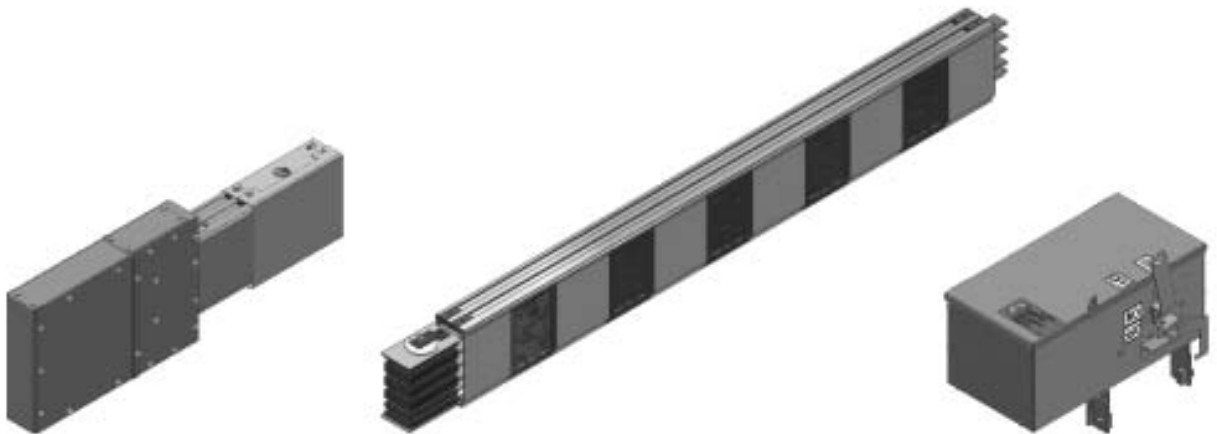


# Low voltage busway

## Pow-R-Flex low ampere busway



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Powering Business Worldwide

## General information

Eaton's Pow-R-Flex low-ampere busway is the latest design in a family of innovative busway products and is the newest in the industry. The Pow-R-Flex low-ampere busway is an excellent solution for distributing power throughout facilities, providing the flexibility to easily use the electrical system power where and when it is needed. The Pow-R-Flex low-ampere busway is practical for manufacturing and assembly facilities, machine shops, school and private laboratories, warehouse facilities, and data centers, and will reduce installation time and costs.

## General description

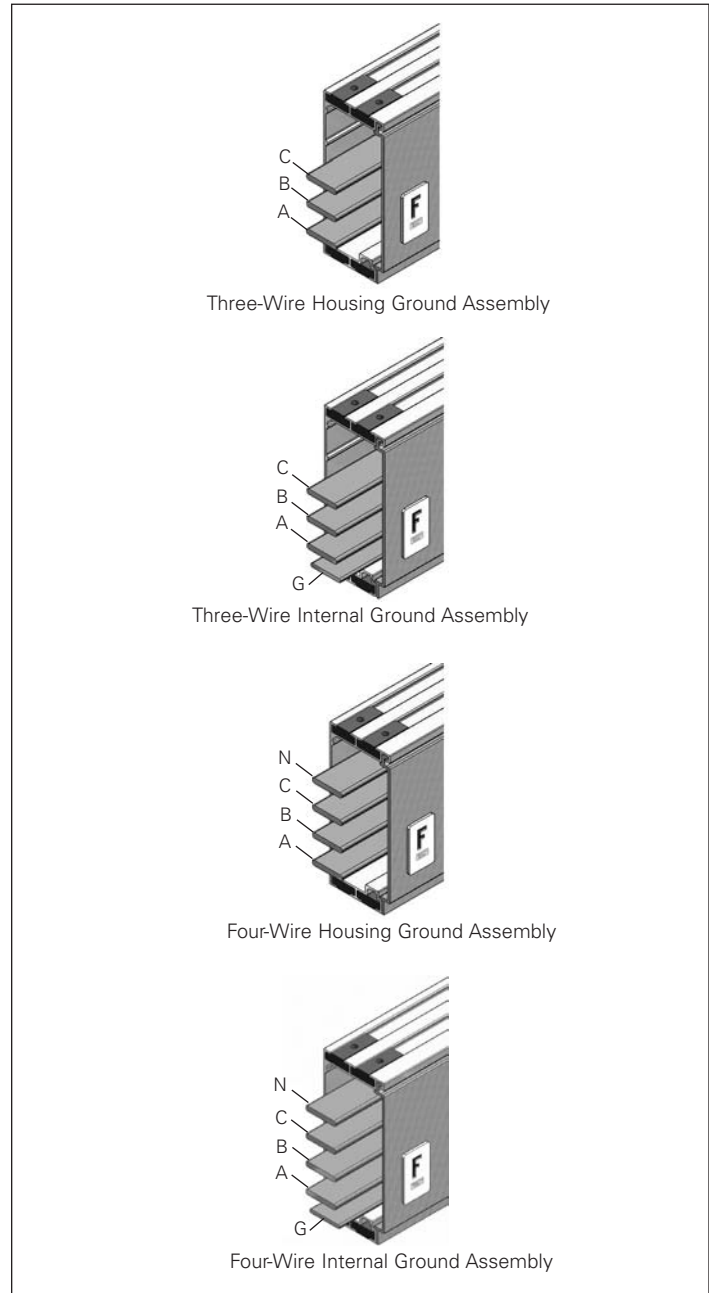
The Pow-R-Flex low-ampere busway is a maximum 600V design that uses the latest in extrusion construction, providing appealing aesthetics without compromising heavy-duty performance.

The design consists of an extruded, all-aluminum housing with silver-plated copper or aluminum conductors. Copper conductors offer ratings from 225–600A, and aluminum conductors offer ratings from 150–400A. The Pow-R-Flex low-ampere busway comes in feeder type and plug-in type with a full line of complementary fittings and accessories. Feeder and plug-in busways can be used interchangeably without adapters or special splice plates. Each section is joined using a Pow-R-Bridge joint-compression fitting. The Pow-R-Flex low-ampere busway comes in two color options: ANSI 61 gray or black.

## Standards

The Pow-R-Flex low-ampere busway meets the requirements of NEMA, ANSI, UL® 857, and CSA®-C22.2 and is manufactured in an ISO® 9001-certified facility. The feeder, plug-in, fittings, and accessories are designed to withstand the short-circuit ratings listed for each ampere rating.

The Pow-R-Flex low-ampere busway is a three-phase design available in three-wire and four-wire configurations with integral housing, internal, and isolated internal ground options. Oversized neutral ratings are available on select current ratings. See **Table 5**.



**Figure 1. Conductor Configurations**

**Note:** Single-phase configurations are also available. Contact your local Eaton sales representative for additional information.

## Conductor details

Pow-R-Flex bus bars are fabricated from high-strength 100% to over 200% neutral capacity on select current ratings. The phase and neutral conductors are silver-plated along the entire length of the bus bars. Aluminum bars are silver-plated by the Alstan 88C process, and copper bars are silver-plated through a flashing process. The ground bar for the internal ground option is not plated.

The internal conductors are separated from one another using an air insulation gap between phases, ground, and housing. The conductors are supported and braced with a durable, high-strength polycarbonate support block that has a Class B 130°C insulation rating. The support blocks provide superior fault current bracing.

For a Pow-R-Flex type plug-in busway, there are no special provisions for plug-in unit connections. Each plug-in unit clamps directly onto each phase and neutral conductor. A support block is used at each plug-in provision, providing additional bracing and support around the plug-in unit provision. This provides a more robust, reliable, and safe plug-in unit connection.

The neutral conductor is made from the same material as the phase conductors and is the same physical size, providing 100% to 200% neutral capacity on select current ratings. See **Table 5** for neutral capacity by ampere rating.

## Ground options

**Integral ground**—uses the extruded aluminum housing as the ground/earth path. It has been designed, manufactured, and UL listed as a 50% integral ground/earth path and is fully fault rated. The system ground continuity is maintained through each joint by the aluminum joint covers. The joint covers are furnished with ground/earth path contact surfaces on the inside of each cover. When installed, the contact surfaces are bolted directly to the busway ground/earth path. A highly visible label is furnished on each joint cover to alert the installer that the covers must be properly installed to maintain the ground/earth path. The result is a 50% ground/earth path with very low resistance characteristics.

**Internal ground**—uses a copper ground/earth conductor that is internal to the busway and is UL listed as a 50% ground/earth path. The internal ground/earth continuity is maintained through the Pow-R-Bridge joint in the same fashion as each phase conductor.

**Isolated internal ground**—uses the 50% internal ground/earth conductor; however, it has been isolated from the busway housing throughout the busway system and is UL listed as a 50% isolated ground/earth path.

## Housing details

The Pow-R-Flex low-ampere busway is constructed with a heavy-duty “U”-shaped aluminum extruded base housing. The front covers are also made from extruded aluminum. The “U”-shaped base and front cover incorporate a unique patent-pending hinge design to lock in the front covers on the top side. The bottom sides are fastened in place. This maintains short-circuit strength, provides clean lines, and adds to the aesthetic look and feel of the product.

The non-magnetic, all-aluminum housing provides for excellent heat dissipation and a significant reduction in reactance and magnetic flux leakage, as compared to steel, or steel and aluminum combination housings. The integrity and strength of the housing ensures specifiers and users of a safe and durable installation over a broad spectrum of applications.

A protective finish is applied by an electrostatic process. There are two color options: ANSI 61 gray or black.

## Pow-R-Bridge

Pow-R-Flex joint connections are made with the Pow-R-Bridge joint package, which is installed on each section of busway prior to shipment. A double-headed, torque-indicating bolt is provided to ensure that the proper installation torque is achieved. Fall-away instruction tags are furnished on the torque-indicating bolt heads to allow for visual inspection from a distance. When the proper torque value is achieved, the top bolt head will shear off and allow the tag to fall to the floor. Any joint that is improperly torqued will retain the highly visible (caution yellow) tag at the bolt head.

The Pow-R-Bridge can provide an adjustment of +/- 0.50-inch (12.7 mm) at each joint. Overadjustment is prevented by the joint covers, which will only allow a 0.50-inch (12.0 mm) adjustment to be made. The nonrotating design of the Pow-R-Bridge maintains its configuration integrity when it has been removed from a section of busway. The conductors, insulator plates, and insulators will not displace or swivel, making reinstallation of the Pow-R-Bridge quick and easy.

## Pow-R-Flex feeder busway

- 150–400A aluminum
- 225–600A copper

Straight sections of feeder busway can be supplied in any length, at 0.50-inch (12.7 mm) increments, from 24.00 inches (609.6 mm) minimum to 120.00 inches (3048.0 mm) maximum. Each feeder section will include one factory-installed Pow-R-Bridge on the left end of the busway when viewing the front of the busway. For added safety and reliability, there are no openings or access covers along the entire length of each feeder section.

## Pow-R-Flex plug-in busway

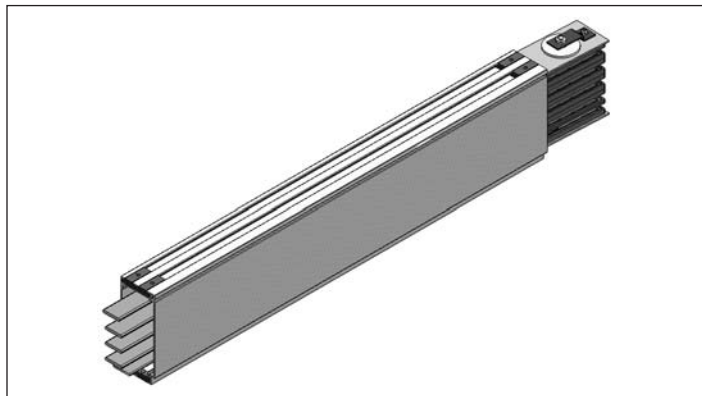
- 150–400A aluminum
- 225–600A copper

Straight sections of plug-in busway can be supplied in only 24.00-inch (609.6 mm) increments from 24.00 inches (609.6 mm) minimum, with a maximum of 120.00 inches (3048.0 mm).

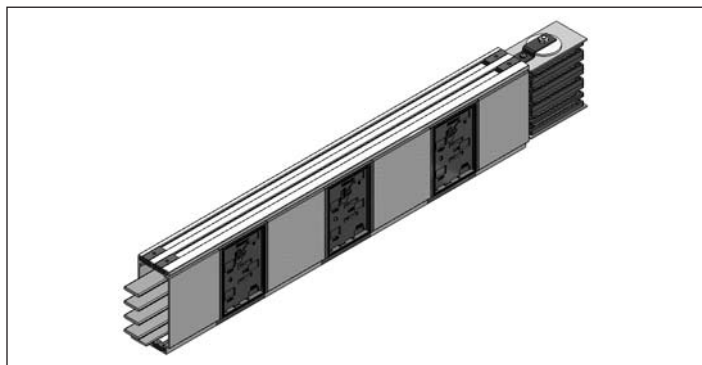
For a Pow-R-Flex type plug-in busway, a plug-in/tap-off provision cover is used. This cover hinges into the housing in the same manner as the extruded front covers and is made from the same durable, high-strength polycarbonate material as the support blocks, which are rated as Class B 130°C insulation. The plug-in provision cover incorporates a shutter design that prevents incidental contact with the conductors inside the busway. The shutter has a positive screw close feature that prohibits the shutter from being operated and opened without the use of a tool. Once the screw is removed, it is mechanically operated by the plug-in unit when a plug-in unit is being inserted onto the busway. This shutter design puts safety first and is IP2X finger safe. One plug-in/tap-off provision cover is provided every 12.00 inches (304.8 mm) along a plug-in busway section. Each feeder section will include one factory-installed Pow-R-Bridge on the left end of the busway when viewing the front of the busway.

**Table 1. Number of Plug-In Openings**

Duct Length Inches (mm)	Number of Plug-In Provisions
24.00 (609.6)	1
48.00 (1219.2)	3
72.00 (1828.8)	5
96.00 (2438.4)	7
120.00 (3048.0)	9



**Figure 2. Feeder Busway**



**Figure 3. Plug-In Busway**

**Electrical data**

**Table 2. Short-Circuit Ratings—Three-Cycle rms Symmetrical**

Ampere Rating	Plug-In Short-Circuit Rating	Feeder Short-Circuit Rating
Aluminum		
150	22,000	22,000
225	35,000	35,000
300	35,000	35,000
400	42,000	42,000
Copper		
225	22,000	22,000
400	35,000	35,000
500	42,000	42,000
600	42,000	42,000

**Table 3. Resistance, Reactance, and Impedance Milliohms per 100 Feet (30.5m) Line-to-Neutral, Plug-In, and Feeder Busway**

Ampere Rating	Resistance R	Reactance X	Impedance Z
Aluminum			
150	9.93	4.56	10.90
225	3.44	2.92	4.57
300	3.44	2.92	4.57
400	2.41	2.50	3.46
Copper			
225	5.30	4.24	6.87
400	1.85	2.96	3.53
500	1.32	2.51	2.75
600	1.32	2.51	2.75

**Table 4. Ground Resistance Values Milliohms per 100 Feet (30.5m)**

Ampere Rating	Integral R	Internal R
Aluminum		
150	0.55	2.86
225	0.55	2.86
300	0.55	2.86
400	0.55	2.86
Copper		
225	0.55	1.44
400	0.55	1.44
500	0.55	1.44
600	0.55	1.44

**Table 5. Oversized Neutral Ratings**

Ampere Rating	Neutral Size D x W Inches (mm)	Neutral Rating
Aluminum		
150	0.28 x 1.75 (7.1 x 44.5)	250%
225	0.28 x 1.75 (7.1 x 44.5)	150%
300	0.28 x 1.75 (7.1 x 44.5)	150%
400	0.28 x 1.75 (7.1 x 44.5)	100%
Copper		
225	0.28 x 1.75 (7.1 x 44.5)	250%
400	0.28 x 1.75 (7.1 x 44.5)	150%
500	0.28 x 1.75 (7.1 x 44.5)	100%
600	0.28 x 1.75 (7.1 x 44.5)	100%

**Table 6. Voltage Drop Volts per 100 Feet (30.5m) Line-to-Line, 60 Hz at Rated Current (Varying Power Factors)**

Ampere Rating	100%	90%	80%	70%	60%	50%
Aluminum						
150	2.58	2.84	2.77	2.65	2.50	2.32
225	1.34	1.70	1.76	1.75	1.71	1.66
300	1.79	2.27	2.34	2.33	2.29	2.21
400	1.67	2.26	2.37	2.41	2.39	2.33
Copper						
225	2.07	2.58	2.64	2.63	2.56	2.46
400	1.28	2.05	2.26	2.36	2.41	2.42
500	1.14	1.98	2.22	2.35	2.42	2.45
600	1.37	2.37	2.66	2.82	2.91	2.94

**Notes:**

- Values shown in **Table 6** are based upon concentrated loads. For plug-in distributed loads, divide the values by 2. See IEEE® 141-13-8.3.
- For line-to-neutral voltage drop, multiply the values from **Table 6** by 0.577.
- For other than rated current, multiply the values from **Table 6** by actual current/rated current.
- For total voltage drop, multiply voltage drop by actual length/100 ft (30.5m).

