

SECTION [26 15 13][16340]

MEDIUM VOLTAGE[AND HEAVY DUTY LOW VOLTAGE] BUSWAYS

Square D™ Power-Zone™ Metal-Enclosed Busway (600 V – 38kV)

Schneider Electric Editor's Note:

This guide specification is written in accordance with the Construction Specifications Institute (CSI) Master Format. This section must be carefully reviewed and edited by the architect or the engineer to meet the requirements of the project. Coordinate this section with other specification sections within the Contract Documents and Drawings.

To properly use / edit this document, show formatting and hidden text by selecting ¶ on the menu or by typing (Ctrl+*) simultaneously. Except for these introductory and closing paragraphs, green hidden text will not print. Text in red is optional. Red text in [brackets] denotes multiple options where one or more should be chosen. All red text should be edited and changed to black for final project conformation. In addition, these introductory paragraphs should be deleted or changed to hidden text. Additional guidance and specifications can be found at .

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration and installation of metal enclosed, self-cooled, non-segregated phase busway assemblies, indoor and outdoor feeder (also identified as MV Busway, MV enclosed busway, MV bus duct, LV heavy duty busway, busway or MV enclosed bus) as required for the complete performance of the Work, as shown on the Drawings, as specified herein[, and as specified elsewhere for the assemblies or systems comprised of the components specified herein].
- B. Related Sections: Related sections include, but shall not be limited to, the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
 - 2. Applicable general requirements for electrical Work specified within Division 26 Specification Sections apply to this Section.

1.2 REFERENCES

- A. General, Publications: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
 - 1. American National Standard Institute
 - a. ANSI C37.23, "Standard for Metal-Enclosed Bus"
 - 2. American Society of Civil Engineers
 - a. ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures"
 - 3. Canadian Standards Association (CSA)
 - a. C22.1, "Canadian Electrical Code, Part I" (CEC)
 - b. C22.2 No. 201, "Metal-Enclosed High Voltage Busways"
 - 4. Institute of Electrical and Electronics Engineers (IEEE)
 - a. IEEE 613, "Recommended Practices for Seismic Design of Substations"
 - b. IEEE 693, "Seismic Qualification of Composites for Substation High-Voltage Requirement"
 - 5. International Organization for Standardization (ISO)
 - a. ISO 9001, "Quality Management Systems – Requirements"

6. National Fire Protection Agency (NFPA)
 - a. NFPA 70, "National Electrical Code (NEC)"
7. Underwriters Laboratories, Inc. (UL)
 - a. UL 1479, "Standard for Fire Tests of Penetration Firestops"

1.3 DEFINITIONS

- A. Unless specifically defined within the Contract Documents, the words or acronyms contained within this specification shall be as defined within, or by the references listed within this specification, the Contract Documents, or, if not listed by either, by common industry practice.

1.4 SUBMITTALS

- A. General: Submittals shall be in accordance with the requirements of Section [01 33 00][01300] Submittals and Section [26 00 10][16010] Electrical Requirements, in addition to those specified herein.
 1. Submit sufficient information to determine compliance with the Contract Documents. Identify submittal data with the specific equipment tags and/or service descriptions to which they pertain. Submittal data shall be clearly marked to identify the specific model numbers, options, and features of equipment and work proposed.
 2. Deviations from the Contract Documents shall be indicated within the submittal. Each deviation shall reference the corresponding drawing or specification number, show the Contract Document requirement text and/or illustration, and shall be accompanied by a detailed written justification for the deviation.
 3. Submit required product data and shop drawings specific to each product and accessory proposed. In addition, include the following information:
 - a. General layout of equipment, termination details, recommended support locations and details, dimensions, weights, and outline drawings showing the final assembled configuration.
 - b. Location of space heaters, space heater loads and wiring. Connection wiring diagrams for heater systems.
 - c. Certified test reports.
- B. Operation & Maintenance (O&M) manuals shall be provided in accordance with the minimum requirements specified in Section [01 78 23][1780] Operation and Maintenance Data, Section [26 00 10][16010] Electrical Requirements and additional requirements specified herein.
 1. Submit required Operations & Maintenance data specific to each product and accessory proposed.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of ten years.
 1. The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third-party registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.
 2. The manufacturer or their representative shall have service, repair, and technical support services available 24 hours 7 days a week basis.
- B. Installer Qualifications: Installer shall be a firm that shall have a minimum of [10] years of successful installation experience with projects utilizing equipment similar in type and scope to that required for this Project [and shall be approved by the manufacturer's representative].

