as follows:
  - 1. Perform measurements during period of normal working load as advised by Board.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility. Make special arrangements with Board to avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding twenty (20) percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as required to meet this minimum requirement.
- E. Contractor Start-Up and Reporting. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- F. Contractor Start-Up and Reporting. Perform the following field tests and inspections and prepare test reports:
  - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

**END OF SECTION 26 24 16**