

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Integrated Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring

1.3 QUALITY ASSURANCE

- A. 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.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Refer to the drawings for Voltage, Amperage, Mains rating type/size, flush or surface mount, and AIC integral rating of each panelboard.
- B. All electrical distribution equipment shall be of one manufacturer, unless specifically noted otherwise or approved by the Engineer.

- C. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - a. For surface-mounted applications, front cover shall match box dimensions.
 - b. For flush-mounted applications, front cover shall overlap box dimensions by at least $\frac{3}{4}$ ".
 - 3. Directory Card: Inside panelboard door, mounted in transparent card holder.
 - 4. Enclosures for interiors rated less than 225A shall not be ventilated.
 - 5. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat
- D. Incoming Mains Location: Top and bottom - refer to drawings.
- E. Phase, Neutral, and Ground Buses: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
 - 1. Bus arrangements shall be standard for the manufacturer (alternate phasing for each consecutive 1-pole branch circuit space).
 - 2. All panelboards shall be "fully bussed" where indications of "space only" are shown on the drawings or where future devices could be mounted.
 - 3. Multiple section panelboards shall maintain full sized bus rating across all sections.
 - 4. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box
 - 5. Isolated Equipment Ground Bus: Adequate for branch-circuit isolated equipment ground conductors; insulated from box (as indicated on the drawings).
 - 6. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads (as indicated on the drawings).
- F. Conductor Connectors: Suitable for use with copper conductors and sizes indicated.
 - 1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Compression or Mechanical type.
 - 3. Ground Lugs and Bus Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs: Compression or Mechanical type, suitable for use with copper conductors. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Compression or Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- G. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- H. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- I. Gutters: Arrange to isolate individual panel sections. Provide oversized gutters as required for sub-feed conductors or other large conductor situations. Field verify extra space requirements.

- J. Panelboard Short-Circuit Current Rating: Each device within a panelboard shall be rated to interrupt a symmetrical short-circuit current level indicated in the panelboard schedule on the drawings. Do not use series ratings for devices within a panelboard.
 - 1. Minimum “integrated” ratings (fully rated) unless noted otherwise in the panelboard schedule on the drawings:
 - a. 240V (and less) lighting and appliance panelboards: 10,000 AIC
 - b. 277/480V lighting and appliance panelboards: 18,000 AIC
 - c. 208V power distribution panelboards: 100,000 AIC
 - d. 480V power distribution panelboards: 65,000 AIC

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

		Square D	Eaton
600V (1200A max)	(FUSES)	QMB	PRL4
	(BREAKERS)	I-LINE	PRL4

- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike; provide two (2) spare keys for each type of panelboard cabinet lock. Provided door-in-door construction with concealed hinges for all distribution panelboards
- D. Mains: As shown on drawings.
- E. Branch Overcurrent Protective Devices: As shown on drawings.
 - 1. For Circuit-Breakers of all sizes: Bolt-on circuit breakers.
 - 2. ON and OFF positions clearly marked; switch cover shall be interlocked with handle to prevent opening when handle is in the ON position (a defeat mechanism shall be provided to allow authorized personnel to open the switch while in the ON position).
 - 3. Switches shall be capable of accepting heavy duty padlocks.
 - 4. All fusible branch switches shall be quick-make, quick-break, with visible blades and dual horsepower ratings.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

		Square D	Eaton
240V (400A max)		NQOD	PRL1
480/277V (400A max)		NF	PRL2

- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

- C. Mains: As shown on drawings.
- D. Branch Overcurrent Protective Devices: As shown on drawings.
 - 1. For Circuit-Breakers of all sizes: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
 - 2. Two and three pole breakers shall be of the common trip type (do not use single pole breakers with tie handles).
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike, provide two (2) spare keys for each type of panelboard cabinet lock. Provided door-in-door construction with concealed hinges for all panelboards.
- F. Surge Protective Device (SPD) TYPE 2
 - 1. SPD Device: IEEE C62.41, UL 1449 Third Edition Listed, integrally mounted, bolt-on style (6" max. lead length), solid-state, parallel-connected, modular SPD. The UL 1449 Third Edition Listed Suppression Ratings shall be used (not the product's independent performance rating).
 - a. Minimum current rating shall be as follows:
 - 1) Line to Line: 160,000 A
 - 2) Line to Neutral: 80,000 A
 - 3) Line to Ground: 80,000 A
 - 4) Neutral to Ground: 80,000 A
 - b. Protection modes shall be as follows:
 - 1) Line to neutral
 - 2) Line to ground
 - 3) Neutral to ground
 - c. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 30 dB at 100 kHz.
 - d. Category C combination wave clamping voltage shall not exceed 700 V, line to neutral, line to ground, and neutral to ground on 120/208 V systems.
 - e. Maximum Continuous Operating Voltage (MCOV) rating shall not exceed 150V on 120/208 V systems.
 - f. Withstand Capabilities: UL1449 3rd edition listed at 20kA I_n per mode TYPE 2 SPD.
 - 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 with battery back-up and alarm test switch; activated on failure of any surge diversion module, or low battery.
 - 3) Externally mounted LED visual indicators for each phase; indicating full protection or no protection.
 - 4) Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.
 - h. The unit shall carry a minimum Ten (10) -Year Warranty.
 - i. UL 1449 Third Edition suppression ratings of the submitted device shall be submitted with the panelboard shop drawings.
 - j. Panelboards with TVSS protection shall be of the same manufacturer as all other panelboards associated with the project.
- G. All main distribution panelboards shall receive Surge Protection Device (SPD).
- H. All emergency panelboards shall receive Surge Protection Device (SPD).