- C. All work performed and all materials used shall be in accordance with the [National Electrical Code], [Canadian Electrical Code] and with applicable local regulations and ordinances. Process controllers, assemblies, materials, and equipment shall be listed and labeled by Underwriter's Laboratories or by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation.
 - 1. The bus components shall be packaged for the largest completed sections shipment as set forth in the Purchase Order. Each shipped bus section shall be crated.
 - 2. Packaging shall be labeled and numbered so that each section or assembly may be identified before being uncrated. All busway pieces and sections shall be clearly identified in accordance with the assembly drawings.
 - 3. Splice plates, gaskets, hardware, and other loose equipment required to assemble and connect busway to equipment shall be identified and shipped with the busway.
 - 4. For projects with multiple bus runs, all busway crates will be tagged with a unique color code for ease of site organization and installation.
- B. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.
- C. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

1.7 WARRANTY

- A. General: Refer to [Section 01 77 00 - Closeout Procedures] [Section 01770 - Closeout Procedures].
- B. The manufacturer shall warrant products against defects in material and workmanship for [12 months from the date of commissioning or 18 months from the date of shipment – whichever comes first.][24 months from the date of commissioning or 36 months from the date of shipment, whichever comes first, provided that the manufacturer performs functional testing, commissioning and first parameter adjusting of equipment.] During the warranty period the manufacturer shall repair or replace defective products. This warranty shall be in addition to any provided by the Contractor. The warranty shall exclude normal wear and tear under normal usage and any damage caused by abuse, modification, or improper maintenance by entities other than the manufacturer or its approved representative.
- C. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.8 SPECIAL TOOLS AND SPARE PARTS [- NOT USED]

- A. The Contractor shall provide a recommended spare parts list with the following information provided as a minimum:
 - 1. Contact information for the closest parts stocking location to the Owner.
 - 2. Critical spare parts shall be identified as those parts being associated with long lead times and/or those being critical to the unit's operation.

3. Maintenance spares shall be identified as being those parts required to regularly perform scheduled maintenance on the furnished equipment. These spares shall include, but shall not be limited to, consumable spares that are required to be exchanged during scheduled maintenance periods.
- B. Any manufacturer specific special tool, not normally found in an electrician's toolbox, required to remove and install recommended or furnished spare parts shall be furnished.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Basis-of-Design Product: Subject to compliance with requirements provide Square D Power-Zone Metal-Enclosed Busway by Schneider Electric.**
- B. Acceptable Products: Metal-Enclosed Busway specified herein shall be the product of a single manufacturer. Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance. Products shall be modified as necessary by the manufacturer for compliance with requirements. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date:
1. Square D Power-Zone Metal-Enclosed Busway by Schneider Electric
 2. [2nd manufacturer and model]
 3. [3rd manufacturer and model]

2.2 GENERAL REQUIREMENTS

- A. Manufacturer shall supply metal-enclosed, non-ventilated, rigidly constructed busway rated for [indoor][outdoor][indoor and outdoor] service. All required transitions and hardware for termination to line and load equipment will be provided by the manufacturer.
- B. Low Impedance Sandwich type, Epoxy Encapsulated or Cable constructed busway assemblies are not acceptable.
- C. Each busway assembly shall be tested in accordance with the standard production tests in IEEE C37.23. Insulating material for supporting, covering busses and connections shall be tested in accordance with IEEE C37.23.

