

**READ THIS FIRST**

Notice to the Design Engineer, this document is part of Facilities and Infrastructure standards for Electrical Systems. Designers are advised to NOT use this template (\*.doc) document as part of any project contract documents. Designers shall use the Port of Seattle MasterSpec specifications from the following link:

**<https://www.portseattle.org/page/guide-specifications>.**

Designers shall edit the corresponding Port's MasterSpec specification to meet the F&I Electrical Standard outlined in this specification. Note that Port's MasterSpec specifications contain specifications and languages for both Aviation and Maritime Divisions. F&I Standards are strictly for Aviation Division, and any Maritime related specs or languages should be removed from the project specifications.

**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.

**1.2 SUMMARY AND NOTES TO DESIGNER**

- A. This Section includes the following:
  - 1. Feeder-bus assemblies rated 600V and less.
- B. Busway that feeds multiple panels or switchboards is typically not allowed as it creates a single point of failure. Busway may be used in some applications. Coordinate use of busway with F&I.
- C. The engineer shall design the busway route to ensure that adequate space is provided around the busway for air to circulate. Multiple busway runs shall be separated by a minimum of 4 inches.
- D. The engineer shall coordinate with the structural engineer to ensure that the busway support system and the building structure to which it is attached will not fail during a seismic zone 3 event.

**1.3 ACTION SUBMITTALS**

- A. Shop Drawings: For each type of bus assembly.
  - 1. Show fabrication and installation details for enclosed bus assemblies. Include plans, elevations, and sections of components. Designate components and accessories, including clamps, brackets, hanger rods, connectors, straight lengths, and fittings.

2. Show fittings, materials, fabrication, and installation methods for listed fire-stop barriers and weather barriers.
3. Indicate required clearances, method of field assembly, and location and size of each field connection.
4. Detail connections to switchgear, switchboards, transformers, and panelboards.
5. Wiring Diagrams: Power wiring.
6. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer.
  - a. Design Calculations: Calculate requirements for selecting seismic restraints.
  - b. Detail fabrication, including anchorages and attachments to structure and to supported equipment.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Floor plans and sections, drawn to scale. Include scaled bus-assembly layouts and relationships between components and adjacent structural, mechanical, and electrical elements. Show the following:
  1. Vertical and horizontal enclosed bus-assembly runs, offsets, and transitions.
  2. Clearances for access above and to the side of enclosed bus assemblies.
  3. Vertical elevation of enclosed bus assemblies above the floor or bottom of structure.
  4. Support locations, type of support, and weight on each support.
- B. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.
- C. Qualification Data: For professional engineer and testing agency.
- D. Product Certificates: For each type of enclosed bus assembly, signed by product manufacturer.
- E. Manufacturer Seismic Qualification Certification: Submit certification that enclosed bus assemblies, accessories, and components will withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems." Include the following:
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Field quality-control test reports.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For enclosed bus assemblies to include in emergency, operation, and maintenance manuals.

## **1.6 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- C. Source Limitations: Obtain enclosed bus assemblies through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NEMA BU 1, "Busways."
- F. Comply with NFPA 70 requirements and Authority Having Jurisdiction.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle enclosed bus assemblies according to NEMA BU 1.1, "General Instructions for Proper Handling, Installation, Operation and Maintenance of Busway Rated 600 Volts or Less."

## **1.8 PROJECT CONDITIONS**

- A. Derate enclosed bus assemblies for continuous operation at indicated ampere ratings for ambient temperature not exceeding 122 deg F.

## **1.9 COORDINATION**

- A. Coordinate layout and installation of enclosed bus assemblies and suspension system with other construction that penetrates ceilings or floors or is supported by them,

including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

- B. Coordinate size and location of concrete curbs around openings for vertical bus. Concrete, reinforcement, and formwork requirements are specified with concrete.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. EATON.
  - 2. Square D
  - 3. F&I approved equal.