**Physical data**

**Table 7. Physical Dimensions—Width x Height in Inches (mm)**

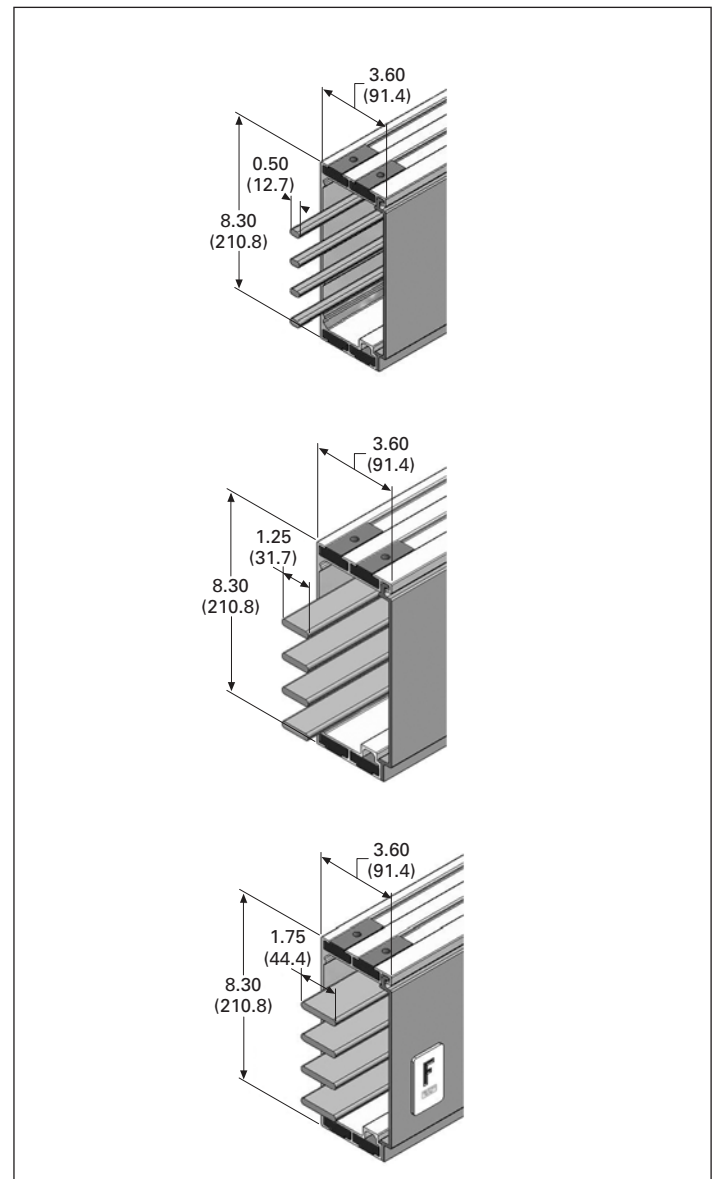
Ampere Rating	Phase Conductor	Ground Conductor	Housing Enclosure
Aluminum			
150	0.28 x 0.50 (7.1 x 12.7)	0.20 x 1.75 (5.1 x 44.5)	3.55 x 8.29 (90.2 x 210.6)
225	0.28 x 1.25 (7.1 x 31.8)	0.20 x 1.75 (5.1 x 44.5)	3.55 x 8.29 (90.2 x 210.6)
300	0.28 x 1.25 (7.1 x 31.8)	0.20 x 1.75 (5.1 x 44.5)	3.55 x 8.29 (90.2 x 210.6)
400	0.28 x 1.75 (7.1 x 44.5)	0.20 x 1.75 (5.1 x 44.5)	3.55 x 8.29 (90.2 x 210.6)
Copper			
225	0.28 x 0.50 (7.1 x 12.7)	0.20 x 1.75 (5.1 x 44.5)	3.55 x 8.29 (90.2 x 210.6)
400	0.28 x 1.25 (7.1 x 31.8)	0.20 x 1.75 (5.1 x 44.5)	3.55 x 8.29 (90.2 x 210.6)
500	0.28 x 1.75 (7.1 x 44.5)	0.20 x 1.75 (5.1 x 44.5)	3.55 x 8.29 (90.2 x 210.6)
600	0.28 x 1.75 (7.1 x 44.5)	0.20 x 1.75 (5.1 x 44.5)	3.55 x 8.29 (90.2 x 210.6)

**Table 8. Weight (lbs/ft)/Current Density (A/in^2)**

Ampere Rating	Current Density	Weight Three-Wire	Weight Four-Wire	Add for Ground	Add for Oversized Neutral
Aluminum					
150	1067	6.45	6.60	0.41	0.40
225	640	7.10	7.50	0.41	0.15
300	610	7.55	8.10	0.41	0.15
400	813	7.55	8.10	0.41	—
Copper					
225	1618	7.50	8.00	1.30	1.30
400	1151	9.80	11.05	1.30	0.82
500	1027	11.45	13.25	1.30	—
600	1233	11.45	13.25	1.30	—

**Table 9. Weight (kg/m)/Current Density (A/cm^2)**

Ampere Rating	Current Density	Weight Three-Wire	Weight Four-Wire	Add for Ground	Add for Oversized Neutral
Aluminum					
150	165	9.60	9.82	0.61	0.60
225	99	10.57	11.16	0.61	0.22
300	132	11.24	12.05	0.61	0.22
400	126	11.24	12.05	0.61	—
Copper					
225	251	11.16	11.91	1.93	1.93
400	178	14.58	16.44	1.93	0.82
500	159	17.04	19.72	1.93	—
600	191	17.04	19.72	1.93	—



**Figure 4. Conductor Dimensions**

**Fittings**

There are various fittings allowing the Pow-R-Flex low-ampere busway to meet every application need: flanges, elbows, offsets, tees, cable tap boxes, adapters, expansion joints, phase transpositions, and end closures.

These fittings, along with standard and minimum dimensions, are described on the following pages.

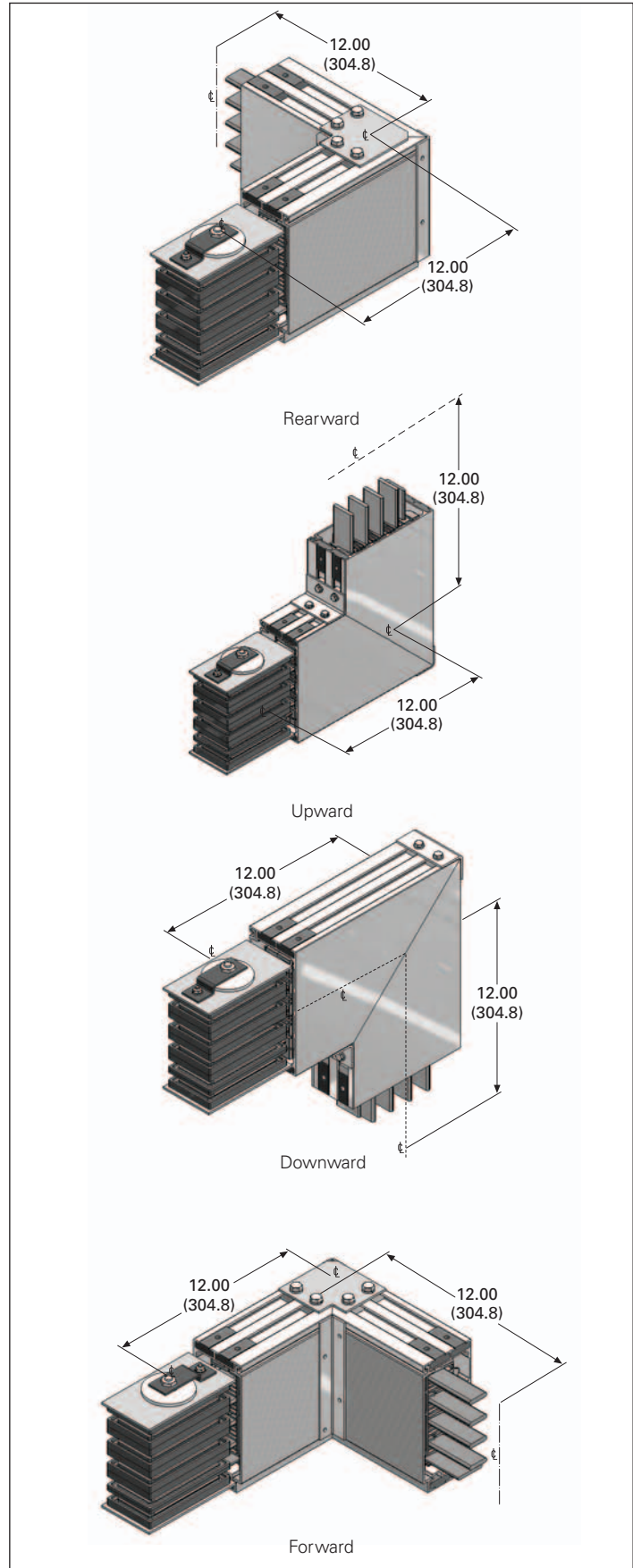
When making field measurements and layouts, it should be remembered that the dimensions are given from the centerline of the busway and the Pow-R-Bridge.

The relationship of fittings to straight lengths (forward, rearward, upward, and downward) is illustrated in **Figure 5**.

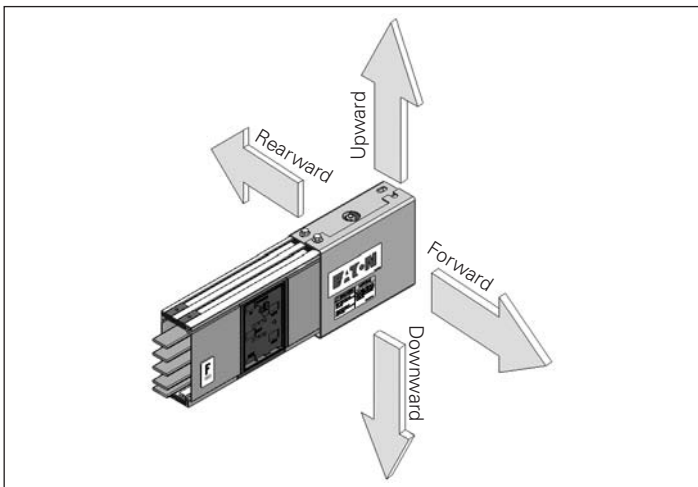
All straight lengths and fittings are marked with a "F" label. The "F" marks the front of the busway and will be noted on the construction or the as-built drawings provided by Eaton.

**Phasing**—the phasing is indicated by the location of the "F" label. When facing the front of the busway, the phasing is N-C-B-A-G top to bottom. See **Figure 6**.

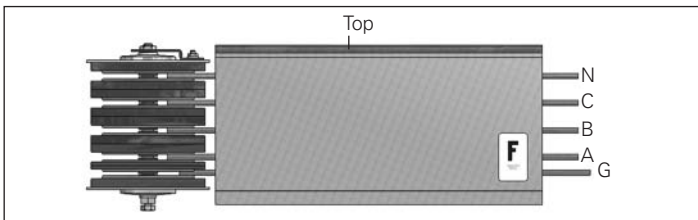
**When installing Pow-R-Flex low-ampere busway, the "F" labels on the front of the busway must be aligned. Failure to do so will result in an improper installation with the phase bars out of sequence.**



**Figure 7. Traditional Elbows**



**Figure 5. Busway Orientation**



**Figure 6. Busway Phase Sequence**

**Traditional elbows**

Elbows are used to make 90-degree changes in the direction of the busway layouts. There are four types of elbows available: forward, rearward, upward, and downward, allowing the busway layout to turn in any direction.

**Figure 7** shows the standard/minimum leg lengths for each type of elbow for all ratings and configurations. Nonstandard lengths are also available.

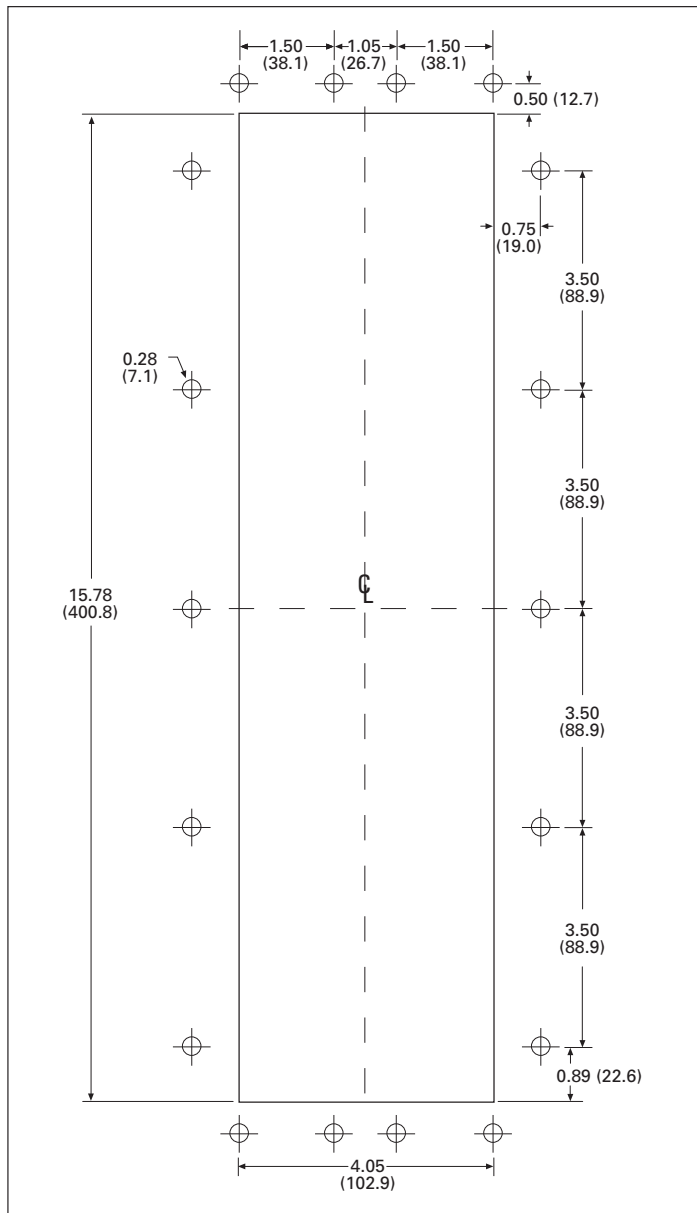
**All dimensions shown are to the centerline of the Pow-R-Bridge and centerline of the busway.**