2.3 RATINGS

- A. The ratings of the busway shall be:
1. Voltage Class: [635 - 1500 V][4.76 kV][15 kV][27 kV][38 kV]
 2. The system grounding shall be [solidly grounded][resistance grounded][ungrounded].
 3. Continuous Current Rating: [1200][1600][2000][2500][3000][3200][4000][5000][6000] Amperes
 4. Rated Momentary Withstand Current, kA rms asymmetrical, 10 cycles:
 - a. [635 - 1500 V]: [56][86][113][133] kA rms asym.
 - b. [4.76 & 15 kV]: [49][62][78][98] kA rms asym.
 - c. [27 & 38 kV]: [25][39][49][62] kA rms asym.
 5. Rated Short Time Withstand Current, kA rms symmetrical:
 - a. [635 - 1500 V]: [42][65][85][100] kA rms sym.
 - b. [4.76 & 15 kV]: [31.5][40][50][63] kA rms asym.
 - c. [27 & 38 kV]: [16][25][31.5][40] kA rms asym.

6. Basic Insulation Level (BIL):
 - a. [4.76 kV]: [60 kV BIL]
 - b. [15 kV]: [95 kV BIL]
 - c. [25 kV]: [125 kV BIL]
 - d. [38 kV]: [150 kV BIL]

- B. The maximum hot-spot temperature rise at any point in the bus, at continuous rated load, shall not exceed 65° C above an ambient temperature of 40° C.

2.4 CONDUCTORS

- A. Conductors shall be in accordance with the American Society for Testing and Materials (ASTM) [6101-T6 Aluminum (57% IACS) ASTM Designation B236] or [ETP 110 Copper (98% IACS) ASTM Designation B187].
- B. Conductors shall be of sufficient cross section so as not to exceed specified temperature limits when operated at the rated continuous current.
- C. All bus joints shall be made utilizing a NEMA hole pattern, with bolts going through the bus conductors and shall be uniformly tightened per the manufacturer's torque recommendations.
- D. Bus joint design shall allow for the removal of individual bus sections without disassembly of adjacent bus sections. Overlap or welded type bus joints are unacceptable.
- E. Contact surfaces shall be [silver plated][tin plated].
- F. High strength Grade-5 plated steel hardware including lock washers and flat washers shall be furnished. Bus joints shall have sufficient total cross-sectional area of the splice plates that equal or exceed the main conductor cross-sectional area.
- G. Adjustable bus joints shall be provided to compensate for normal installation tolerances.

2.5 INSULATION

- A. Busway systems above 1500V shall have insulated conductors. Busway systems below 1500V shall have [un-insulated][insulated] conductors.
- B. Conductors shall be insulated using an epoxy process having a continuous rating of 130°C minimum. Applied insulation shall have a thickness to meet the specified full voltage rating. Sleeve type, heat shrink or tape insulating systems are not acceptable.
- C. Shipping split joints and equipment connections shall be insulated with PVC non-tracking and flame retardant removable boots.
- D. For equipment connections in which removable bus boots are not commercially available, bus connections shall be insulated as per the voltage class utilizing putty and tape, as per the Manufacturers instruction manual.

2.6 CONDUCTOR SUPPORTS

- A. Insulators shall be track-resistant, flame-retardant and non-hygroscopic, having adequate mechanical strength to withstand forces imposed by the specified short circuit rating.
- B. [600-Volt systems shall be supported with GPO-3 fiberglass supports.]5 & 15kV systems shall be furnished with GPO-3 fiberglass, high alumina polyester insulator system molded from UL listed materials or a combination of GPO-3 Fiberglass, High alumina polyester with a porcelain insert. A

corona resistant material shall be used between the bus insulation and bus supports on equipment rated above 5kV. 5 & 15kV porcelain supports shall be provided with a complex alumina coating fusion bonded to the surface. 38kV bus supports shall be wet process porcelain or epoxy.

- C. Conductor supports shall be designed and mounted in a manner so that there will be no hardware accessible, exposed or penetrating through exterior of enclosure.

