

## **SECTION 26 25 00 – ENCLOSED BUS ASSEMBLIES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes busway and fittings including plug-in units.

#### **1.2 REFERENCES**

- A. Institute of Electrical and Electronics Engineers:
1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- B. National Electrical Manufacturers Association:
1. NEMA BU 1 - Busways.
  2. NEMA BU 1.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Busway Rated 600 Volts or Less.
- C. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- D. Underwriters Laboratories Inc.:
1. UL 857 - Busways; Current Edition, Including All Revisions.

#### **1.3 SUBMITTALS**

- A. Shop Drawings: Provide dimensioned plan views and sections indicating proposed busway routing, required clearances, and locations and details of supports, fittings, equipment connections, and firestops and weatherseals at building element penetrations. Indicate voltage and current ratings, short circuit current ratings, configurations, and installed features and accessories. Include details of wall and floor penetrations. Where roof penetrations are required provide certification that work does not void roof warranty. Provide all required seismic equipment anchorage details and calculations.
- B. Product Data: Submit manufacturer's standard catalog pages and data sheets for busway system components and accessories. Include dimensions, weight, materials, fabrication details, finishes, and service condition requirements. Submit seismic certification of equipment.
1. Include busway resistance, reactance, and impedance data, voltage drop ratings and fault current data.
  2. Include characteristic trip curves for each type and rating of circuit breaker plug-in device.



- C. **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.
- D. **Coordination Drawings:** Provide detailed floor plan views and layouts.
  - 1. Indicate busway layout and support locations. Provide isometric drawing.
  - 2. Coordinate the arrangement of busway with structural members, ductwork, piping, equipment and other potential conflicts.
  - 3. Coordinate the work with other trades to avoid installation of obstructions within busway required clearances.
  - 4. Coordinate arrangement of busway with the dimensions and clearance requirements of the actual equipment to be installed.
  - 5. Coordinate the work with placement of supports, anchors, etc. required for mounting.
  - 6. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 7. Where busway extends through roof, coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
- E. **Maintain at the project site a copy of each referenced document that prescribes execution requirements.**

#### **1.4 CLOSEOUT SUBMITTALS**

- A. **Project Record Documents:** Record actual locations of busway routing and location of plug-in units.
- B. **Provide seismic certification and equipment anchorage details.**
- C. **Test Results:** Provide field test results.
- D. **Operation and Maintenance Data:**
  - 1. Submit joint re-tightening schedule.
  - 2. Include information on replacement parts and recommended maintenance procedures and intervals.

#### **1.5 QUALIFICATIONS**

- A. **Manufacturer:** Company specializing in manufacturing products specified in this section with minimum five years documented experience.

#### **1.6 QUALITY CONTROL**

- A. **Manufacture busway in an ISO 9001 certified facility.**



- B. Provide busway certified for Seismic Withstand Capability in accordance with the International Building Code and the California Building Code for Seismic Zone 4 worst case levels.

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

- A. Handle in accordance with NEMA BU 1.1 and manufacturer's written instructions.
- B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation including outdoor busway, which is not weatherproof until completely and properly installed. 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 products carefully to avoid damage to internal components, enclosure, and finish.

## **1.8 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install indoor busway until building is closed in and suitable temperature conditions are controlled.
- B. Conform to NEMA BU 1 service conditions during and after installation of busway.

## **1.9 UTILITY INTERCONNECTIONS**

- A. Coordinate with Utility Company to provide busway connections suitable for system requirements.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acceptable Manufacturers:
  - 1. Eaton.**
  - 2. Square D.**
  - 3. General Electric.**
  - 4. Substitutions: Not Permitted.**
- B. Furnish busway system and all associated components and accessories from a single manufacturer and obtained from a single supplier.
- C. Listing of an alternate acceptable manufacturer does not indicate or imply acceptance of their standard products. Manufacturers listed above are not relieved from complying with all specified ratings, features and functions. By using a product other than the basis of design the Contractor accepts responsibility for any and all costs associated with any necessary modifications to related work including any design fees, inspection fees and construction management fees.