**Standard flanges**

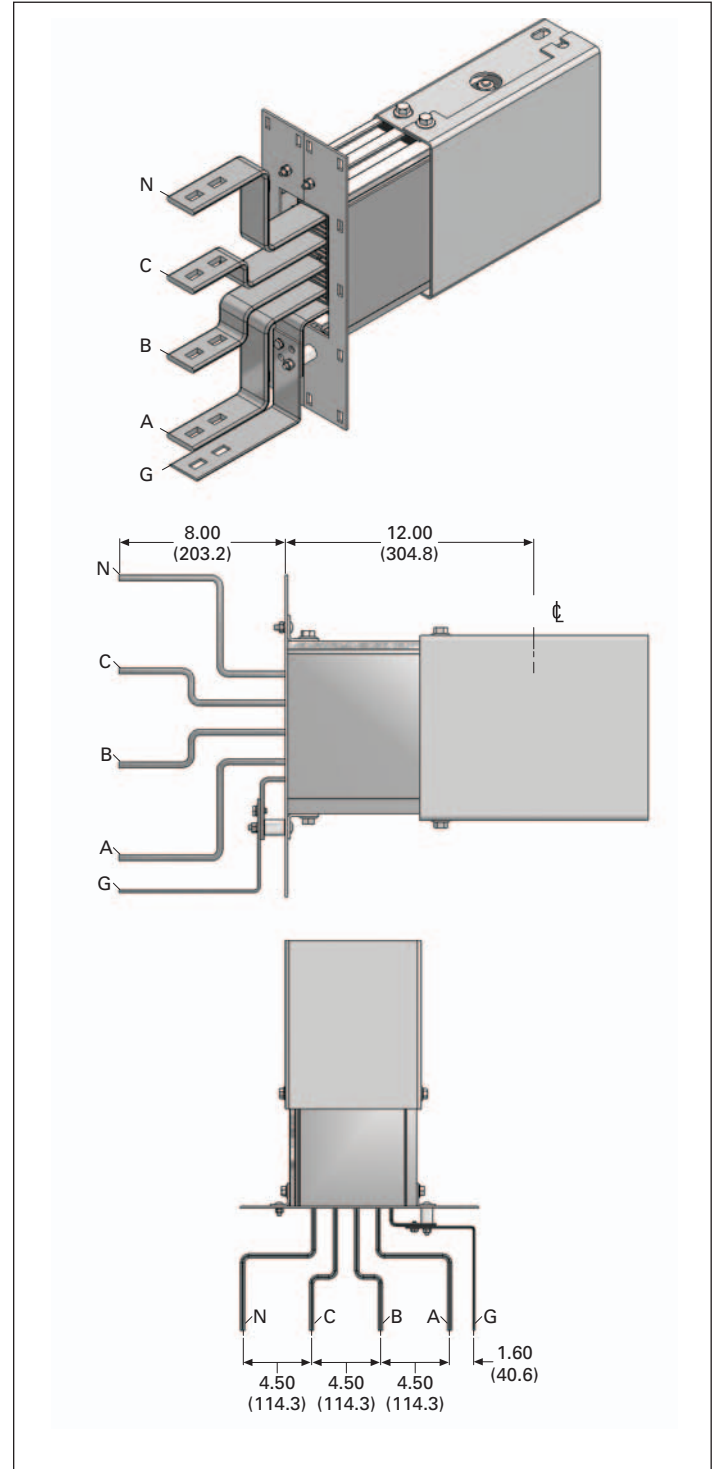
Flanges provide for a direct connection to low voltage switchgear, switchboards, panelboards, motor control centers, and other electrical equipment. Cutout dimensions and drilling plans are provided with the customer installation drawings, and it is the responsibility of the equipment manufacturer to provide the opening, flange drillings, connecting hardware, and bus risers in their electrical equipment. For proper coordination between the busway and other equipment, detailed drawings, including equipment orientation, must accompany the order prior to release and manufacture.

**Figure 9** shows the standard/minimum flange length and phase-to-phase dimensions for all ratings and configurations. Nonstandard lengths and phase-to-phase dimensions are also available.

**All dimensions shown are to the centerline of the Pow-R-Bridge measured from the top of the flange plate.**



**Figure 8. Flange Cutout Detail**



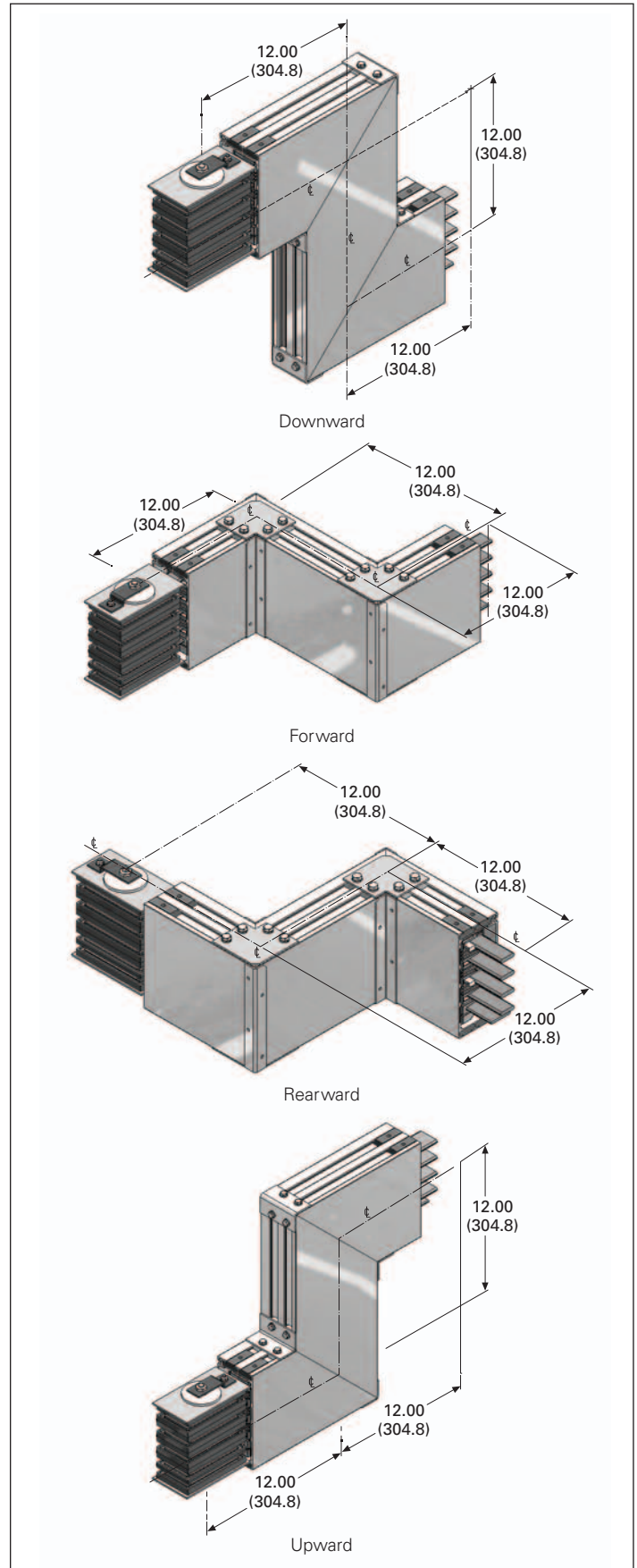
**Figure 9. Standard Flanges**

**Offsets**

An offset is used to allow the busway layout, avoid any obstacles, and to conform to the building's structure. It is two elbows fabricated into a single fitting for use where space restrictions prohibit the use of two traditional elbows. There are four types of offsets available: forward, rearward, upward, and downward, allowing the busway layout to offset in any direction.

**Figure 10** shows the standard/minimum leg lengths for each type of offset for all ratings and configurations. Nonstandard lengths are also available.

**All dimensions shown are to the centerline of the Pow-R-Bridge and centerline of the busway.**



**Figure 10. Offsets**



**Cable tap boxes**

There are two types of cable tap boxes: end and center. End cable tap boxes are used to feed power to a run of busway with cable and conduit or where loads served by busway are connected without the need of overcurrent protection. Center cable tap boxes are used to center feed a run of busway with cable and conduit or where loads served by the busway are connected without the need of overcurrent protection.

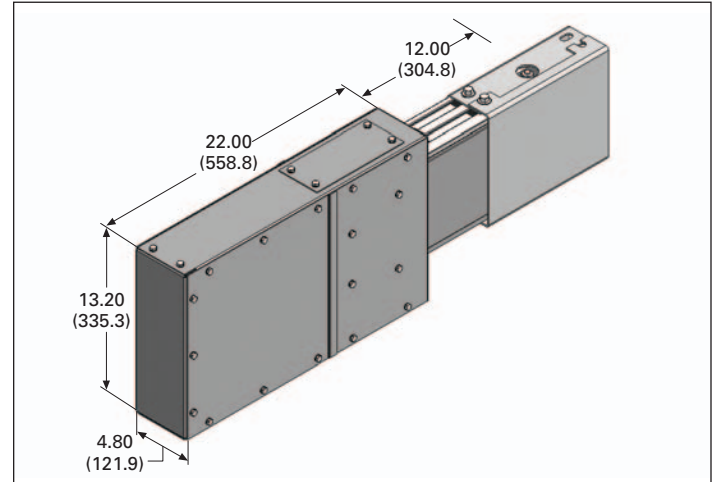
The front and back covers are removable, improving the ease of cable termination. Top and bottom access plates are removable, allowing easy access to the lugs with tools. See **Figure 12** and **Figure 13**. There are two mechanical lugs provided: per phase and one lug for the ground.

Terminal conductor range is as follows:

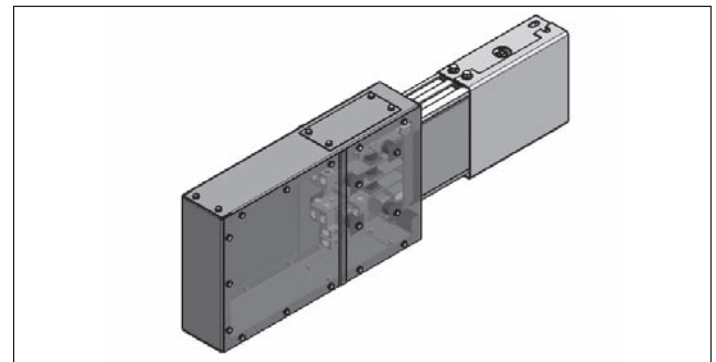
- Phase and neutral: (1) #4–350 kcmil
- Ground: (1) #8–1/0

**Figure 12** shows the standard/minimum stub lengths for each type of cable tap box for all ratings and configurations. Nonstandard lengths and enclosure sizes are also available.

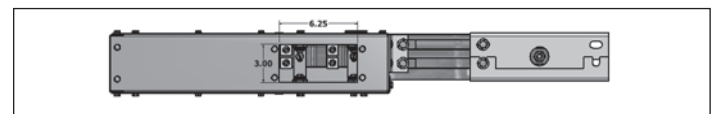
**All dimensions shown are to the centerline of the Pow-R-Bridge measured from the edge of the box enclosure.**



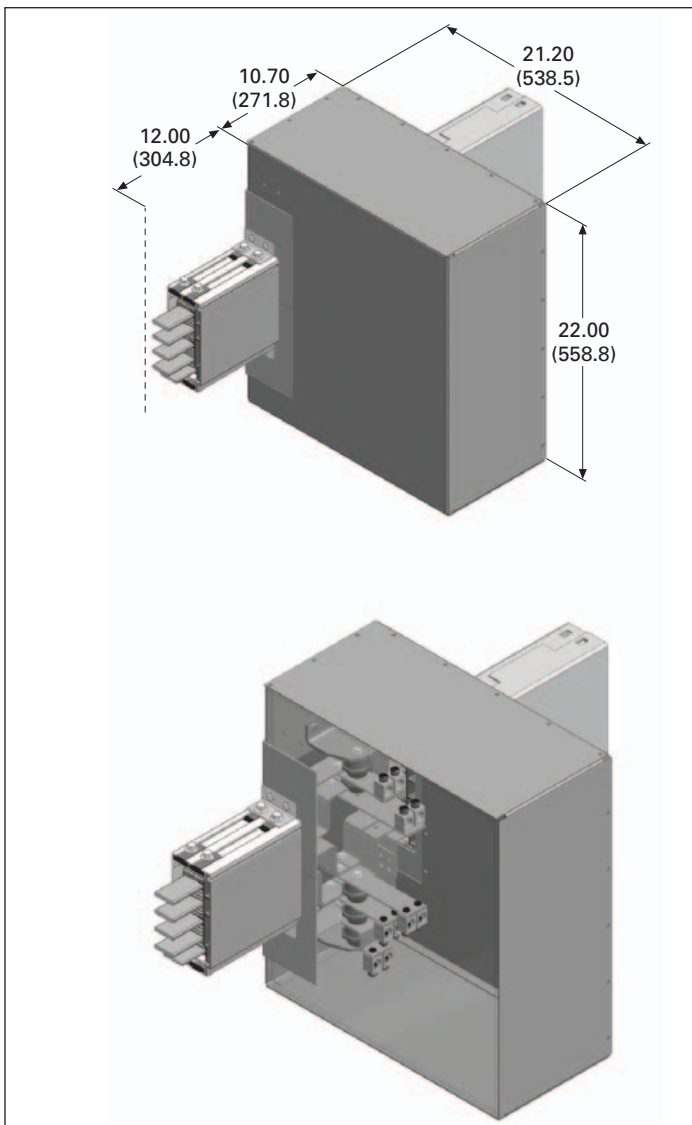
**Figure 12. End Cable Tap Box**



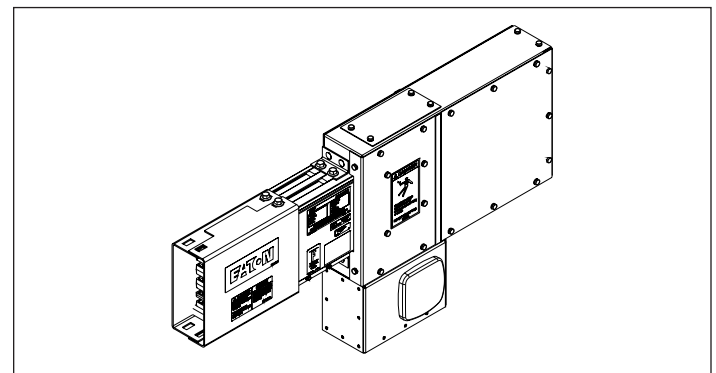
**Figure 13. End Cable Tap Box Detail View**