2.7 ENCLOSURES

- A. Enclosures shall be constructed of high conductivity aluminum and shall be capable of resisting corrosive attack under normal environmental conditions. Enclosures shall be designed and constructed so that no direct water or contaminant path exists into the enclosure.
- B. Surfaces shall be finished utilizing an automated Electro-Static Powder Coat Finish. Enclosure finish shall be rated for 1000-hour salt spray testing. Protective plating shall be required between any mechanical assemblies consisting of unpainted dissimilar metals.
- C. Top and bottom covers shall be removable for field access to all bus joints, bus supports and heater elements.
- D. Standard enclosure hardware shall be #400 Stainless Steel. Enclosure hardware shall be of the single wrench type for ease of field assembly.
- E. Copper ground conductors shall be provided. Ground bus shall be bonded to each metal enclosure to provide a continuous electrical ground.
- F. Copper ground pads shall be furnished at equipment connections for attachment to the station grounding system. Ground pads shall be supplied with a NEMA 2-hole pattern to facilitate the attachment of grounding lug.
- G. Enclosure shipping sections shall be designed and constructed in a manner so that there will be no enclosure joint hardware accessible, exposed or penetrating through the exterior side sheets or covers of the enclosure. Field drilling of enclosure for assembly shall be prohibited.
- H. All outdoor enclosures shall be provided with lipped covers, gasketed with EPDM/Neoprene blend gasketing. Gaskets shall be concealed to prevent deterioration, and positioned to prevent assembly hardware from violating the gasket.
- I. Breather drains shall be required along bottom covers and at all low points of the installation.
- J. Enclosures shall be shipped in the longest practical shipping lengths (19-foot maximum) (5.8 meters maximum) to minimize field assembly.

2.8 EQUIPMENT INTERFACE

- A. The Contractor shall be responsible for the design and co-ordination of connections to the associated equipment. Contractor shall coordinate the necessary interfacing details from the equipment for termination design by the busway manufacturer. Contractor shall provide busway manufacturer with applicable switchgear and transformer drawings for matching and coordination requirements prior to fabrication.
- B. All necessary adapter bars and spacers, bolting hardware and insulating materials, for connections to transformer or switchgear terminals, shall be provided.
- C. Equipment connections shall include bolting hardware, bus adapters, insulating materials and assembly drawings.

- D. Braided flexible connectors shall be furnished for connection of the bus bars to all bushing assemblies.

2.9 WALL AND FLOOR PENETRATIONS

- A. A flame-retardant, vapor-resistant, non-hygroscopic, non-conductive and weather/dust-tight barrier shall be provided where the bus duct penetrates interior and exterior walls and floors.
- B. Fire rated barriers shall be provided at wall and or floor penetrations. Fire rated barriers shall have a flame rating in accordance with UL 1479.
- C. Wall and floor penetrations shall have a gasketed, flanged frame between the outside of the busway enclosure and the wall or floor penetration. Frames shall be provided for both the interior and exterior sides of the wall and floor penetration.
- D. Fire resistant materials necessary to fill the void between the wall and floor penetrations surrounding the busway assembly shall be provided by the installation contractor.

2.10 SPACE HEATERS

- A. Thermostatically Controlled Space Heaters shall be provided for all outdoor busway assemblies. Heaters for indoor bus duct shall be supplied.
- B. Space heaters shall be rated for 240 volts and operated at 120 volts. Space heater capacity shall be as required to maintain the busway internal temperature above the dew point.
- C. Heaters shall be accessible and removable from the outside of the enclosure. Heater systems shall only be maintained during periods when the busway is de-energized.
- D. Space heater circuits shall be factory wired. Connection point for the 120-volt supply shall be located on the switchgear end of the busway. A connection junction box shall be provided.
- E. Heater Circuits for Hazardous/classified areas shall be defined by Class, Division, Group and T-rating.
- F. Heater Circuit Monitors or Heater Indicators shall be provided. Heater monitor shall be able to alert on loss of heater element. Heater indicator shall give indication on loss of individual heater element.

2.11 EXPANSION JOINTS

- A. Expansion joints shall be provided. The location and quantity of expansion joints shall be determined by the bus manufacturer to compensate for the effects of bus thermal expansion due to continuous current. Expansion joints shall be considered on continuous straight runs of over 80 feet for copper conductors, and 60 feet for aluminum conductor bus runs.
- B. Expansion joints shall also be able to be used to protect the busway for seismic application. These joints shall be located near the connected equipment, and allow for movement of the connected equipment during a seismic event independent of the bus run.

2.12 STRUCTURAL

- A. Structural supports and hangers shall be provided. Outdoor structural supports shall be galvanized steel, of shape and design of the manufacturer. Indoor Trapeze hangers shall be of [painted steel][galvanized] finish.
- B. Manufacturer to indicate recommended locations and type of support, if supports are to be supplied by installation contractor vs the busway manufacturer.