## 2.2 BUSWAY

- A. Provide busway system consisting of all required components, fittings, devices, supports, accessories, etc. as necessary for a complete operating system.
- B. Utility Interconnections: Provide utility company approved cable tap-boxes or other fittings required by utility company.
- C. Description: Prefabricated sectionalized enclosed bus assemblies and associated fittings and devices; listed and labeled as complying with UL 857.
- D. Busway General Requirements:
  1. Busway Type: Feeder or Plug-in type as indicated, totally enclosed, low impedance, full neutral, internal ground bus, non-ventilated; suitable for installation in any mounting orientation the busway is designed for (horizontal flatwise, horizontal edgewise, vertical) without derating.
  2. Enclosure: Sprinkler proof for indoor installations.
  3. Temperature Rise: Not exceeding 55 degrees C, when operating at continuous rated current in an ambient temperature of 104 degrees F (40 degrees C).
  4. Bus bars and stabs to be suitably plated at all electrical contact points.
  5. Both feeder and plug-in busway rated 800 A and above to be of sandwich type construction, with no air gaps between bus bars except at plug-in openings.
  6. Bus bar Insulation: NEMA Class B, rated 266 degrees F (130 degrees C).
  7. Housing: Constructed with code gage steel or aluminum to reduce hysteresis and eddy current losses, with suitable protective finish of ANSI 49 gray polyester paint or ANSI 61 epoxy powder paint applied by an automated electrostatic process.
  8. Conductors: Copper bars, fully insulated except at joints.
  9. Joints: Single bolt type, with silver-plated contact surface for bus and splice plate., with high strength steel bolts and conical washers to maintain proper pressure over a large contact surface area:
    - a. Use torque-indicating bolts with visual indication that proper torque has been applied; requires only a standard long handle wrench for proper activation.
    - b. Bolts to be at ground potential to allow adjustment without requiring de-energizing of busway.
    - c. Designed such that tightening of joints only requires access to one side of busway.
    - d. Allows for length adjustment of plus/minus 0.125 inch (3.2 mm).
    - e. For busway rated 800 A and above, joint connection assemblies to be removable to allow electrical isolation or physical removal of a busway length without disturbing adjacent busway lengths.
  10. Voltage Drop:
    - a. Voltage drop specified is based on the busway operating at full rated current and at stabilized operating temperature in 86 degrees F (30 degrees C) ambient.



- b. Do not exceed 3.1 volts per 100 feet (30.48 m) for three phase, line-to-line voltage drop at 40 percent power factor concentrated load.
- c. Do not exceed 4.0 volts per 100 feet (30.48 m) for line-to-line voltage drop at the load power factor that produces maximum voltage drop in the busway.
- d. Do not exceed a total busway voltage drop that causes the total feeder voltage drop to exceed 2 percent as required by California Title 24 Building Energy Efficiency Standards. The total feeder voltage drop includes the total feeder length from the service entrance equipment to the branch circuit panel with the largest calculated voltage drop.
- e. For purposes of voltage drop calculations assume a total load equal to 80% of the device rating serving the busway.

**E. Short Circuit Current Rating:**

- 1. Provide busway system and associated components with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study or as indicated on the drawings whichever is higher. Where no available fault currents are indicated provide short circuit current rating equal to the short circuit current rating of the switchgear serving the busway. Provide a minimum short circuit current rating of 125kA rms symmetrical.
- 2. Listed series ratings are not acceptable. Provide fully-rated busway.

**2.3 SOURCE QUALITY CONTROL**

- A. Inspect and test according to NEMA BU1 and NETA ATS

**PART 3 - EXECUTION**

**3.1 EXISTING WORK**

- A. Remove exposed abandoned busways, including abandoned busways above accessible ceiling finishes. Patch surfaces.
- B. Maintain access to existing busways and other installations remaining active and requiring access. Modify installation or provide access panel.
- C. Extend existing busway installations using materials and methods as specified.
- D. Clean and repair existing busways to remain or to be reinstalled.

**3.2 PREPARATION**

- A. Perform insulation resistance testing on individual current-carrying busway system components prior to installation in accordance with NECA 408 and NEMA BU1.1.
- B. Verify that field measurements are as shown on drawings.