- I. Arc Energy Reduction: Energy reducing maintenance switching with local status indicator is required for 1200A or higher.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet AIC rating of associated panelboard as indicated.
 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 8. 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. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
 - f. Shunt Trip: 120V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
 - h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position. Provide for fire alarm circuit breaker.
- B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
 1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Consult Utility Co. for coordination of the primary and secondary service requirements. The Electrical Contractor shall provide all labor and material required by the Utility Co. for both temporary and permanent electrical service for this project. Verify all costs with the Utility Co. prior to bidding this project.
- B. Install lightning surge arresters on main service entrance per manufacturers installation instructions (Square D Cat. No. SDSA1175 or SDSA3650 or equal). Refer to plans for voltage and phasing of service.
- C. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.
- D. Mount top of trim 84 inches above finished floor unless otherwise indicated. In no case shall the highest over-current protective device handle exceed 79" above the finished floor.
- E. 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.
- F. Provide a 4" concrete house-keeping pad for all floor mounted power distribution panelboards.
- G. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges - consult with the engineer.
- H. Install filler plates in unused spaces.
- I. Ensure that panelboard doors & latches operate smoothly.
- J. Provision for Future Circuits at Flush Panelboards: Stub two 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- K. Wiring in Panelboard Gutters: Neatly arrange conductors into groups. Form, bundle and wrap with wire ties after completing load balancing.
- L. Comply with NECA 1.
- M. Panelboard layouts on the drawings are based upon one manufacturer. Verify dimensions of proposed manufacturer's equipment for compliance with layout shown on the drawings prior to bidding. Any required layout changes due to larger equipment sizes shall be submitted to the Engineer prior to bidding. NFPA 70 working clearances shall be maintained at all times.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create

directory; handwritten directories and photocopies of the panelboard schedules from the drawings are not acceptable.

- C. Panelboard Nameplates: Label each panelboard with a phenolic, engraved nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a phenolic, engraved nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Follow NECA 90, Annex A Electrical Testing Procedures.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
 - a. Instrument: Use an infrared scanning device designed to measure temperature and detect significant deviations from normal values. Minimum resolution 320x240, 45deg. field of view. Equal to Flir E8-XT or Fluke TiS60. Provide calibration record for device used. Follow instructions of test equipment used.
 - b. Comply with ASTM E1934-99a. Standard guide for Examining Electrical and Mechanical equipment with Infrared Thermography.
 - c. Prepare a certified report identifying items checked and describing results of scanning. The infrared thermographer shall provide documentation for all infrared examinations. The following information shall be included in a report to the end user:
 - 1) The name, affiliation, address, and telephone number of the infrared thermographer, and his/her certification level and number, if applicable.
 - 2) The name and address of the end user,
 - 3) The name(s) of the assistant(s) accompanying the infrared thermographer during the examination,
 - 4) The manufacturer, model and serial number of the infrared imaging system used,
 - 5) The inventory list with notations of the items of equipment that were examined and explanations for the items not examined. Also, the items with low-emissivity surfaces should be identified.
 - 6) The date(s) of the inspection and when the report was prepared.
 - 7) When performing a qualitative infrared examination, the infrared thermographer shall provide the following information for each item identified:
 - a) Its exact location.

- b) A description, such as its significant nameplate data, phase or circuit number, rated voltage, current rating and/or rotation speed.
 - c) The measured voltage and measured current.
 - d) The ambient air temperature and, when relevant, the wind speed and direction and the sky conditions at the time of the examination.
 - e) The time the item was documented.
 - f) Hardcopies of the thermal image (thermogram) and of a corresponding visible-light image.
 - g) The field of view or magnification multiplier of the infrared imager lens, and any imager settings that could affect the accuracy, reliability, or repeatability of the inspection data.
 - h) Notation of any attenuating media, such as windows, filters, atmospheres, or external optics.
 - i) A subjective repair priority rating provided by the qualified assistant or end user representative, or both, based on the importance of the exception to the safe and profitable operation of the facility.
 - j) Any other information or special conditions which may affect the results, repeatability, or interpretation of the exception.
- d. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
- 4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
 - E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.
 - F. **CLEANING:** On completion of installation, inspect interior and exterior of panelboards. 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.

END OF SECTION 262416