### **2.2 ENCLOSED BUS ASSEMBLIES**

- A. Feeder-Bus Assemblies: NEMA BU 1, 3-phase, 4 wire, low-impedance bus assemblies in nonventilated housing; single-bolt joints; ratings as indicated.
  - 1. Seismic Fabrication Requirements: Fabricate mounting provisions and attachments for feeder-bus assemblies with reinforcement strong enough to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems" when mounting provisions and attachments are anchored to building structure
  - 2. Voltage: For use on the following systems:
    - a. 120/208V, 3 phase, 4 wire OR
    - b. 277/480 V; 3 phase; 4 wire.
  - 3. Current: As calculated by the engineer plus 10 %.
  - 4. Neutral: 100% nominal, 200% neutral for predominantly non-linear loads.
  - 5. Ground: 50% capacity.
  - 6. Temperature Rise: 55 deg C above 40 deg C ambient maximum for continuous rated current.
  - 7. Bus Materials: Current-carrying copper conductors, 98% conductivity. Fully insulated with Class 130C polyester or epoxy insulation, no air gaps; plated surface at contact surfaces. NO ALUMINUM CONDUCTORS OR TERMINALS ALLOWED.
  - 8. Short Circuit Rating: Not less than determined by the engineer. Higher fault currents may require fuse protection. Note that short circuit ratings and fuse sizes for specific fault levels are not consistent between manufacturers.
    - a. The Engineer shall determine the maximum fault current, including anticipated future growth, available to busway system. No part of the busway system shall be rated less than this figure, including the interrupting rating of any devices.

9. Enclosure: Sandwich construction, furnished in 10 foot lengths. Steel with manufacturer's standard finish, totally enclosed, non-ventilated.
10. Joints: Single bolt with Belleville washer, torque-indicating double headed bolt, access required from one side only.
11. Fittings and Accessories: Manufacturer's standard.
12. Mounting: Arranged flat, edgewise, or vertically without derating.

### **PART 3 - INSTALLATION**

#### **3.1 EQUIPMENT INSTALLATION**

- A. Install busway in accordance with manufacturer's recommendations and NFPA 70.
- B. Ensure that adequate space is provided around the busway for air to circulate. Multiple busway runs shall be separated by a minimum of 4 inches.
- C. Busway route will be designed to avoid crossing seismic joints, wherever possible.
- D. Support bus assemblies independent of supports for other elements such as equipment enclosures at connections to panelboards and switchboards, pipes, conduits, ceilings, and ducts.
  1. Design each fastener and support to carry load indicated by seismic requirements and to comply with seismic-restraint details according to Section 260548.16 "Seismic Controls for Electrical Systems."
  2. Support bus assembly to prevent twisting from eccentric loading.
  3. Support bus assembly with not less than 3/8-inch steel rods. Install side bracing to prevent swaying or movement of bus assembly. Modify supports after completion to eliminate strains and stresses on bus bars and housings.
  4. Fasten supports securely to building structure according to Section 260529 "Hangers and Supports for Electrical Systems."
- E. Install expansion fittings at locations where bus assemblies cross building expansion joints. Install at other locations so distance between expansion fittings does not exceed manufacturer's recommended distance between fittings.
- F. Construct rated fire-stop assemblies where bus assemblies penetrate fire-rated elements such as walls, floors, and ceilings. Seal around penetrations according to Section 078413 "Penetration Firestopping."
- G. Install weatherseal fittings and flanges where bus assemblies penetrate exterior elements such as walls or roofs. Seal around openings to make weathertight. See Section 079200 "Joint Sealants" for materials and application.
- H. Install a concrete curb at least 4 inches high around bus-assembly floor penetrations.
- I. Coordinate bus-assembly terminations to equipment enclosures to ensure proper phasing, connection, and closure.

- J. Tighten bus-assembly joints with torque wrench or similar tool recommended by bus-assembly manufacturer. Tighten joints again after bus assemblies have been energized for 30 days.

### **3.2 CONNECTIONS**

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### **3.3 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports prior to energization.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification 7.4 "Metal Enclosed Busways". Certify compliance with test parameters.
- C. Remove and replace units that do not pass tests and inspections and retest as specified above.
- D. After energization, check entire busway for proper orientation.
- E. Infrared Scanning: Two weeks after Substantial Completion and before Final Acceptance, perform an infrared scan of bus assembly including joints and plug-in units.
  - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
  - 2. The Port shall have the option of performing its own infrared inspection.
  - 3. Prepare a certified report identifying bus assembly checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- F. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

### **3.4 ADJUSTING**

- A. Set field-adjustable, circuit-breaker trip ranges and overload relay trip settings as indicated.

### **3.5 CLEANING**

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

### **3.6 PROTECTION**

- A. Provide final protection to ensure that moisture does not enter bus assembly.

END OF SECTION 262500