**Figure 14. Mechanical Lug Access**



**Figure 11. Center Cable Tap Box**



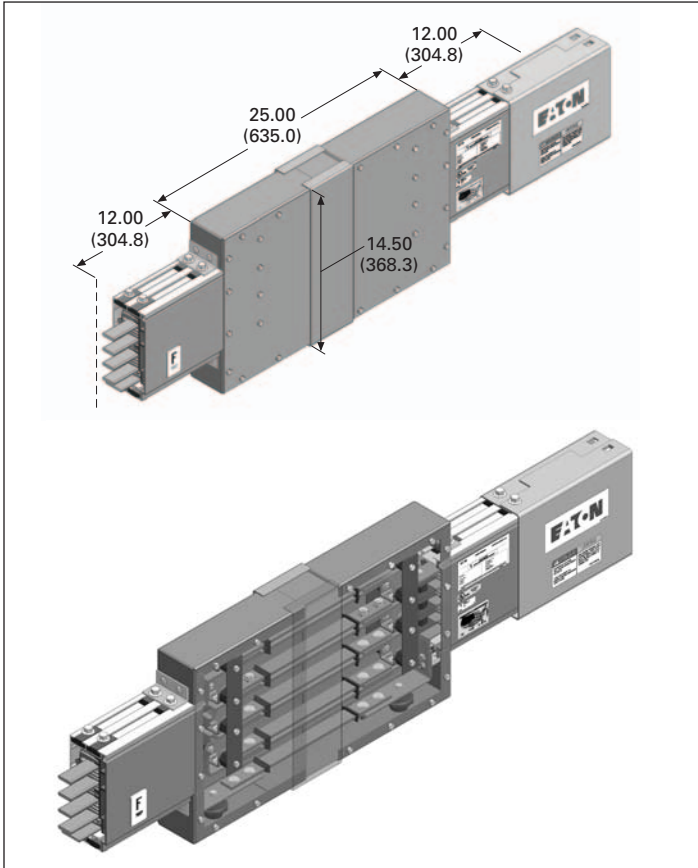
**Figure 15. End Cable Tap Box With IQ Power Meter**

**Expansion joints**

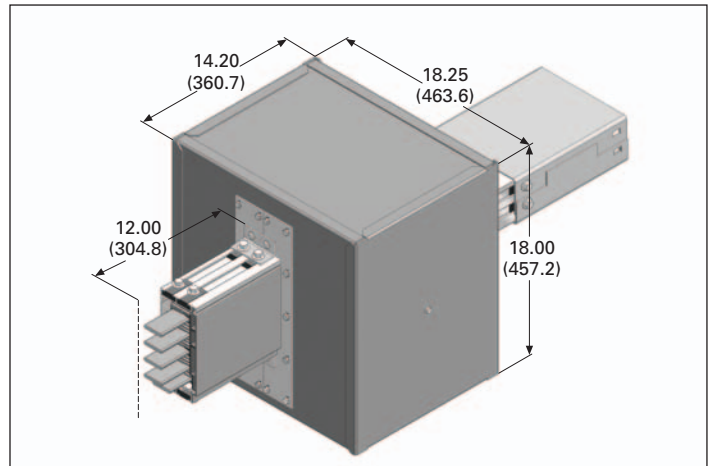
Expansion joints accommodate the expansion and contraction of bus bars with respect to the enclosure. They accommodate for the difference in the coefficient of expansion of the aluminum housing and copper or aluminum bus bar conductors. Expansion joints must be used whenever a run of busway crosses an expansion joint of a building. They should also be installed in the center of an extremely long straight run of busway; one every 300 feet (91m) for copper and one every 225 feet (68m) for aluminum. Usage per footage recommendations are based upon full-load ampere ratings. The use of expansion joints should be engineered for specific applications and installations. Minimum dimensions are shown in **Figure 16**.

**Phase transpositions**

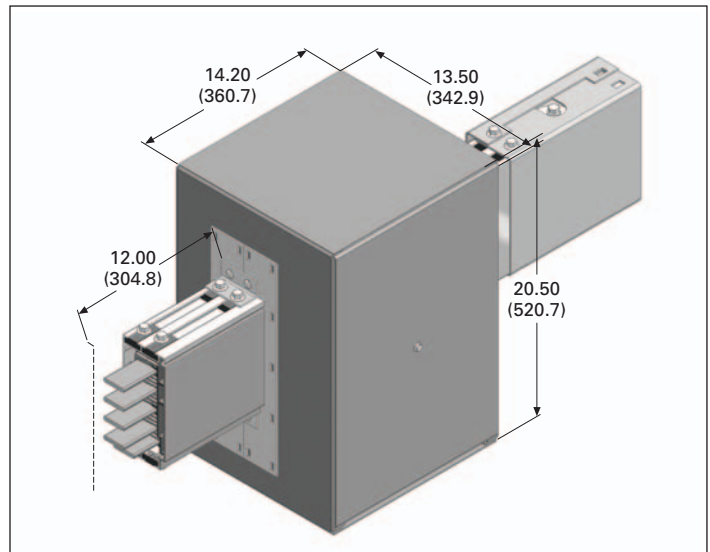
Phase transposition fittings are used in applications where a phase rotation is needed due to a change in phasing from the source equipment to the load equipment. They may also be used to correct plug-in unit orientation when the busway comes out of proper orientation for plug-in units due to the routing of the busway. There are two types of phase transpositions: 90 degree and 180 degree. In both types, all conductors are transposed. See **Figures 17** and **18** for minimum dimensions.



**Figure 16. Expansion Joint**



**Figure 17. 90-Degree Phase Transposition**



**Figure 18. 180-Degree Phase Transposition**

### Vapor–fire barriers

Vapor–fire barriers hold a two-hour fire rating and are used to seal the busway internally for penetrations through walls, floors, and other fire-rated penetrations, preventing the passage of flame, noxious gas, smoke, and moisture. See **Figure 19** for minimum dimensions.

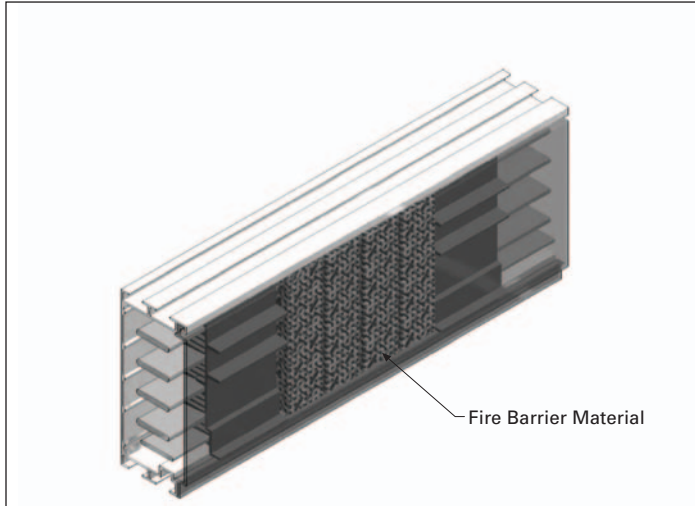


Figure 19. Vapor–Fire Barrier

### Tees (horizontal)

Tee fittings allow for busway connection in three different horizontal directions. Pow-R-Flex tee fittings consist of special joint covers with instructions on how to place the bridge joint. The through connections connect to the short sides of the bridge joint, and the change connections connect to the long side of the bridge joint.

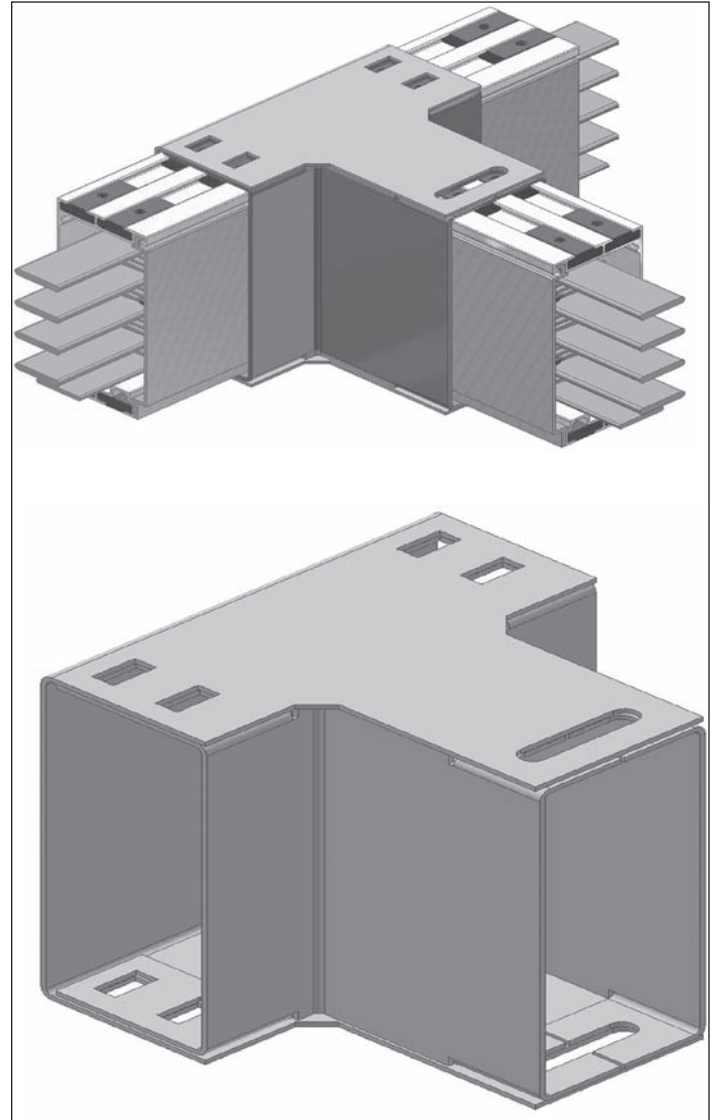


Figure 20. Horizontal Tees

**Accessories**

**End closures**

End closures terminate a bus run and can be used to cap off either the left or right end of a section of busway. End closures enclose and prevent incidental contact with live conductors. An end closure adds 0.25 inches to the overall length of the busway run. See **Figure 21**.

**Wall flanges**

Wall flanges fit around the busway and are designed to close off the wall gap opening around the busway, made to allow the busway to pass through a wall. Wall flanges are primarily for cosmetic purposes and do not provide any type of vapor or fire barrier. See **Figure 22**.

The recommended cutout opening in a wall for the busway should be 2.00 inches (50.8 mm) greater than the busway dimensions or A x B.

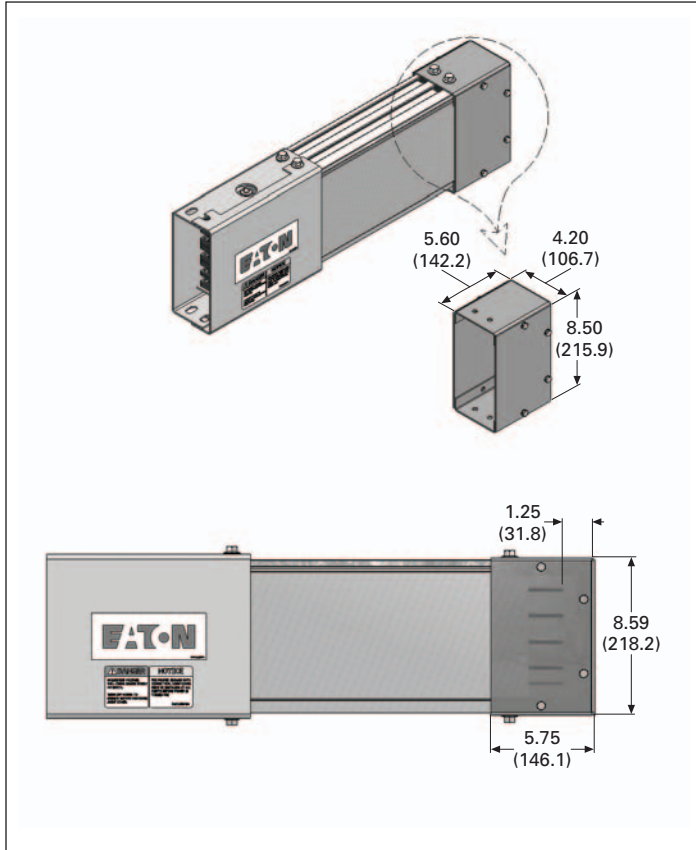


Figure 21. End Closure

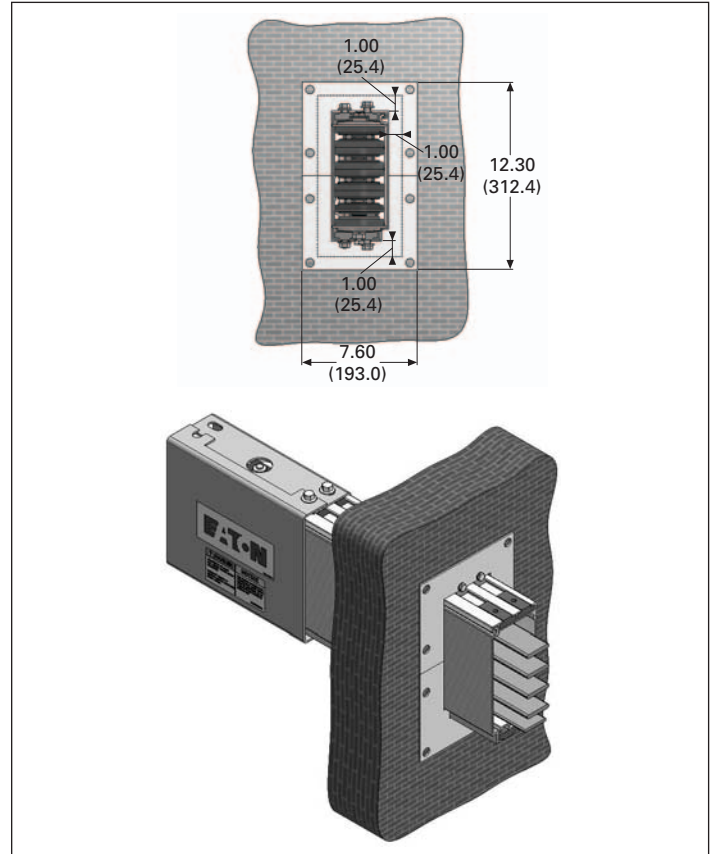
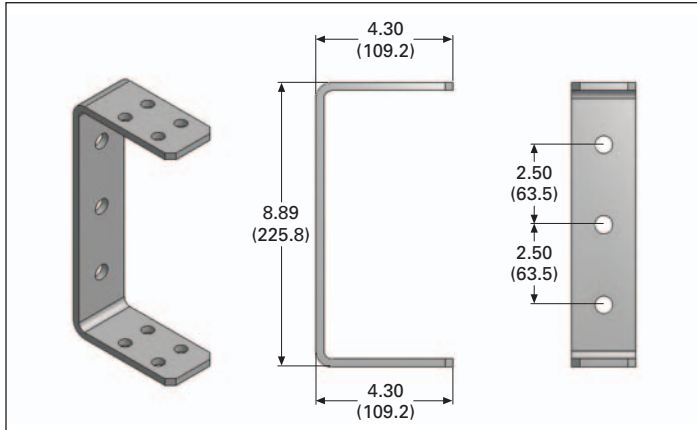


Figure 22. Wall Flange

### Type C wallmount hanger

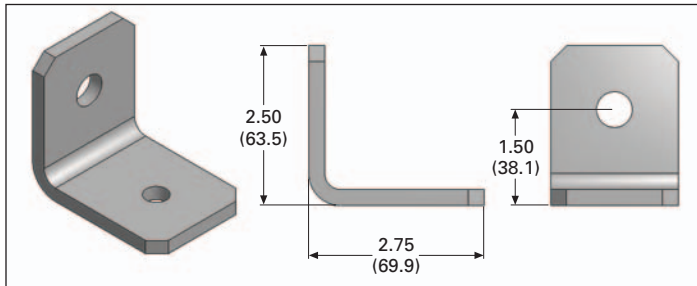
The Type C wallmount hanger provides a means to mount the Pow-R-Flex low-ampere busway to a wall, beam, pedestal, or other fixed structure. The Type C brackets are installed prior to installing the busway. Each hanger comes with the hardware to mount the hanger to the busway. One hanger should be used every 10 feet (3m), and the busway span between hangers should not exceed 10 feet (3m). See **Figure 23**.



