

**SECTION 26 25 00
ENCLOSED BUS ASSEMBLIES**

PART 1 - GENERAL

1.1 SCOPE

- A. This section defines low voltage indoor and outdoor busway, fittings and plug-in units for use in AC systems, rated 600 V or less.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1. ***[Related Sections (where applicable) include the following:***
a. ***Section 26 24 13 – Switchboards]***

1.3 SUBMITTALS

- A. Provide product information prior to fabrication and installation. Product data shall include all dimensions, weights, electrical ratings, wiring diagrams and required clearances.
- B. When requested, provide additional product data and certifications necessary to show conformance with this specification. Additional data limited to routine factory tests.
- C. Provide information for record purposes including field test reports and maintenance data.

1.4 RELATED STANDARDS

- A. Comply with requirements of latest revisions of applicable industry standards, specifically including the following:

1. NEMA BU 1.1 - Busways
2. UL 857 - Underwriters Laboratories Busway Standard
3. CSA C22.2 No. 27, Busway
4. NFPA 70 – National Electrical Code
5. UL 1479 - Underwriters Laboratories Fire Test of Through Penetration Firestop
6. IBC (International Building Code), CBC (California Building Code) – Seismic Compliance

- B. ***[Manufacturer Seismic Qualification: The low voltage busway shall meet and be certified to seismic requirements specified in the [IBC 2015 International Building Code] [CBC 2013 California Building Code] [ASCE American Society of Civil Engineers 7-10]. The low voltage busway shall be compliant with IBC 2015 parameters:***

1. ***Building Occupancy Category (as defined in Table 1.1 from ASCE 2010: [I] [II] [III] [IV] [I – Agricultural facilities, certain temporary facilities, minor storage facilities] [II – All buildings and other structures not listed in I, III or IV] [III – Buildings and structures that represent a substantial hazard to human life in the event of failure or that can cause substantial economic impact or mass disruption of day-to-day civilian life. Examples include and are not limited to, places where >300 congregate in one area, daycare facilities with >150 occupants, elementary and secondary schools with >250 occupants, colleges and adult education with >500 occupants, health care facilities with >50 resident patients without surgery or emergency facilities, power generation stations for the national grid, water treatment, sewage treatment and telecommunication centers] [IV – Buildings and other structures deemed essential, including, but not limited to hospitals, surgery and emergency treatment facilities, fire, rescue, ambulance, police, emergency vehicle garages, earthquake hurricane and other emergency shelters, emergency preparedness, power generation stations required in an emergency, ancillary structures such as communication towers, fuel storage tanks, cooling towers, electrical substation structures, fire water storage tanks, aviation control towers, air traffic control centers, emergency aircraft hangers, water pressure for fire suppression and critical national defense functions.]***
2. ***Seismic Design Category: [A] [B] [C] [D] [E] [F]***

3. **Site Class: [A – Hard Rock] [B - Rock] [C – Very dense soil and soft rock] [D – Stiff soil profile] as defined in IBC 2006 Table 1613.5.2 Site Class Definitions**
 4. ***Ip – Importance Factor: [1.5 – Components must function after an earthquake for life safety purposes (Building Occupancy Code IV)] [1.25 - Buildings and structures that represent a substantial hazard to human life in the event of failure or that can cause substantial economic impact or mass disruption of day-to-day civilian life (Building Occupancy Code III)] [1.0 – Non-essential buildings. Function not life critical. (Building Occupancy Code I and II)]***
 5. ***Ss – Mapped Spectral Accelerations for Short Periods at 0.2 seconds - [180%g - for single width bus] [89%g - for double width bus]***
 6. ***Sds – 5% Damped Design Spectral Response Accelerations for Short Periods at 0.2 seconds – [1.33 - for single width bus] [0.65 – for double width bus]***
 7. ***z/h – height factor ratio: [] Note: Ratio is a calculated value equal to the floor the gear is installed on divided by 12. A 6th floor installation is a 0.5 value. A basement or ground floor installation is a 0.0 value.***
- C. ***Equipment shall be designed to be located in a concrete and steel, moment-resisting frame building not exceeding 12 stories in height with a minimum story height of 10 feet.]***

1.5 QUALITY ASSURANCE

- A. All busway products shall be manufactured in a facility which has
 1. A Quality Management System registered to ISO9001:2000 (EN ISO 9001:2000; BS EN ISO 9001:2000; ANSI ASQ 9001:2000).
 2. An Environmental Management System registered to ISO 14001:2004.