- C. Verify that the ratings of busway system components are consistent with the indicated requirements.
- D. Verify that mounting surfaces are ready to receive busway and associated supports.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### **3.3 INSTALLATION**

- A. Install in accordance with NEMA BU1.1 and with manufacturer's instructions.
- B. Arrange busway parallel and perpendicular to building lines.
- C. Install busway plumb and level with sections aligned and with horizontal runs at the proper elevation.
- D. Arrange busway to provide required clearances and maintenance access for busway and for other equipment adjacent to busway.
- E. Unless otherwise indicated, orient horizontal plug-in busway with plug-in openings on sides to permit practical use of all plug-in openings.
- F. Maintain proper phase sequence throughout busway system, accounting for phase transitions where applicable.
- G. Tighten joints using torque wrench, to manufacturer's specified values.
- H. Install busway length with expansion fitting at each location where busway run crosses building expansion joint or in long straight runs for temperature expansion/contraction in accordance with manufacturer's instructions.
- I. Mount horizontal busway runs in flatwise position.
- J. Provide end closures at unconnected ends of busway runs.
- K. Busways in electrical rooms shall be plug in type with minimum of (2) plug provisions for future and clear space around each plug provision.
- L. Each busway in electrical room shall be provided with a busway T stub for future connections and clear space around each T provision.
- M. Support busway at intervals not exceeding 5 feet as required by the NEC. Support intervals for indoor busway may exceed 5 feet where designed and recommended by the manufacturer with a maximum spacing of 10 feet. Support vertical riser at each floor. Use suitable spring hangers for vertical riser applications where busway penetrates and is supported by building floors. Use manufacturer's recommended hangers and supports or provide required support and attachment components in accordance with Section 26 05 29.
- N. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.



- O. Provide sway bracing as required to keep busway runs straight and prevent rotation and movement, accounting for unbalanced weight distribution of plug-in units where applicable.
- P. Install busway with integral fire stops located where busway penetrates fire-rated walls and floors. Seal around opening to maintain fire-rating equal to wall or floor rating.
- Q. Install 4 inch concrete curb around interior floor penetrations.
- R. Install busway with integral weatherseal located where busway penetrates exterior wall or roof. Provide wall or roof flange and seal around opening to maintain weathertight installation. Seal roof penetrations as required to preserve integrity of roofing system and maintain roof warranty.
- S. Outdoor Feeder Busway: Arrange busway to prevent water infiltration through drain holes from rain or snow. Seal joints in accordance with manufacturer's instructions and remove drain hole plugs.
- T. Install plug-in units in accordance with manufacturer's instructions. Provide independent supports where recommended by manufacturer. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study.
- U. Install fuses in fused switches.
- V. Select and install heater elements in motor controllers to match installed motor characteristics.
- W. Install permanent markings on busway as required in the Identification for Electrical Systems section 26 05 54.
- X. Ground and bond busway in accordance with Section 26 05 27. Where integral housing ground is utilized, verify joint covers and other components required for continuity are properly installed.
- Y. Clean dirt and debris from busway enclosure and components in accordance with manufacturer's instructions. Do not use compressed air or a blower in order to prevent debris infiltration. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.
- Z. Adjusting:
  - 1. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
  - 2. Adjust supports as required to minimize strain on busway and associated components.

### **3.4 FIELD QUALITY CONTROL**

- A. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing.



- B. Electrically isolate busway system before energizing and perform insulation resistance testing in accordance with NECA 408 and NEMA BU1.1.
  - 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- C. Perform infrared scanning of energized busway system under maximum load conditions in accordance with NECA 408.
- D. In addition to tests specified, inspect and test in accordance with NETA ATS, except Section 4. Perform inspections and tests listed in NETA ATS, Section 7.4.
- E. Correct deficiencies and replace damaged or defective busway system components.
- F. Include test reports with close-out submittals.
- G. Training: Provide minimum of two hours of training for Owner's personnel on the operation, adjustment and maintenance of system. Use operation and maintenance manual as training reference supplemented with additional training materials as required. Provide training at project site.

END OF SECTION 26 25 00