**Figure 23. Type C Wallmount Hanger**

### Type L wallmount hanger

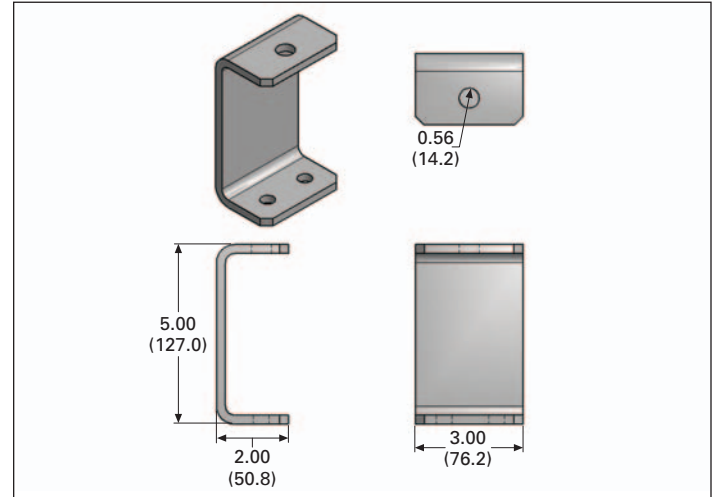
The Type L wallmount hanger provides a means to mount the Pow-R-Flex low-ampere busway flush against a wall. The Type L brackets are sold as a two-piece hanger set and come with the hardware to mount the hanger to the busway. One hanger should be used every 10 feet (3m), and the busway span between hangers should not exceed 10 feet (3m). See **Figure 24**.



**Figure 24. Type L Wallmount Hanger**

### Horizontal hanger—single

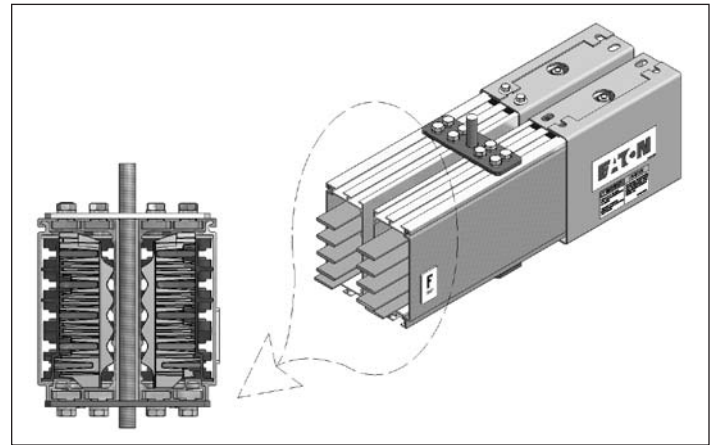
Horizontal hangers provide a means to attach a single 0.50-inch (12.7 mm) threaded drop rod to the busway, suspending the busway from above. Each hanger comes with the hardware to mount the hanger to the busway. One hanger should be used every 10 feet (3m), and the busway span between hangers should not exceed 10 feet (3m). See **Figure 25**.



**Figure 25. Single Hanger**

### Horizontal hanger—back-to-back

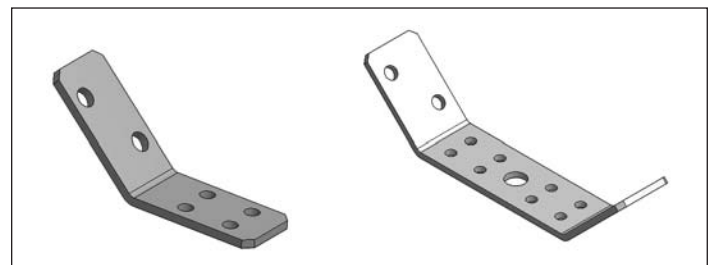
The back-to-back horizontal hanger allows two busway runs to be mounted back-to-back and suspended from above, using a single 0.50-inch (12.7 mm) threaded drop rod. Each hanger comes with the hardware to mount the hanger to the busway. One hanger should be used every 10 feet (3m), and the busway span between hangers should not exceed 10 feet (3m). See **Figure 26**.



**Figure 26. Back-to-Back Hanger**

### Sway braces

Sway brace brackets provide a provision to brace the busway run at a 45-degree angle, restricting the suspended busway from swinging. There are two types of sway brace brackets: single and back-to-back. Each sway brace comes with the hardware to mount the brace to the busway. See **Figure 27**.



**Figure 27. Sway Braces**

**Busway power monitoring**

Eaton’s family of IQ electronic power meters is available to monitor each run of busway. Each power meter is attached to the end cable tap box and comes installed, ready for use. The installing contractor will need to wire the CTs to the meter. CTs are included with the power meter.

Each power meter comes with a highly visible LED display, showing metered values for each phase with its three-line display. This display is very easy to read, even if installed at a height or distance. Using the keypad and menus on the local display, users can display a variety of electrical system values or program the meter. Metered data may also be transmitted and configured remotely, depending upon the selected meter and options selected.

**Table 10. IQ Electronic Power Meters**

Features	IQ 130	IQ 140	IQ 150	IQ 250	IQ 260	PXM2000
Current, per phase	X	X	X	X	X	X
Current demand	X	X	X	X	X	X
Calculated neutral current	X	X	X	X	X	X
Voltage, per phase (L-L, L-N)	X	X	X	X	X	X
Min./max. readings (I, V)	X	X	X	X	X	X
Min./max. readings (I, V, PF, F, W, VAR, VA)	—	X	X	X	X	X
Frequency	—	X	X	X	X	X
Real, reactive, apparent power, total (W, VAR, VA)	—	X	X	X	X	X
Power factor, total	—	X	X	X	X	X
Real, reactive, apparent power demand	—	X	X	X	X	X
Real, reactive, apparent energy, total (Wh, VAR, Vah)	—	—	X	X	X	X
Total Harmonic Distortion (THD), per phase (V, I)	—	—	—	Opt	X	X
Set point driven alarm	—	—	—	Opt	X	X
I/O (Digital in/digital out, analog out, KYZ out)	—	—	—	Opt	Opt	Opt
Logging, trend, event	—	—	—	—	—	X
Embedded Web server	—	—	—	—	—	X
Firmware flash update	—	—	—	—	—	X
Waveform display	—	—	—	—	—	X
RS-485	Opt	Opt	Opt	X	X	X
Modbus RTU	Opt	Opt	Opt	X	X	X
Modbus ASCII	Opt	Opt	Opt	X	X	X
KYZ output	Opt	Opt	Opt	X	X	X
DNP 3.0	—	—	—	X	X	X
HTTP, HTTPS	—	—	—	—	—	X
SNMP	—	—	—	—	—	X
SMTP	—	—	—	—	—	X
NTP	—	—	—	—	—	X



**Figure 28. IQ Meter (Front)**



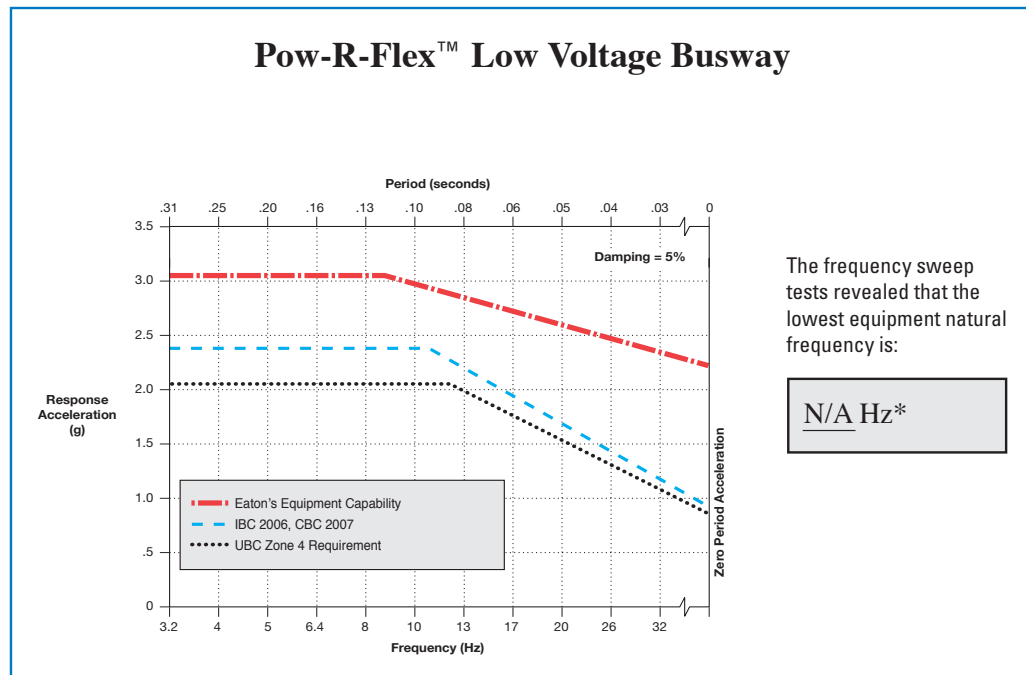
**Figure 29. IQ Power Meter (Rear)**

# SEISMIC QUALIFIED



## TEST CERTIFICATE OF SEISMIC WITHSTAND CAPABILITY

Eaton Corporation's equipment identified below was tested for seismic withstand capability and tested in accordance with the combined requirements specified in the International Building Code, California Building Code and the Uniform Building Code. As required by the codes, the equipment demonstrated its ability to function after the seismic tests. The seismic capability of the equipment exceeds the worst-case required levels, as illustrated in the figure below.



*Nathan Glenn*  
 3RD PARTY TEST ENGINEER IN CHARGE

Nathan Glenn, PE  
 Westinghouse Electric Company, LLC

TESTED BY  
 Wyle Laboratories  
 October, 2009 – 57093R09-2A



For interpretation of testing data  
 refer to Eaton  
 Publication SA12501SE

Drawing Number PU01700001E

Figure 30. Test Certificate of Seismic Withstand Capability

## Plug-in unit overcurrent protective devices

### General information

A variety of plug-in units have been designed for the Pow-R-Flex low-ampere busway to meet multiple applications and a variety of installation conditions. Plug-in unit devices provide easy and flexible access to a building's electrical power system, while providing safe overcurrent protection to equipment and wiring.

All Pow-R-Flex plug-in units are designed with the safety of the installer and user as the key criteria. The following safety features are standard for all fusible and molded-case circuit breaker plug-in units:

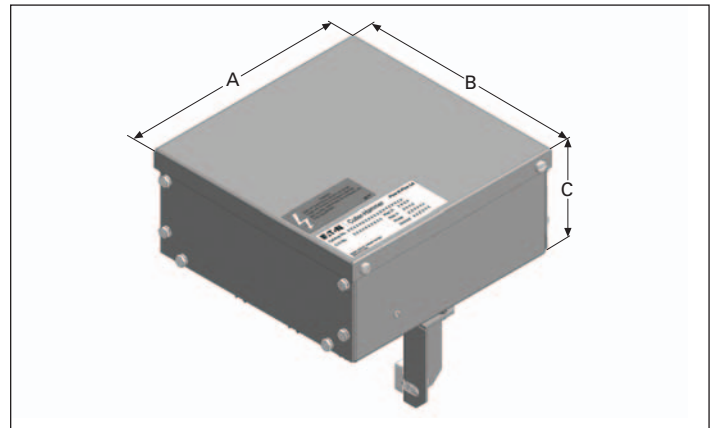
- Each plug-in unit ground stab makes positive contact with the busway ground (integral or internal) before the phase or neutral stabs contact the bus bars
- Plug-in unit molded guide tabs are provided in the stab support base. These ensure proper phase alignment and open the busway outlet shutter mechanism
- Each plug-in unit has an interface bracket, which prevents the unit from being installed onto or removed from the busway, while the device is in the on/closed position
- Each plug-in unit has a door interlock, preventing the front cover from being opened while the device is in the on/closed position and preventing accidental closing of the device while the front cover is open
- Line-side barriers are provided over the line-side terminal to help prevent accidental contact with line-side connections
- When the plug-in unit is installed, the stab-base assembly on the plug-in unit is recessed into the busway outlet cover to help seal against moisture and dust
- Each plug-in unit has mounting flanges, which help protect the stab-base assembly and have captive hardware that bolt the unit securely to the busway

## Plug-in cable tap boxes

Plug-in cable tap boxes are used to back feed power to a run-off busway, or where equipment served by the busway is connected without overcurrent protection. Plug-in cable tap boxes fit into any plug-in provision on a plug-in type busway. See **Figure 33**.

**Table 11. Plug-In Cable Tap Box Details**

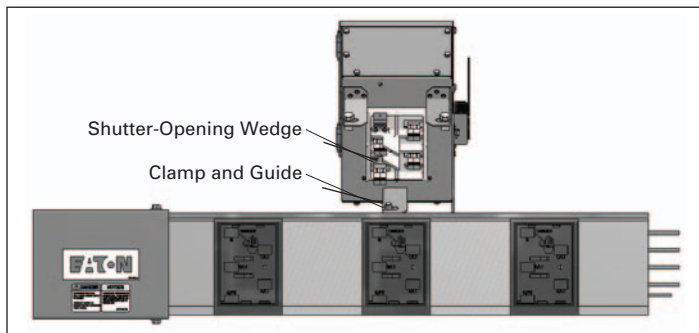
Catalog Number	Ampere Rating	Mechanical Lugs (Standard)	Mechanical Lugs (Metric)
LAPTB100MG	100	—	—
LAPTB100MGN	100	—	—
LAPTB200MG	200	—	—
LAPTB200MGN	200	—	—



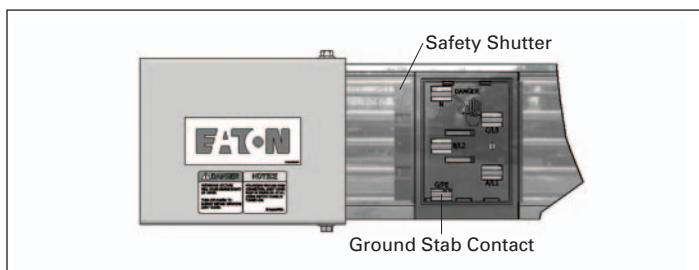
**Figure 33. Plug-In Cable Tap Box**

**Table 12. Plug-In Cable Tap Box Dimensions**

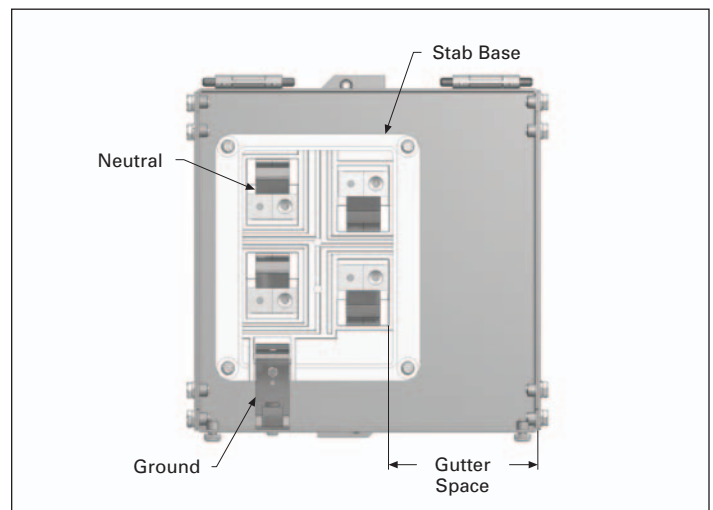
Catalog Number	A	B	C	D
LAPTB100MG	—	—	—	—
LAPTB100MGN	—	—	—	—
LAPTB200MG	—	—	—	—
LAPTB200MGN	—	—	—	—



**Figure 31. Plug-In Stab Assembly Details**



**Figure 32. Plug-In Outlet Details**



**Figure 34. Plug-In Cable Tap Box Details**



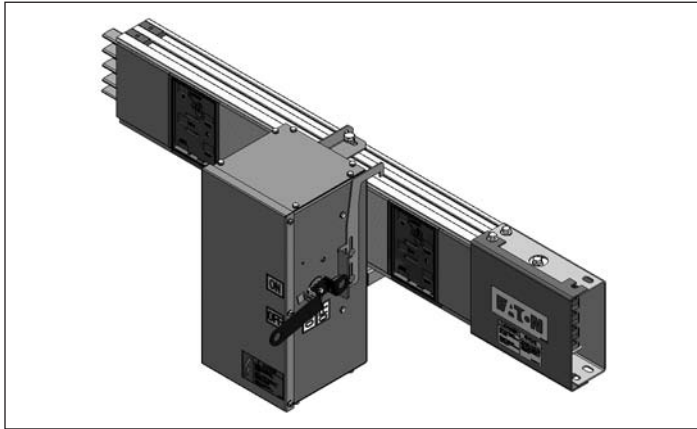


Figure 35. Plug-In Device Mounting

**Circuit breaker plug-in units**

Circuit breaker plug-in units are stock and come with the circuit breaker fully installed, ready for installation and termination. All units are three-phase with three-pole Eaton Series C® molded-case circuit breakers.