1.6 REGULATORY REQUIREMENTS

- A. Underwriters Laboratories Listing
 1. All straight lengths, fittings and plug-in units shall be listed and marked in accordance with UL Standard No. 857.
 2. This listing shall include mounting of the busway in any position (i.e. horizontal flat wise, horizontal edgewise and vertical) without derating.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to NEMA Publication BU1.1, which is a guide for proper installation, operation and maintenance of busway products.
- B. Handle busway in accordance manufacturer’s recommendations. Utilize factory provisions for all lifting, rigging, or hoisting.
- C. Store busway prior to installation in a temperature and humidity controlled space.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The low voltage busway shall be SENTRON BUSWAY manufactured by Siemens or pre-approved equal. Approved manufacturers are as follows:
 1. SIEMENS
 2. []

2.2 GENERAL REQUIREMENTS

- A. General
 1. Furnish and install a complete low impedance prefabricated busway distribution system as shown on the plans.
 2. Busway shall be [] volts [] phase [] wire with minimum 50% capacity integral housing ground. Aluminum housing shall qualify for grounding purposes.

3. The ampere ratings, approximate footage, fitting, plug-in units, etc., are shown on the plans. The electrical contractor shall be responsible for routing the busway to coordinate with the other trades. Final field measurements shall be made by the contractor prior to release of the busway for fabrication.

B. Short-Circuit Rating And Tests

1. The short-circuit rating of the busway shall be *[the Consulting engineer's calculated required rating of] []* RMS symmetrical amperes.
2. The short circuit rating of the busway shall be determined according to UL Standard No. 857. This rating must be based upon actual tests at the rated short-circuit current for six (6) cycles.

2.3 CONSTRUCTION

A. Housing

1. The busway housing shall be of 100% aluminum construction and painted with polyester urethane powder paint to provide protection against corrosion.
2. The busway housing shall be totally enclosed non-ventilated for protection against mechanical damage and dust accumulation.
3. The busway shall be certified for *[IP 40 Indoor] [IP 55 Splash Proof] [NEMA 3R Outdoor (feeder only)]*.
4. *[Connection between the bus plug and housing ground shall incorporate integral tap off locations to ensure electrical conductivity. Welded taps shall not be allowed.]*

B. Joint

1. The busway joint shall be of the one-bolt type which utilizes a high strength steel bolt(s) and Belleville washers to maintain proper pressure over a large contact surface area.
2. The bolt shall be torque indicating, fully insulated and at ground potential.
3. The bolt shall be two-headed design to indicate when proper torque has been applied and require only a standard long handle wrench to be properly activated.
4. Access shall be required to only one side of the busway for tightening joint bolts.
5. The joint shall allow +/- .625" (15.8mm) adjustment in section length.
6. It shall be possible to remove any joint connection assembly to allow electrical isolation or physical removal of a busway length without disturbing adjacent busway lengths.

C. Bus Bars

1. The bus bars shall be fabricated from high strength, *[58 percent conductivity aluminum] [98 percent conductivity copper]* and suitably plated at all contact surfaces to ensure good electrical contact at all joints and plug-in tap-off points.
2. Each bus bar shall be insulated over its entire length (except for contact surfaces) with an electrostatically applied, Class B (130°C certified) epoxy insulation.
3. The temperature rise at any point in the busway shall not exceed 55°C rise above ambient temperature when operating at rated load current.
4. Both feeder and plug-in busway shall be of sandwich construction meaning no air gap shall exist between bus bars except at the joints.
5. Bus bars for plug-in busway shall incorporate integral (not welded) tap-off locations for plug-in units to ensure 100% electrical continuity.

D. Support Of Busway

1. Hanger spacing shall be noted on layout drawings or installation instructions and shall not exceed manufacturer's recommendations.
2. Feeder and plug-in busway shall be approved for hanger spacing of up to 10'0" for horizontally mounted runs and up to 16'0" for vertically mounted runs.

E. Plug-In Openings

1. On plug-in busway there shall be five dead-front, hinged cover type plug-in openings on each side of a ten foot length.
2. All openings shall be usable simultaneously.

