

# ROSEWOOD MIDDLE DEMOLITION

## SECTION 26 24 16 – PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer to Section 260571 “Power System Study” for overcurrent protective device coordination and submittal requirements.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

#### 1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. SPD: Surge Protective Device.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Refer to Section 260571 for Fault Current Coordination and ARC Flash Report requirements.
- C. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- D. Field Quality-Control Reports:

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1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards. Room names and numbers shall match the final signage at the site. Submit final versions prior to installation in panelboard.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panelboards for installation according to NEMA PB 1.

### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

### 1.8 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment,

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raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

#### 2.2 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets as noted on schedules.

1. Rated for environmental conditions at installed location.
  - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
  - b. Outdoor Locations: NEMA 250, Type 4.
  - c. Kitchen Areas: NEMA 250, Type 4X stainless steel.
  - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
2. Front Cover: For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
  - a. Flush Mounted Panelboards: Standard front cover. Secured to box with concealed trim clamps. Match box dimensions.
  - b. Surface Mounted Panelboards: Entire front trim hinged to box. Continuous piano hinge. Provide standard door with front trim.
3. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
4. Finishes:
  - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
  - b. Back Boxes: Galvanized steel.
5. Directory Card: Inside panelboard door, mounted in plastic sleeve.
6. Main Overcurrent Protective Devices: Molded-case circuit breakers.

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- a. Center Mounted Main: Branch mounted main breakers are not allowed.
7. Branch Overcurrent Protective Devices: Molded-case circuit breakers.
  - a. Center mounted branch devices and sub-feed branch devices are not allowed.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity
  1. Neutral Bus: Neutral bus rated 100 percent of phase bus.
  2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.
- E. Feed-through Lugs: Not acceptable.
- F. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the design drawings. If it is not possible to match "specific breaker placement" during construction, clearly note in submittal documentation for approval.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices. Future devices indicated as "SPACE" on drawings.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Series rating of equipment is not acceptable.

### 2.3 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, power and feeder distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
  1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- C. Mains: Circuit breaker.
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

### 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker, unless otherwise noted on drawings.

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- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

### 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with full interrupting capacity to meet available fault currents.
  - 1. Electronic Trip Circuit Breakers: Electronic trip circuit breakers with RMS sensing; field-replaceable rating plug or field-replicable electronic trip and individually field-adjustable long time, short time, and instantaneous trip pickup level settings. Trip unit shall also have adjustable long time and short time delay settings. Provide for circuit-breaker frame sizes 250A and larger.
    - a. Ground Fault Protection: Any 1000A-rated circuit breaker or larger, above 150V L-G, shall have ground fault pickup and time delay settings in addition to overcurrent trip settings indicated above.
  - 2. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Field adjustable instantaneous trip setting for circuit-breaker frame sizes 100 A to 225A.
  - 3. Breakers Serving Elevator Controllers: Field adjustable instantaneous-trip setting for circuit-breaker.
  - 4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
  - 5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 6. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
  - 7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - e. Shunt Trip: Trip coil energized from separate circuit, set to trip at 75 percent of rated voltage. Match coil voltage to control power source.
    - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    - g. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    - h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

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### 2.6 SURGE PROTECTIVE DEVICES

- A. General: Externally mounted, modular, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules. All Surge Protective Devices (SPD) systems shall be modular permanently connected, parallel designs. Series suppression elements shall not be acceptable. SPD system shall be a hybrid design utilizing thermally Protected Metal Oxide Varistors and Filter capacitors to suppress EMI/RFI electrical noise
- B. The SPD shall be rated for 480/277VAC, three-phase, four-wire plug ground. The SPD system shall provide surge protection in all possible modes (L-N, L-G, L-L, and N-G). Each replaceable module shall provide the ability to deliver full surge current rating per mode.
  - 1. Per Mode: 250 kA.
  - 2. Per Phase: 500 kA.
- C. The SPD shall provide EMI/RFI electrical noise attenuation of 36 to 44dB in the range of 50 kHz to 100 MHz.
- D. Voltage Protection Ratings: The UL 1449 3<sup>rd</sup> Edition Voltage Protection Ratings "VPR" (6kV, 3000 Amps, 8/20 $\mu$ s waveform) shall not exceed the UL assigned values listed below:
  - 1. L-L: 2000 V.
  - 2. L-N, L-G, N-G: 1200 V.
- E. The SPD shall have a minimum UL 1449 3<sup>rd</sup> Edition Nominal Discharge Current Rating ( $I_n$ ) of 10,000 Amps.
- F. Each individual module shall feature a green LED indicating the individual module has all surge protection devices active and a red LED indicating protective device is off-line.
- G. Accessories shall include the following:
  - 1. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
  - 2. Audible alarm activated on failure of any surge diversion module.
- H. Six-digit transient-counter set to totalize transient surges that deviate from the sine-wave envelope by more than 125 V
- I. Connect SPD leads into an unoccupied branch overcurrent device. Device shall be located immediately adjacent to the branch overcurrent device serving it. Factory leads shall not be extended or spliced, device must be installed in a manner to utilize the factory leads.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

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- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install filler plates in unused spaces.
- F. Stub eight 3/4-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 3/4-inch empty conduits into raised floor space or below slab not on grade.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- 1. Physical inspection and Testing

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- a. Verify equipment rating correspond to drawings and specifications.
  - b. Inspect the physical and mechanical condition and verify that it complies with manufacturer's standards.
  - c. Verify equipment is properly secured and aligned with the required clearances as specified in the drawings and specifications. Assure that the equipment is properly grounded.
  - d. Verify that all packing materials have been removed and the equipment has been cleaned.
  - e. Confirm all breaker sizes, quantities, and configurations correspond to the drawings and specifications.
  - f. Confirm bolted and mechanical lug electrical connections are low impedance using one of the following means:
    - 1) Measure the resistance with a low-resistance ohmmeter. Bolted electrical connection resistances shall be compared to resistances measured on similar connections. Any similar resistance values that deviate more than 50 percent should be investigated.
    - 2) Inspect the bolted connection and verify that it is at the manufacturer's rated torque using a calibrated torque wrench. If manufacturer's data is not available verify the torque meets the requirements of Table 100.12 in the ANSI/NETA ATS-2009.
  - g. A thermographic test shall be conducted. Equipment will be open at the time of the scan in order to get an accurate reading from the testing device. All equipment should be energized and loaded during test. Thermographic images of any connections that fail the test must be submitted with a description of the failure including the probable cause of the failure.
2. Electrical Inspection and Testing
- a. Test each bus section for insulation resistance for one minute on phase to phase and phase to ground connections. Verify the test results comply with manufacturer's documentation or the requirements established in Table 100.1 of the ANSI/NETA ATS-2009.
  - b. Verify all meters functionality and accuracy after testing and calibrating all inputs.
  - c. Verify instrument transformers meet all the requirements of the drawings and specifications.
    - 1) Test transformer wiring integrity and proper transformer operation.
    - 2) Verify transformer output voltage is at the specified level.
3. Test Reports: Prepare a written report to record the following:
- a. Test procedures used.
  - b. Test results that comply with requirements.
  - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
  - d. Thermographic Test Report
- B. Panelboards will be considered defective if they do not pass tests and inspections.

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### 3.5 ADJUSTING

- A. Set field-adjustable circuit-breaker trip ranges. Unless otherwise noted, trip settings shall mimic trip characteristics for thermal magnetic circuit-breakers of similar trip rating.
- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  - 1. Measure as directed during period of normal system loading.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 262416

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