**Table 13. Circuit Breaker Interrupting Ratings (kA Symmetrical)**

Ampere Rating	240 Vac	480 Vac	600 Vac	Breaker Frame
15-225	65	—	—	ED
15-100	18	14	—	EHD
15-150	18	14	14	FDB
15-225	65	35	18	FD
15-225	100	65	25	HFD
70-250	65	35	18	JDB
70-250	65	35	18	JD
70-250	100	65	25	HJD

**Note:** 100%-rated circuit breakers are not for use in plug-in units.

**Table 14. Breaker Unit Catalog Numbering System**

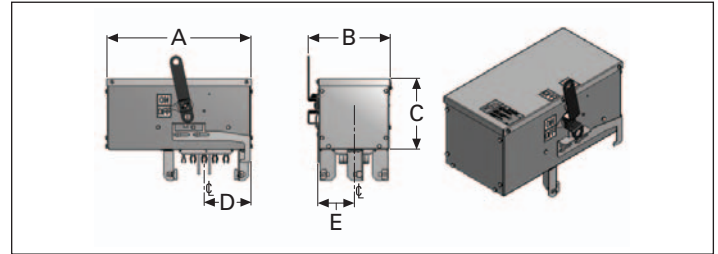
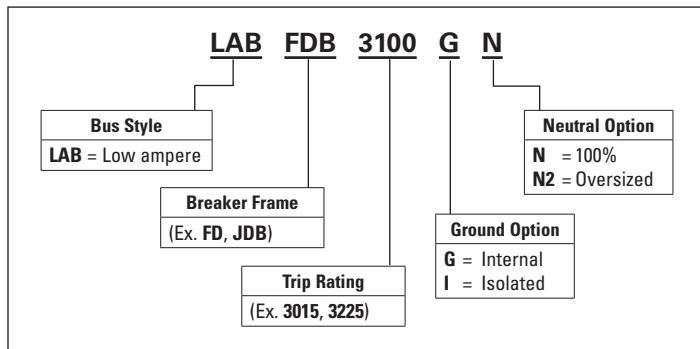


Figure 36. Circuit Breaker Plug-In Unit Dimensions

**Table 15. Breaker Plug-In Unit Dimensions**

Plug-In Unit	Max. Amperes	Max. Voltage	A	B	C	D	E
LABFD (F-Frame)	225	600	18.00 (457.2)	10.80 (274.3)	8.17 (207.5)	5.97 (151.6)	4.80 (121.9)
LABJD (J-Frame)	250	600	18.56 (471.4)	10.80 (274.3)	9.08 (230.6)	5.97 (151.6)	4.61 (117.1)

**Table 16. Breaker Plug-In Unit Physical Data**

Plug-In Unit	Mechanical Terminals	Approximate Weight lbs
LABFD (F-Frame)	Cu/Al-(1)#4-4/0	25
LABJD (J-Frame)	Cu/Al-(1)#14-350 kcmil	40

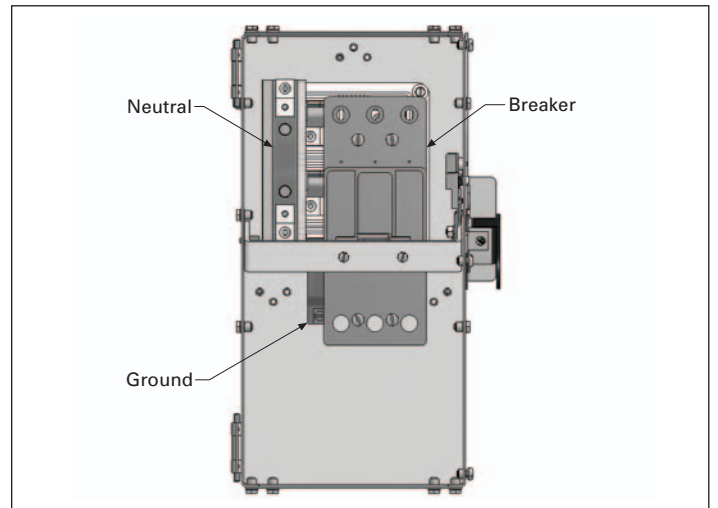


Figure 37. Circuit Breaker Plug-In Unit Details

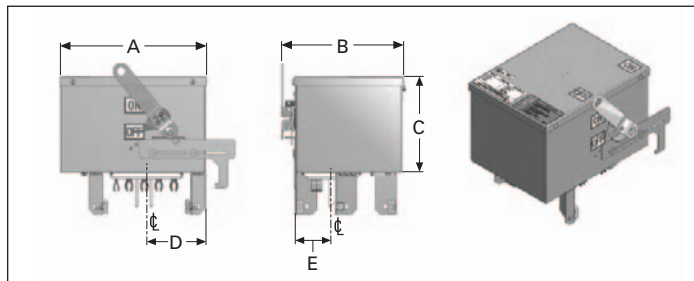
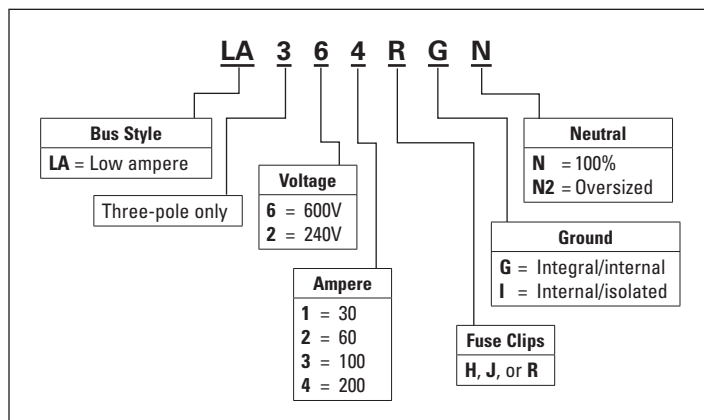
**Fusible switch plug-in units**

Fusible switch plug-in units are stock and come fully assembled with the switch assembly and fuse mounting base ready for installation and termination. All fusible switch plug-in units come standard with Class R fuse clips and can be field modified for use with Class H and J fuses. Fuses are not included. Instructions for fuse base modifications are shown on the data label mounted on the inside of the plug-in unit door.

**Table 17. Fusible Switch Horsepower and Interrupting Rating (kA Symmetrical)**

Ampere Rating	Voltage	NEC Standard	Eaton Maximum	Fault Current
30	240	3	3	50
60	240	7.5	7.5	50
100	240	15	15	50
200	240	25	25	50
30	480	5	15	50
60	480	15	30	50
100	480	25	60	50
200	480	50	125	50
30	600	7.5	20	50
60	600	15	50	50
100	600	30	75	50
200	600	60	150	50

**Table 18. Fusible Unit Catalog Numbering System**



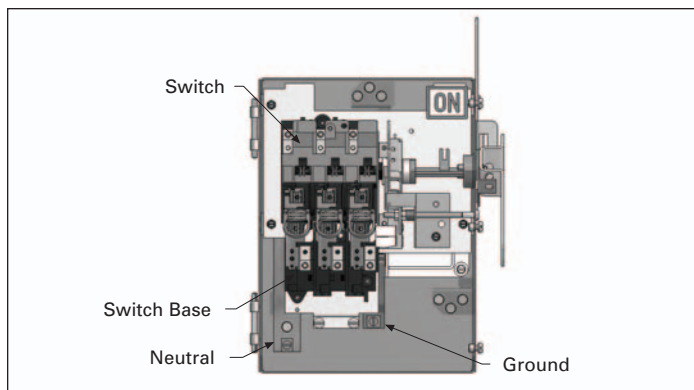
**Figure 38. Fusible Switch Plug-In Unit Dimensions**

**Table 19. Fusible Switch Plug-In Unit Dimensions**

Plug-In Unit	Max. Amperes	Max. Voltage	A	B	C	D	E
LAF321R	30	240	—	—	—	—	—
LAF361R	30	600	—	—	—	—	—
LAF322R	60	240	—	—	—	—	—
LAF362R	60	600	—	—	—	—	—
LAF323R	100	240	—	—	—	—	—
LAF363R	100	600	—	—	—	—	—
LAF324R	200	240	—	—	—	—	—
LAF364R	200	600	—	—	—	—	—

**Table 20. Fusible Plug-In Unit Physical Data**

Plug-In Unit	Mechanical Terminals	Approximate Weight lbs
LAF321R	Cu (1) #14-#3 Al (1) #12-#2	25
LAF361R	Cu (1) #14-#3 Al (1) #12-#2	25
LAF322R	Cu (1) #14-1/0 Al (1) #12-1/0	35
LAF362R	Cu (1) #14-1/0 Al (1) #12-1/0	35
LAF323R	Cu (1) #14-1/0 Al (1) #12-1/0	35
LAF363R	Cu (1) #4-250 kcmil Al (1) #4-250 kcmil	35
LAF324R	Cu (1) #4-250 Al (1) #4-250	45
LAF364R	Cu (1) #4-250 Al (1) #4-250	45



**Figure 39. Fusible Switch Plug-In Unit Details**

**Surge protective device plug-in units**

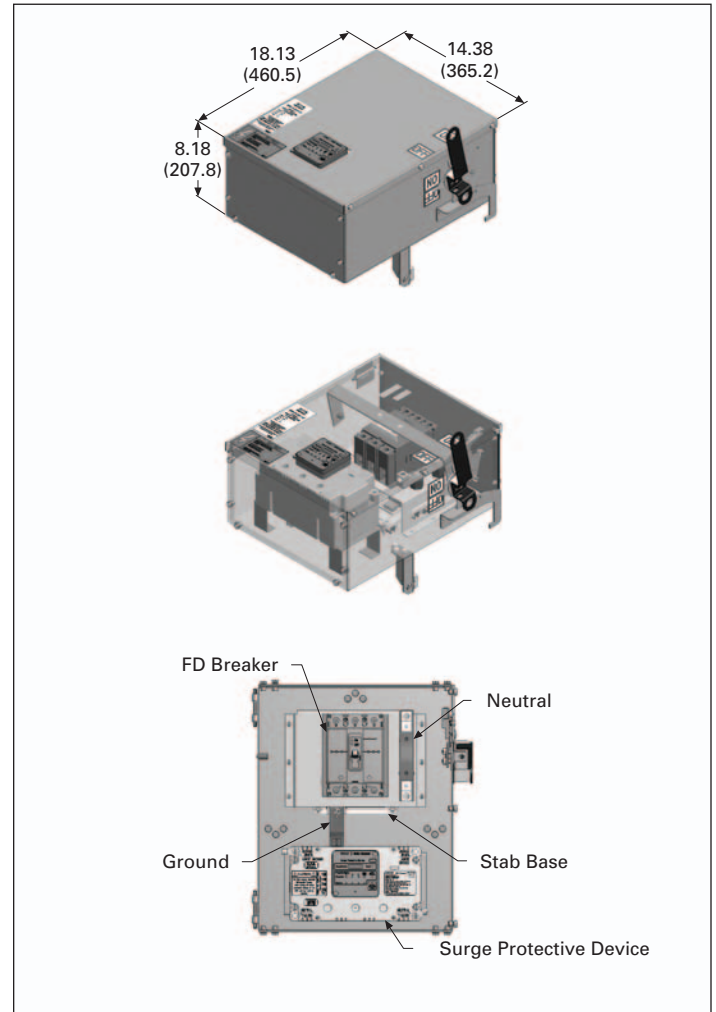
The Pow-R-Flex plug-in device product offering includes surge protective devices (SPD), which are ideal for busway-fed distribution systems. A transient voltage is a random high-energy, short-duration electrical anomaly. These high-energy surges can disrupt, damage, or destroy sensitive microprocessor-based equipment. Eaton has developed the SPD series of products to ensure that quality power is supplied to commercial, industrial, medical, institutional, and data-center facilities.

The SPD device not only protects against externally created impulse transients, such as lightning, utility capacitor switching, and disturbances emitted by adjacent facilities, but also provides needed protection against internal transients. This type of transient is generated within a facility's own distribution system. Sources of internally generated or ring-wave transients are imaging equipment, variable-frequency drives, lighting dimmers, arc welders, and the switching on and off of electrical distribution equipment.

The SPDs also offer units that filter repetitive electrical line noise (EMI/RFI), which is defined as any unwanted electrical signal that produces undesirable effects in the circuits of sensitive electronic equipment or disturbances that are two times peak voltage. The suppression of AC transients is accomplished through the use of thermally protected metal-oxide varistors (MOVs), which provide a low-impedance path to divert surges away from loads. Electrical line noise and ringing transients are eliminated by adding filtering capacitors to the suppression device.

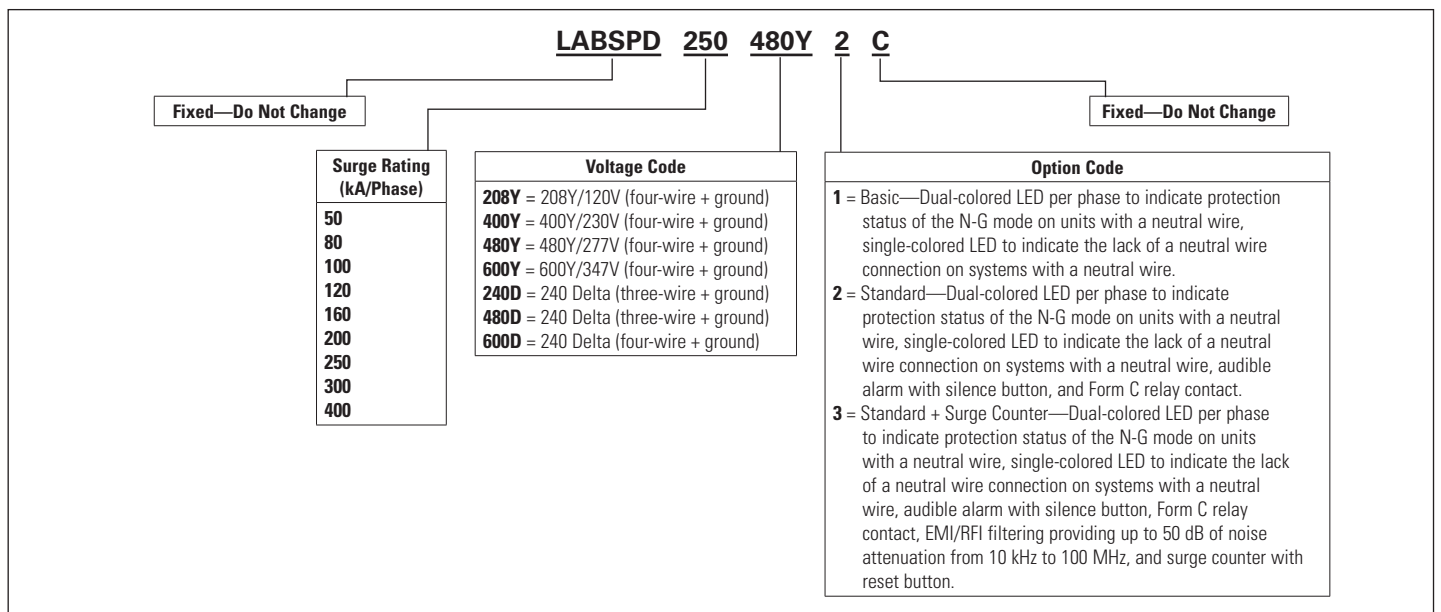
The benefits of combining SPDs and filtering are reduced MOV stress (resulting in a longer life cycle), lower let-through voltage, better noise attenuation levels, and increased reliability.

