GUIDE FORM SPECIFICATION

CCR-II (Outdoor Busway)

1. SUMMARY

1.1 This specification covers the electrical characteristics and general requirements for busways for use in electrical systems rated 1,000 V and below. The busway system allows users to distribute electrical energy safer and more efficiently within a smaller footprint.

Where designated, low-impedance busway systems of the indicated ratings shall be offered with all necessary fittings, power takeoffs, hanging devices and accessories.

1.2 Specification includes:

1.2.1 Three-phase busway system with the following features:

Section 4.1 – Housing

Section 4.2 – Conductor

Section 4.3 – Insulation

Section 4.4 – Joint Structure

Section 4.5 – Accessories & Components

2. STANDARDS AND CERTIFICATIONS

2.1 The busway shall be designed and manufactured to the following standards:

2.1.1 Electrical Testing Laboratories (ETL) (US/Canada) Classified to UL 857. Each busway rating has been tested individually and complies for all type tests and certified by an independent authorized UL testing laboratory.

2.1.2 Compliant – CUL Listing.

2.1.3 Compliant – National Electric Code (NEC) Article 364 – Busways 19.

2.1.4 Compliant – NEMA AB1, Molded Case Circuit Breakers and Molded Case Switches.

2.1.5 NFPA 70 – National Fire Protection Agency.

2.1.6 EAE has ISO 9001, ISO 14001, OSHAH 18001, ISO 27001 and ISO 17025 certifications.

2.1.7 All the required type tests for each rating shall be available according to IEC 61439-6 and certified with a 3rd party.

2.1.8 Compliant – IEC 60364-1 Low-voltage electrical installations.

2.1.9 The busway shall have high flame resistance and circuit integrity properties under fire conditions according to IEC 60331, BS 8602, BS 8491 standards including joints.

2.1.10 Seismic Resistance as per IEC 60068-3-3 / 60068-2-57 and IEEE 693.

2.1.11 ATEX as per EN 60079-0:2009, EN 60079-18:2009, EN60079-31:2009.

3. SYSTEM DESCRIPTION

3.1 Electrical Requirements

3.1.1 System voltage: Up to 1,000V

3.1.2 Operating frequency: 50/60 Hz

3.1.3 Ampacity and 1 second RMS Symmetrical Short Circuit Rating shall be:

Aluminum conductors	*Copper conductors*
600A: 25kA	650-850A: 35kA
800-1250A: 35kA	1000A: 50kA
1600: 60kA	1250-1600-200A: 80kA
2000A: 80kA	
2500A+: 100kA	2500-3200A: 100kA
	3400A and above: 120kA

3.1.4 Conductor: 3-conductor (L1/L2/L3/PE housing)
4-conductor (L1/L2/L3/N1/PE housing)
4½-conductors (L1/L2/L3/N1/CPE ½/PE housing)
5-conductors (L1/L2/L3/N1/PE/PE housing)

3.1.5 The position shall be 100% rated for any horizontal or vertical orientation.

3.1.6 The maximum hot-spot temperature rise at any point in the busway at continuous rated load shall not exceed 131°F (55°C).

3.1.7 The Voltage drop of the busway shall follow the table below for the designated voltage and conductor type:

Amperage Rating (A)	Al Busway (V)	Amperage Rating (A)	Copper Busway (V)
400	6.39	**630**	6.03
550	6.22	**800**	6.23
630	5.13		
800	5.27		
1000	5.57	**1000**	5.18
1300	5.23	**1250**	4.95
1600	5.10	**1600**	4.68
2000	5.00	**2000**	5.32
2500	5.15	**2500**	4.86
3000	4.97		
3200	4.53	**3200**	4.93
3600	4.64	**3600**	4.41
4000	4.14	**4000**	4.60
4500	4.89		
		5000	4.54
		6000	4.75

Note: Voltage drop calculated with power factor = 0.8, Frequency = 60Hz
Note: Voltage drop is per 100 ft. (3048 cm.)
Note: Resistance value at an ambient air temperature of 35°C for the phase conductor and reactance of the phase conductor (independent of temperature)

Table 1: Voltage Drop by Amperage, Aluminum and Copper Busway

4. COMPONENTS

4.1 **Housing** – The busway system shall have a "Sandwich-Compact" structure, providing superior voltage drop characteristics. The conductors shall be packed and placed into the housing in such a way to not allow any air gaps.

4.1.1 The busway shall have a minimum Ingress Protection (IP) of 68, offering extensive protection from dirt, dust, oil, and other non-corrosive materials. The busway shall offer complete protection from contact with enclosed equipment. The protection shall include being completely dust tight and significant protection against water exposure.

4.1.2 The housing shall be RAL7035-Electrostatic painted extruded aluminum to provide maximum protection against corrosion from water and other contaminants normally encountered during construction.

4.1.3 The busway housing shall be 100% aluminum construction to reduce hysteresis and eddy current losses.

4.1.4 Busway housing shall have optional powder coating finish, if designated by the end user.

4.1.5 The sandwich-compact structure shall extend to the plug-in busway as well, eliminating air gaps between conductors at the plug-in points.

4.1.6 The housing material and paint shall be designed in such a way to ensure non-propagating properties, in the occurrence of an electrical event.

4.1.7 When installed flatwise or edgewise, 19.69 inches (500 millimeters) of clearance shall be allowed vertically and 7.87 inches (200 millimeters) horizontally. The distance between two parallel busways shall be 7.87 inches (200 millimeters), both vertically and horizontally.