2.13 RATING NAMEPLATES

- A. The complete busway assembly shall have permanent nameplates, one at each end.
- B. Information on the nameplate shall include the following as a minimum:
 - 1. Manufacturer's name, date of manufacture
 - 2. Manufacturer's order number
 - 3. Maximum voltage
 - 4. Rated continuous current
 - 5. System: Phase, Wire, Neutral Rating
 - 6. Frequency
 - 7. Rated power frequency withstand voltage
 - 8. Basic insulation level (BIL) if applicable
 - 9. Rated short-time withstand current (symmetrical)
 - 10. Rated short-circuit withstand current (asymmetrical)
 - 11. Temperature rise of busses and enclosure.

PART 3 - EXECUTION

3.1 GENERAL

- A. In addition to the requirements specified herein, execution shall be in accordance with the requirements of specifications Section [26 00 10][16010], Section [26 08 00][16080] and Drawings.
- B. Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.
- C. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
- D. **Pre-Installation Conference:** Prior to commencing the installation, an onsite pre-installation conference shall review the material selections, installation procedures, and coordination with other trades. Attendees shall include, but shall not be limited to, the Contractor, the Installer, manufacturer's representatives, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Engineer
- A. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.
- B. Install equipment in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.
- C. Provide final protection and maintain conditions in a manner acceptable to the manufacturer that shall help ensure that the equipment is without damage at time of Substantial Completion.

3.2 FACTORY ACCEPTANCE TESTING [- NOT USED]

3.3 FIELD QUALITY CONTROL [- NOT USED]

- A. Functional testing, commissioning, and first parameter adjusting shall be carried out by a factory-trained manufacturer's field service representative. This manufacturer's field service technician shall provide all

material, equipment, labor and technical supervision to perform inspection, testing and adjustments to ensure equipment is installed, adjusted, and tested in accordance with the manufacturer's recommendations and is ready for operation. The manufacturer's field service technician shall replace damaged or malfunctioning equipment and report to the Engineer any discrepancies or issues with the installation.

- B. The manufacturer's representative shall, upon satisfactory completion of inspection and testing, attach a label to all serviced devices indicating the date serviced and testing company responsible.

3.4 FIELD TESTING AND COMMISSIONING [- NOT USED]

A. Operational Readiness Testing

1. The Contractor shall inspect and test furnished equipment and associated systems for conformance to the contract documents, including equipment manufacturer's recommendations, and readiness for operation. The test shall include the following as a minimum:
 - a. Visually inspect for physical damage and proper installation
 - b. Perform tests in accordance with manufacturer's instructions
 - c. Perform tests to ensure compliance with Contract Documents
 - d. Perform tests that equipment is ready for operation
 - e. Touch-up paint all chips and scratches with manufacturer-supplied paint and transfer remaining paint to Owner
2. Contractor shall submit an operational readiness test report documenting all test results, including all assumptions, conditions, allowances and corrections made during the test. The test report shall include a signed statement from the Contractor, installer(s) and the factory-trained manufacturer's representative(s) certifying that the furnished equipment and associated system have been installed, configured, and tested in accordance with the manufacturer's recommendations, completely conforms to the requirements of the Contract Documents and is ready for operation.

3.5 TRAINING [- NOT USED]

- A. O&M Training: Onsite training specific to the equipment furnished shall be provided to the Owner's staff by a factory trained manufacturer's representative. Training duration shall be sufficiently adequate to cover the operation and maintenance of the equipment and shall consist of not less than [1][2 repeated] session(s) with [1] hours of onsite classroom and hands-on instruction for a minimum of [4] attendees per session.

1. The instructor shall provide sufficient time and detail in each session to cover the following as a minimum:
 - a. Theory of operation
 - b. Major components of equipment
 - c. Operation of equipment
 - d. Configurations of equipment
 - e. Maintenance, troubleshooting and repair
 - f. Replacement of component level parts
2. [The submitted O&M manuals shall be used for training.][Manuals and documentation shall be provided to each participant for training.]

END OF SECTION [26 15 13][16340]

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