Because the SPD units are directly connected to the busway, they are able to minimize let-through voltage and isolate critical loads, which are fed from a protected busway run. Due to the integrated design, the SPD plug-in units save the user wall space and greatly reduce the installed project cost. The SPD plug-in units are furnished with a breaker disconnect. For catalog numbers and selection criteria, see **Table 21**.



**Figure 40. SPD Plug-In Unit**

**Table 21. SPD Plug-In Unit Catalog Numbering System**



## Plug-in unit devices

### Receptacle plug-in units

Eaton's unique receptacle plug-in unit design makes them the most flexible receptacle units in the industry. Pow-R-Flex receptacle plug-in units come fully assembled and wired, reducing installation time. Each unit is built to order, based upon receptacle type and rating combinations. Additionally, each individual unit has been optimally phased balanced and are also optimally phased balanced for the entire run, based upon the combination of receptacle plug-in units on the run. This eliminates the need to manually phase balance during installation. They are UL 857 and CSA listed, and come in seven different styles with two different breaker options, using standard NEMA receptacle configurations.

**Table 22. Maximum 240V Plug-In Units**

Plug-In Unit Type	Maximum Ampere Rating	Maximum Ampere Rating/Circuit	Number of Circuits	Receptacle Mounting
Single	60	60	1	Fixed/cord
Double	120	60	2	Fixed/cord
Quad	120	60	4	Fixed/cord

**Table 23. Maximum 400/480/600V Plug-In Units**

Plug-In Unit Type	Maximum Ampere Rating	Maximum Ampere Rating/Circuit	Number of Circuits	Receptacle Mounting
Single	60	60	1	Cord
Double	120	60	2	Cord
Quad	240	60	4	Cord

**Note:** For receptacle options, see receptacle selection chart.

**Table 24. Receptacle Unit Physical Dimensions in Inches (mm)**

Plug-In Unit Type	Voltage	Width	Height	Depth
Single	240	8.50 (215.9)	11.50 (292.1)	6.50 (165.1)
Single	400	8.50 (215.9)	11.50 (292.1)	6.50 (165.1)
Single	480	8.50 (215.9)	11.50 (292.1)	6.50 (165.1)
Double	240	8.50 (215.9)	12.25 (311.2)	6.50 (165.1)
Double	400	11.00 (279.4)	12.00 (304.8)	6.50 (165.1)
Double	480	11.00 (279.4)	12.00 (304.8)	6.50 (165.1)
Quad	240	21.00 (533.4)	10.00 (254.0)	5.50 (139.7)
Quad	400	21.00 (533.4)	11.50 (292.1)	7.25 (184.2)
Quad	480	21.00 (533.4)	11.50 (292.1)	7.25 (184.2)

**Table 25. Receptacle Unit Short-Circuit Withstand Rating (rms Symmetrical)**

Plug-In Unit Type	Breaker Type	240V	400V	480V
Single	CH	10,000A	10,000A	10,000A
Single	FD ①	22,000A	10,000A	10,000A
Double	CH	10,000A	10,000A	10,000A
Double	FD ①	22,000A	10,000A	10,000A
Quad	CH	10,000A	10,000A	10,000A
Quad	FD ①	22,000A	10,000A	10,000A

① 25 kAIC is available for single-phase connectors at 240V.

## NEMA receptacle configurations

**Table 26. Straight-Blade Receptacles**

Phase	Voltage	Configuration	15A	20A	30A	50A	60A
Single-phase	125V	Two-pole, three-wire, grounded	5-15R ①	5-20R ①	5-30R	—	—
Single-phase	250V	Two-pole, three-wire, grounded	6-15R ①	6-20R ①	6-30R	6-50R	—
Single-phase	277V	Two-pole, three-wire, grounded	7-15R	7-20R	—	—	—
Three-phase	250V	Three-pole, four-wire, grounded	15-15R	15-20R	15-30R	15-50R	15-60R

① Available in a duplex configuration.

**Table 27. Twist-Lock Receptacles**

Phase	Voltage	Configuration	15A	20A	30A	50A	60A
Single-phase	125V	Two-pole, three-wire, grounded	L5-15R ①	L5-20R	L5-30R	CS6360 ②	—
Single-phase	250V	Two-pole, three-wire, grounded	L6-15R ①	L6-20R	L6-30R	CS8264 ②	—
Single-phase	277V	Two-pole, three-wire, grounded	L7-15R	L7-20R	L7-30R	—	—
Three-phase	250V	Three-pole, four-wire, grounded	—	L15-20R	L15-30R	CS8364 ②	—
Three-phase	208/120V	Three-pole, five-wire, grounded	—	L21-20R	L21-30R	—	—
Three-phase	480/277V	Three-pole, five-wire, grounded	—	L22-20R	L22-30R	—	—

① Available in a duplex configuration.

② California standard receptacles.

**Table 28. Pin and Sleeve Connectors (UL and IEC 309)**

Phase	Voltage	Configuration	15A	20A	30A	50A	60A
Single-phase	125V	Two-pole, three-wire, grounded	—	P5-20C	P5-30C	—	P5-60C
Single-phase	250V	Two-pole, three-wire, grounded	—	P6-20C	P6-30C	—	P6-60C
Single-phase	277V	Two-pole, three-wire, grounded	—	P7-20C	P7-30C	—	P7-60C
Three-phase	250V	Three-pole, four-wire, grounded	—	P15-20C	P15-30C	—	P15-60C
Three-phase	208/120V	Three-pole, five-wire, grounded	—	P21-20C	P21-30C	—	P21-60C
Three-phase	480/277V	Three-pole, five-wire, grounded	—	P22-20C	P22-30C	—	P22-60C

**Note:** For other receptacle options, contact the factory.

**Note:** 480/277V receptacles may be applied at 400/230V.

**Fused duplex receptacle unit**

The fused duplex receptacle unit shown in **Figure 41** allows for quick standard receptacle power at any plug-in location along the busway run. There are two options. The LAFD62FD62F comes with two NEMA 5-20R, 20A duplex standard receptacles. The LAFU61FU61F comes with two NEMA L5-15R duplex twist-lock receptacles. Each unit is fused protected at 20 and 15A and is 120V single-phase, three-wire.



**Figure 41. Fused Duplex Receptacle Unit**

**Single receptacle unit (240V max.)**

The single receptacle unit shown in **Figure 42** is configured to order based upon the receptacle type and rating. These units are three-phase and can service single- or three-phase loads, 120V, 240V, and 208/120V. They use Type CH plug-in (10 kAIC), single-pole, two-pole, or three-pole breakers. Each unit comes with one receptacle, with the breaker sized per the receptacle rating. Each receptacle can be fixed mounted to the front of the enclosure or cable mounted to a cord drop coming out of the bottom of the enclosure. See **Figure 43**. Cord drop lengths may be 1–15 feet in 1-foot increments. Consult NEC® Sections 368, 400, and 645 for cord drop applications.



**Figure 42. Single Receptacle Unit (Fixed Mounted)**



**Figure 43. Single Receptacle Unit (Cord Mounted)**

**Double receptacle unit (240V max.)**

The double receptacle unit shown in **Figure 44** is configured to order based upon each receptacle type and rating. These units are three-phase and can service single- or three-phase loads, 120V, 240V, and 208/120V. They use Type CH plug-in (10 kAIC), single-pole, two-pole, or three-pole breakers. Each unit comes with up to two receptacles, with each breaker sized per the receptacle rating. Each receptacle can be fixed mounted to the front of the enclosure or cable mounted to a cord drop coming out of the bottom of the enclosure. See **Figure 45**. Cord drop lengths may be 1–15 feet in 1-foot increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.



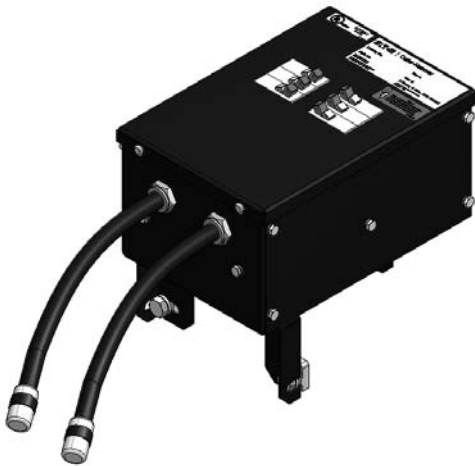
**Figure 44. 240V, Double Receptacle Unit (Fixed Mounted)**

**Quad receptacle unit (240V max.)**

The quad receptacle unit shown in **Figure 46** is configured to order based upon each receptacle type and rating. These units are three-phase and can service single- or three-phase loads, 120V, 240V, and 208/120V. They use Type CH plug-in (10 kAIC), single-pole, two-pole, or three-pole breakers. Each unit comes with up to four receptacles, with each breaker sized per the receptacle rating. Each receptacle can be fixed mounted to the front of the enclosure or cable mounted to a cord drop coming out of the bottom of the enclosure. See **Figure 47**. Cord drop lengths may be 1–15 feet in 1-foot increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.



**Figure 46. 240V, Quad Receptacle Unit (Fixed Mounted)**



**Figure 45. 240V, Double Receptacle Unit (Cord Mounted)**

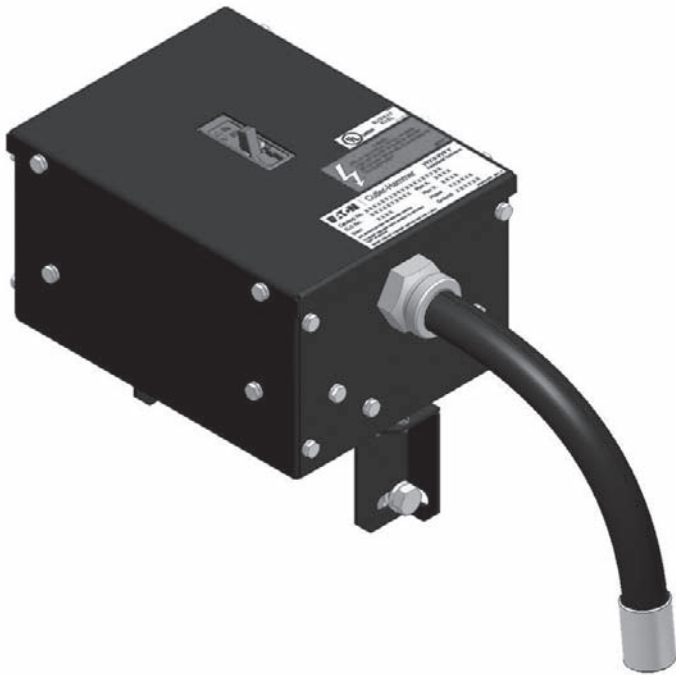


**Figure 47. 240V, Quad Receptacle Unit (Cord Mounted)**

## Plug-in unit devices (continued)

### Single receptacle unit (600V max.)

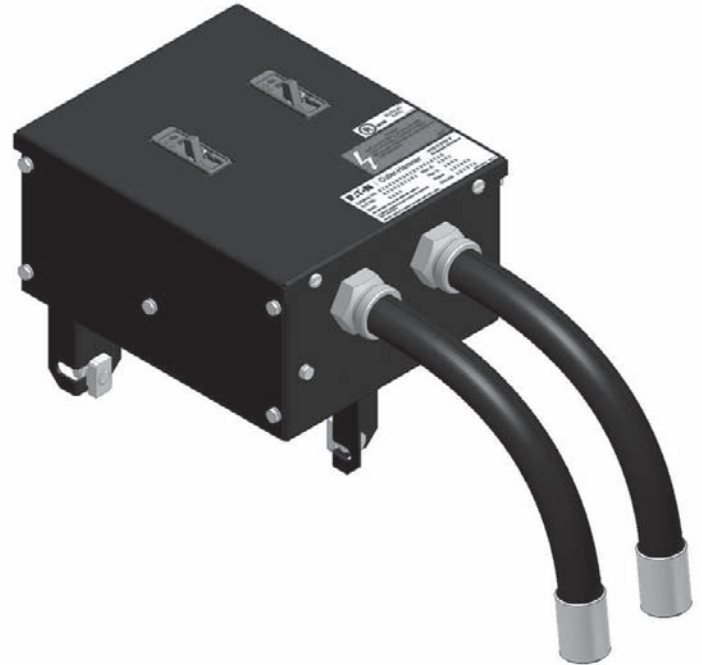
The single receptacle unit shown in **Figure 48** is configured to order based upon the receptacle type and rating. These units are three-phase and can service single- or three-phase loads up to 600V maximum (120V, 240V, 400V, 480V, 600V, 208Y/120V, 400/230V, 480/277V, 600/347V). Type F-Frame bolt-on molded-case circuit breakers are used in single-pole, two-pole, or three-pole configurations. Each unit comes with one receptacle, with the breaker sized per the receptacle rating. Each receptacle is cable mounted to a cord drop coming out of the bottom of the enclosure. See **Figure 48**. Cord drop lengths may be 1–15 feet in 1-foot increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.



**Figure 48. 600V Single Receptacle Unit**

### Double receptacle unit (600V max.)

The double receptacle unit shown in **Figure 49** is configured to order based upon the receptacle type and rating. These units are three-phase and can service single- or three-phase loads up to 600V maximum (120V, 240V, 400V, 480V, 600V, 208Y/120V, 400/230V, 480/277V, 600/347V). Type F-Frame bolt-on molded-case circuit breakers are used in single-pole, two-pole, or three-pole configurations. Each unit comes with two receptacles, with the breakers sized per the receptacle rating. Each receptacle is cable mounted to a cord drop coming out of the bottom of the enclosure. See **Figure 49**. Cord drop lengths may be 1–15 feet in 1-foot increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.