4.1.8 The standard wall crossing for a busway joint shall be 13.78 inches (350 mm), from the edge of the wall to the center point of the Joint Pack.

4.1.9 A minimum of 3.94 inches (100 millimeters) shall be allowed when a busway crosses under a beam in the flatwise position.

4.1.10 A minimum of 3.94 inches (100 millimeters) shall be allowed when a busway crosses under a beam in the edgewise position.

4.1.11 In a gallery, with either an edgewise or flatwise application, a distance of 7.87 inches (200 millimeters) shall be maintained, both vertically and horizontally.

4.2 **Conductors**

4.2.1 Aluminum or Copper conductors shall be epoxy coated. All phase and neutral conductors' joints and contact surfaces shall be Tin plated (Silver shall also be available, upon request).

4.2.2 In addition to epoxy coating, the busway shall have a double Mylar® (class B polyester film) sheath to provide additional protection/insulation and reduce friction between busbars.

4.2.3 Bus bars shall be suitably plated at all joints and contact surfaces.

4.2.4 3 Conductors shall have: (3 full-size conductors + housing).

4.2.5 4 Conductors shall have: (4 full-size conductors + housing).

4.2.6 4½ Conductors shall have: (4 full-size conductors + CPE (50% earth conductor + housing)).

4.2.7 5 Conductors shall have: (4 full-size conductors + PE (100% earth conductor + housing)).

4.2.8 The neutral conductors shall have the same cross-section and insulation properties as the phase conductors.

4.2.9 The conductors shall be ordered in copper (98% conductivity), Aluminum (58% conductivity).

4.2.10 The Aluminum conductors shall be EC grade aluminum. Minimum conductivity shall be 34 Ω·m/mm².

4.2.11 The Copper conductors shall be composed of 99.95% electrolytic copper at a minimum. The minimum conductivity shall be 56 Ω·m/mm².

4.2.12 The neutral bar shall be at the bottom for horizontal and to the left for vertical busway runs.

4.3 **Insulation**

4.3.1 A formulated Class B epoxy shall be applied as insulation to the busway providing high insulation and high peak temperature resistance.

4.3.2 The insulation process shall apply to the spray insulation process which produces uniform application of the epoxy powder over the entire conductor bar. An inline filter process and magnetic separator shall be used to eliminate contaminants common to fluidized bed systems.

4.3.3 Epoxy shall be UL V0 class, halogen and toxic free.

4.3.4 All insulators shall be recognized by UL.

4.3.5 Between the housing and the conductor, a cast resin insulation shall be used to achieve the IP 68 rating.

4.4 **Joint Structure**

4.4.1 The Joint Pack shall be designed in such a way that both the male and female Joint Packs come pre-installed on the busway sticks, reducing field installation time. The Joint Pack shall be a single assembly that does not require multiple fit ups. The Joint Pack shall be of a bolt design which is able to disassemble the conductors, insulators and other components.

4.4.2 A Belleville spring shall be used to ensure contact pressure at the joint.

4.4.3 All parts of the joint structure shall be plated with Tin (Silver shall also be available, upon request), protecting against contact losses due to corrosion, ensuring safe/reliable earth connections and very low resistance values throughout the entire busway run. The plating process shall not involve dipping

of the conductor, the plating shall be applied in a powder coat to ensure higher accuracy and consistency of the plated material.

4.4.4 It shall be possible to make up a joint from one side in the event the busway is installed against a wall or ceiling. The joint shall be so designed as to allow removal of any length without disturbing adjacent lengths.

4.4.5 The fastening mechanism for the Joint Pack shall be designed to have over torque protection. When the torque is exceeded, a failsafe shall be deployed halting further torquing.

4.4.6 The Joint Pack shall be IP 68 rated. A two-part resin (mixed equal parts, solution A and solution B) shall be mixed and poured into the Joint Pack after proper installation and Megger testing. After the resin is allowed to cure completely, confirm by Megger testing prior to proceeding.

4.5 **Accessories & Components**

4.5.1 All system components including Tees, Flanges, Reducers, Expansion Joints, Elbows, etc. shall be of the same material from the same manufacturer.

4.5.2 End pieces and end caps shall be provided to install at the ends of each line.

4.5.3 The busway system shall offer all necessary accessories. Special or custom accessories shall be available upon request to meet design parameters. Special busway (non-standard length) shall have a minimum length of 17.72 inches (450 millimeters) and a maximum length of 9.84 feet (3 meters).

4.5.4 Horizontal expansion units shall be used every 131.23 feet (40 meters) and at the building expansions. Horizontal expansion joints shall be utilized if a busway line is crossing adjacently through a building joint expansion. The horizontal expansion joint shall have a sufficient minimum movement span of 2 inches (50 millimeters). The total length of the module shall not exceed 59.05 inches (1,500 millimeters).

4.5.5 Vertical expansion units shall be used on every floor. The busway system shall be rigidly fixed by supports on every floor.

4.5.6 Horizontal runs of busway shall be UL Listed for hanging on 10 feet (3.05 meters) centers in any position. The vertical riser runs of the busway shall be supported with rigid hangers in positions indicated on plans (maximum 16 feet (4.88 meters)) centers.

4.5.7 The minimum dimension between 2 risers shall be 7.87 in (200 mm).