3. Busway shall be installed so that plugs are side mounted to permit practical use of all ten plug-in openings.
 4. It shall be possible to inspect the plug-in opening and bus bars prior to the installation of the plug-in unit.
 5. Plug-in openings to be finger safe (IP2X) with the plug-in cover open.
- F. Plug-In Units
1. Plug-in units shall be *[circuit breaker type] [fusible switch type]* with visible blade, & quick make / quick break mechanism.
 2. Plug-in units, which cannot be operated directly from the floor, shall be equipped with suitable means for hook stick operation.
 3. The interrupting rating of circuit breaker plug-in units shall be *[]* RMS symmetrical amperes.
- G. Plug-In Unit Safety Devices
1. *[Each plug-in unit shall be mechanically interlocked with the busway housing to prevent installation or removal of plug-in units while the switch is in the ON position.]*
 2. Plug-in enclosures shall make positive ground connection with the ground bus before the contact fingers make contact with the phase bars.
 3. The plug-in units shall be equipped with internal barriers to prevent accidental contact with live parts on the line side of the protective device during time of wire pulling.
 4. *[Covers of all plug-in units must have "releasable" type interlocks to prevent the cover from being opened when the switch is in the ON position.]*
- H. *[Expansion Section*
1. *Expansion sections shall be provided and installed for every:*
 - a. *200 foot continuous busway run. A jog greater than 10 feet resets the continuous run length.*
 - b. *Building expansion joint traversed.*
 - c. *Vertical run greater than 40 feet. The expansion section shall be placed within the first 20 feet of the transition to vertical, end cable tap box or flange.*
 2. *The busway run shall be positioned to accommodate all expansion sections.]*
- I. Voltage Drop
1. The voltage drop (input voltage minus output voltage) specified shall be based on the busway operating at full rated current and at stabilized operating temperature in 35° C ambient temperature.
 2. The three-phase, line-to-line voltage drop shall not exceed 4.0 volts per hundred feet at 70% power factor concentrated load, which condition may exist during motor starting.
- J. Fire Rating
1. The busway shall be UL listed to meet two-hour fire ratings for gypsum wallboard construction and three-hour fire rating for poured concrete or concrete block construction.
- K. Seismic Rating
1. The busway shall be qualified for use in seismic areas.
 2. Seismic compliance shall be qualified only through shake table testing. Compliance by calculation is not acceptable.
- L. *[Meter Center Modules*
1. *When required, install meter centers utilizing a direct connection at the bus joint.*
 2. *The meter center shall be mounted such that the dimension from top of floor to center of top meter module is no more than 6'-6".]*
- M. *[Panelboard Modules*
1. *When required, install panelboards utilizing a direct connection at the bus joint.]*
- N. *[Transient Surge Protection Device (SPD)*

1. **Each busway run shall be protected by multiple Siemens Sentron SPD Bus Plugs spaced every [50][100] feet. Select one of the next two paragraphs and delete the two that do not match your busway total length.**
 - a. **[For busway runs of less than 50 feet: A 100 kA Sentron SPD Bus Plug shall be installed in the first plug-in opening closest to the incoming power source and a 100 kA Sentron SPD Bus Plug at the last plug-in opening]**
 - b. **[For busway runs greater than 50 feet: A 100 kA Sentron SPD Bus Plug shall be installed in the first plug-in opening closest to the incoming power source and a 100 kA Sentron SPD Bus Plug installed at the last plug-in opening. Additional 100 kA Sentron SPD Bus Plugs shall be installed mid-span every [50][100] feet over the entire length of the plug-in busway.]**
 - c. **For systems with busway tees, a 100 kA Sentron SPD Bus Plug shall be placed at the end of the teed run. If the teed run is long than 50 feet, place an additional 100 kA Sentron SPD Bus Plug in the first opening after the tee. For teed runs of 51 feet or more, place an additional 100 kA Sentron SPD Bus Plugs shall be installed mid-span every [50][100] feet over the entire length of the teed plug-in busway.]**

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install busway and accessories in accordance with manufacturer's instructions. Additional instructions are detailed in NEMA publication BU1.1 which is provided with the equipment by the electrical manufacturer.
- B. Install busway length with expansion fitting at each location where busway run crosses building expansion.
- C. Provide curb around interior floor penetrations per NFPA-70.
- D. **[Install NEMA 3R busway where busway penetrates [exterior wall] [roof]. Provide [wall] [roof] flange and seal around opening to maintain weather tight installation.]**
- E. The busway shall be installed with a slope of 1-5 degrees below horizontal and sloped away from the building.

3.2 ADJUSTMENTS AND CLEANING

- A. Set field-adjustable trip devices per coordination study.
- B. Clean exposed surfaces using manufacturer recommended materials and methods. Touch-up damaged coating and finishes using non-abrasive materials and methods recommended by manufacturer. Eliminate all visible evidence of repair.

3.3 TESTING

- A. ...

3.4 WARRANTY

- A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than eighteen months from date of shipment.

3.5 [STARTUP SERVICES

- A. **Engage a factory-authorized service representative to perform startup service.**
- B. **Train Owner's maintenance personnel on procedures and schedules for energizing and de-energizing, troubleshooting, servicing and maintaining equipment and schedules.**

- C. *Verify that circuit breaker is installed and connected according to the Contract Documents.*
- D. *Complete installation and startup checks according to manufacturer's written instructions.]*

END OF SECTION