**Figure 49. 600V Double Receptacle Unit**

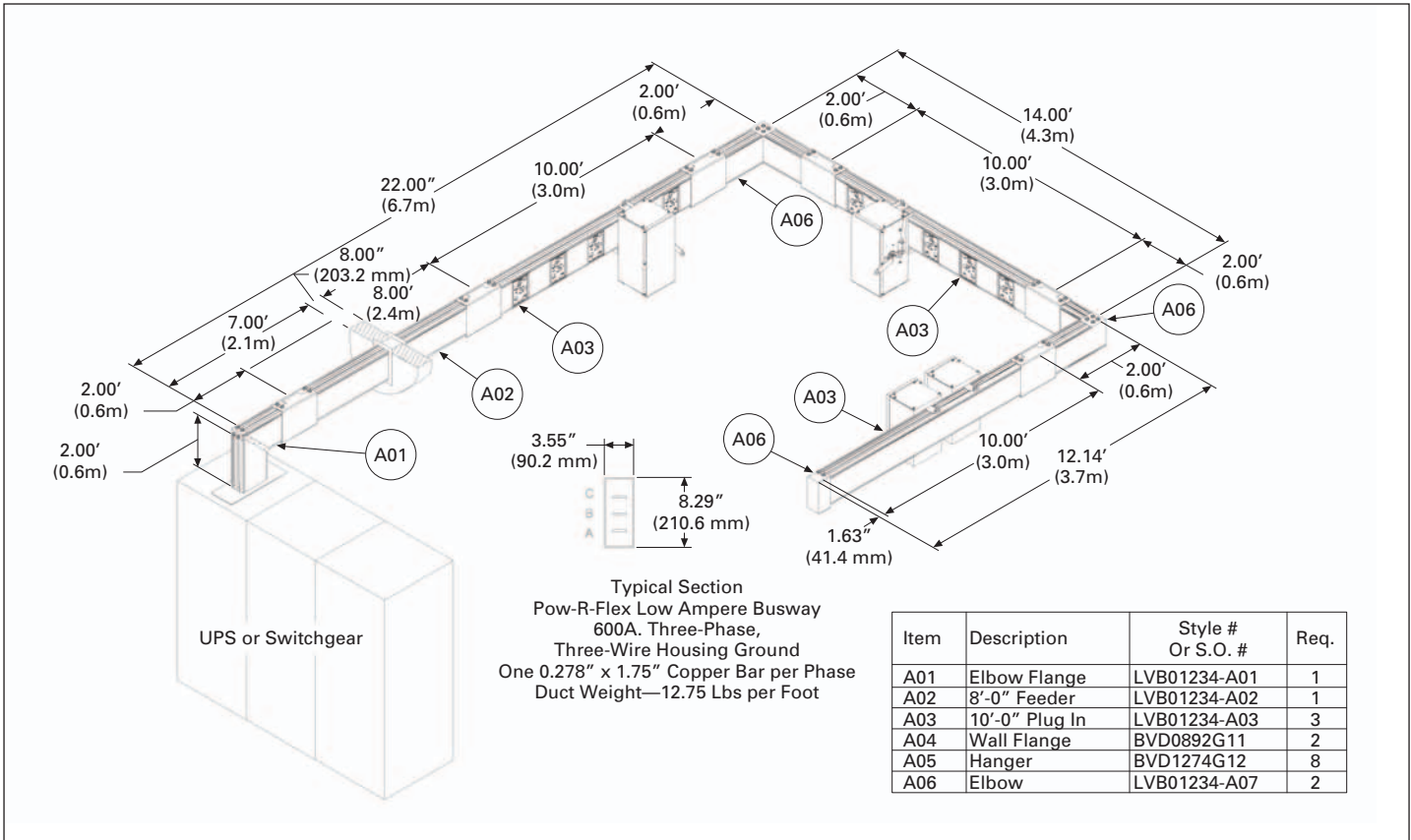
### Quad receptacle units (600V max.)

The quad receptacle unit shown in **Figure 50** is configured to order based upon the receptacle type and rating. These units are three-phase and can service single- or three-phase loads up to 600V maximum (120V, 240V, 400V, 480V, 600V, 208Y/120V, 400/230V, 480/277V, 600/347V). Type F-Frame bolt-on molded-case circuit breakers are used in single-pole, two-pole, or three-pole configurations. Each unit comes with up to four receptacles, with the breakers sized per the receptacle rating. Each receptacle is cable mounted to a cord drop coming out of the bottom of the enclosure. See **Figure 50**. Cord drop lengths may be 1–15 feet in 1-foot increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.



**Figure 50. 600V Quad Receptacle Unit**

### Installation drawing information



**Figure 51. Sample Installation Drawing**

After the layout approval process, installation drawings will be provided just prior to shipment of the busway from the factory. A sample is illustrated in **Figure 51**. The drawings will contain a complete layout of the entire busway installation and a bill of material that includes the following:

1. The item number of each section, which can be correlated with the layout drawing
2. A description of each section
3. The style number of each section, which can be correlated to the nameplate information on each section
4. The quantity of each style number required
5. The height, width, and weight (per foot) of each ampere rating
6. Location of "F" markings on the busway
7. Fitting reference drawings
8. Electrical equipment/switchgear locations and orientation
9. Wall and floor locations
10. The length of each section

The installer should review the installation drawings prior to and during the installation process. Please note that plug-in units are generally not shown on the installation drawings. The installer will also receive installation instruction leaflets and operation and maintenance manuals with the drawings.



## Specifications

### PART 1—GENERAL

#### 1.01 SCOPE

- A. The Contractor shall furnish and install the busway system including all necessary fittings, hangers, and accessories as specified herein and as shown on the contract drawings.

#### 1.02 RELATED SECTIONS

- A. SECTION 26 43 13—SURGE SUPPRESSION DEVICES

#### 1.03 REFERENCES

- A. The low voltage busway and all components shall be designed, manufactured, and tested in accordance with the latest applicable following standards of ANSI and NEMA:
1. NEMA BU.1
  2. ANSI/UL 857
    - a. All fittings and plug-in units shall be listed and marked in accordance with UL 857.
    - b. All ampere and voltage ratings and configurations shall be listed and marked in accordance with UL 857.
    - c. Track busway or continuous plug-in busway rated higher than 225A is not recognized by UL 857 and shall not be accepted.
  3. CSA

#### 1.04 SUBMITTALS—FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer:
1. Master drawing index
  2. Isometric drawing of each busway run
  3. Component list
  4. Busway ratings including:
    - a. Short-circuit rating
    - b. Voltage
    - c. Continuous current
  5. Major component ratings including:
    - a. Voltage
    - b. Continuous current
    - c. Interrupting ratings
  6. Cable terminal sizes
  7. Product data sheets

#### 1.05 SUBMITTALS—FOR CONSTRUCTION

- A. The following information shall be submitted for record purposes:
1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
  2. Certified production test reports
  3. Installation information
  4. Seismic certification and equipment anchorage details

#### 1.06 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO® 9001 or 9002 certified.
- C. For the equipment specified herein, the manufacturer shall have an environmental system registered to ISO 140001.
- D. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- E. The busway and related accessories shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code (IBC) and CBC standards. Proof of third-party certification shall be provided upon request.
- F. The busway and related fittings shall be available for all ratings and configurations, including internal ground, isolated ground and oversized neutral. The selection of one option shall not eliminate the use of another.

#### 1.07 REGULATORY REQUIREMENTS

- A. The busway shall bear a UL label.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions and NEMA publication BU.1. One (1) copy of these instructions shall be included with the equipment at time of shipment.

#### 1.09 OPERATION AND MAINTENANCE MANUALS

- A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.
- B. Prior to installation, busway shall be stored in a dry temperature and humidity controlled environment.

#### 1.10 EXTRA PRODUCTS

- A. Spare parts shall be furnished for each rating of busway, consisting of:
1. One set of joint covers for each busway type, including spare hardware

### PART 2—PRODUCTS

#### 2.01 MANUFACTURERS

- A. Eaton Corporation

#### 2.02 RATINGS

- A. The busway shall be Eaton's type Pow-R-Flex and shall be:
1. Single-phase, three-wire with 50% integral housing ground
  2. Single-phase, three-wire with 50% internal ground bar or 50% isolated internal ground bar
  3. Three-phase, three-wire with 50% integral housing ground
  4. Three-phase, three-wire with 50% internal ground bar or 50% isolated internal ground bar
  5. Three-phase, three-wire with 100% ground

6. Three-phase, four-wire with 100% neutral and 50% integral housing ground
  7. Three-phase, four-wire with 100% neutral and 50% internal ground bar or 50% isolated internal ground bar
  8. Three-phase, four-wire with 100% neutral and 100% ground
- B. Copper busway shall have a minimum of 3-cycle short-circuit rating of 22 kA rms symmetrical for 225A ratings, 35 kA rms symmetrical for 400A ratings, 42 kA rms symmetrical for 500 and 600A ratings.
- C. Aluminum busway shall have a minimum of 3-cycle short-circuit rating of 22 kA rms symmetrical for 150A ratings, 35 kA rms symmetrical for 225A ratings, 42 kA rms symmetrical for 300 and 400A ratings.

### 2.03 CONSTRUCTION

- A. The busway and associated fittings shall consist of copper or aluminum conductors totally enclosed, non-ventilated, 2-piece extruded aluminum housing. Indoor feeder and indoor plug-in busway shall be interchangeable at the same rating without the use of adapters or special splice plates. Fittings (elbows, tees, flanges, etc.) shall be identical for use with both the plug-in and feeder types of busway. The busway shall be capable of being mounted flat-wise, edgewise, or vertically without derating. The busway shall consist of standard 10-foot sections with special sections and fittings provided to suit the installation. Horizontal runs shall be suitable for hanging on 10-foot maximum centers. Provide one (1) hanger for every ten (10) feet of horizontally mounted duct.

### 2.04 BUS

- A. Bus bars shall be fabricated from high strength, 55% conductivity aluminum or 98% conductivity copper and shall be silver-plated at all joint and contact surfaces.
- B. The busway shall be capable of carrying rated current continuously without exceeding a temperature rise of 55 degrees C based on a 40 degrees C ambient.

### 2.05 BUS JOINTS

- A. Each busway section shall be furnished complete with joint hardware and covers. The busway joints shall be a single-bolt, non-rotating, removable bridge design. All bridge joints shall be furnished with torque-indicating double head joint bolts and Belleville washers. The bridge joint shall use a captive nut retainer on the opposite side of the torque-indicating bolt. The bridge joint design shall ensure proper installation without the use of a torque wrench, and provide visual indication that the joint has been tightened to the proper torque value. Each busway joint shall allow for a minimum length adjustment of +/- 0.5 inches. De-energization of busway shall not be required for safe testing of joint tightness.

### 2.06 HOUSING

- A. The busway housing shall be a 2-piece design fabricated from extruded aluminum. The 2-piece housing shall consist of a base channel and interlocking front cover bolted together, along the bottom flange. The busway enclosure finish shall be ANSI 61 gray or black and shall conform to UL requirements.
- B. The busway conductors shall be totally enclosed within the housing and shall not require any optional covers to prohibit access to the conductors. Busway with open channels or tracks shall not be permitted.

### 2.07 PLUG-IN BUSWAY

- A. Where required, busway shall be of the plug-in type. Plug-in busway shall be available in standard 2-, 4-, 6-, 8-, and 10-foot lengths, with plug-in openings provided on one side of the busway sections on 12-inch centers. The plug-in openings shall not have hinged or removable covers and shall have an integral shutter that slides open when a plug-in unit is being inserted. The integral shutter mechanism shall prohibit dirt and debris from entering contact plug-in openings in the busway. The design shall allow for nine (9) plug-in opening outlets per ten (10) feet of plug-in length. The integral shutter mechanism for plug-in openings shall have a positive screw close feature that prevents the shutter from being opened when the plug-in opening is not being used by a plug-in unit. A standard housing ground connection shall be supplied in each plug-in opening. Positive mechanical guides for plug-in units shall be provided at each plug-in opening to facilitate unit alignment, engage shutter mechanism, and prevent improper installation.
- B. Where required, plug-in units of the types and ratings indicated on the plans and specifications shall be supplied. Standard fusible and circuit breaker type plug-in units shall be mechanically interlocked with the busway housing to prevent their installation or removal while the switch is in the ON position. The enclosure of any plug-in unit shall make positive ground connection to the duct housing before the stabs make contact with the bus bars. All standard fusible and circuit breaker plug-in units shall be equipped with an interlock that can be defeated to prevent the cover from being opened while the switch is in the ON position and to prevent accidental closing of the switch while the cover is open. The plugs shall be provided with a means for padlocking the cover closed and padlocking the disconnect device in the OFF position. The operating handle and mechanism shall remain in control of the disconnect device at all times, permitting its easy operation from the floor by means of a hook stick or chain. All plug-in units shall be interchangeable without alteration or modification of plug-in duct.
- C. All plug-in unit types and ratings must be fully interchangeable for use on all busway ampere ratings.
- D. Fusible-type plugs shall have a quick-make/quick-break disconnect switch and positive pressure fuse clips
- E. Circuit breaker-type plugs shall have an interrupting rating as shown in the contract documents, and shall meet all requirements of UL Standard 489. All breaker plug-in devices shall be from the same manufacturer as the busway.
- F. Receptacle type plugs shall have fused or circuit breaker overcurrent protection. Circuit breakers shall be plug-on or bolt-on type with an interrupting rating of 10 kA or 22 kA three-phase at 240V; 25 kA single-phase at 240V, 10 kA at 400V and 480V and 10 kA at 600V. All fault current ratings shall be symmetrical rms amperes. Circuit breakers shall be from the same manufacturer as the busway. Receptacles shall be UL listed, any standard NEMA configuration, and either bolted to the enclosure or affixed to an electrical cord dropped down from the enclosure. Cord drops shall use UL listed strain relief devices. Receptacle type plugs shall come fully assembled and wired from the manufacturer. Field kits for drop cords and receptacles shall not be acceptable. For fault current ratings above 22 kA at 240V or 10 kA at 400V and/or 480V, the connector/receptacle and breaker combination must be tested to UL 231 and UL approved.

## 2.08 SURGE SUPPRESSION DEVICES

- A. Provide surge suppression devices as specified in Section 26 43 13.

## 2.09 END CABLE TAP BOXES

- A. End cable tap boxes shall be configured to accept up to two (2) 350 kcmil cables per phase and shall conform to UL 857 and NEC standards for wire bend space, allowing incoming cables from the end, top, and bottom sides. Left and right side removable covers shall be provided for easy cable access. Lug access covers shall be provided for easy access to cable termination lugs. Cable tap boxes shall be mountable up against wall without causing the busway to be offset from the wall.
- B. End cable tap boxes shall allow for CTs to be mounted within the tap box for metering.

## 2.10 BUSWAY WHOLE RUN METERING

- A. An electronic power meter equivalent to an Eaton IQ 250/260 electronic power meter shall be used to monitor power utilization for each busway run and shall be mounted in a separate enclosure bolted to each end cable tap box.
- B. The electronic power meter shall have a digital display showing real-time information about critical power parameters for each phase. Each phase shall be visible on the display simultaneously.
- C. The electronic power meter shall comply with ANSI C12.20 for power utilization and quality with an accuracy of 0.2 percent.
- D. The electronic power meter shall be capable of monitoring the following parameters for each phase: current, current demand, neutral current, voltage, frequency; real, reactive and apparent power, total and per phase; power factor, total and per phase; and minimum and maximum readings for each parameter.
- E. The electronic power meter shall communicate in RS-485 or Modbus RTU, or Modbus ASCII or DNP 3.0 and KYZ output. Shall also be capable of optional I/O as specified.

## PART 3—EXECUTION

### 3.01 FACTORY TESTING

- A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
- B. The manufacturer shall provide three (3) certified copies of factory test reports upon request.

### 3.02 INSTALLATION

- A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings and NEMA BU.1.
- B. Expansion fittings shall be used to account for the coefficient of expansion and contraction due to heating and cooling of the conductors. An expansion fitting shall be used every 300 feet for copper conductors and 225 feet for aluminum conductors for busway running continuously without change in direction.
- C. Busway supports shall be provided by the manufacturer of the busway and shall be installed per the manufacturer's installation instructions.

### 3.03 TESTING

- A. Perform testing on all busway runs per NEMA publication BU.1 and manufacturer's recommendations prior to energizing.

### 3.04 WARRANTY

- A. Equipment manufacturer warrants that the Products manufactured by it will conform to the manufacturer's applicable specifications and be free from failure due to defects in workmanship and material for one (1) year from the date of installation of the Product or eighteen (18) months from the date of shipment of the Product, whichever occurs first. Extended warranties shall be allowed as specified herein.

### 3.05 STARTUP SERVICES

- A. A factory-authorized service representative shall perform all startup services.
- B. Train owner's maintenance personnel on procedures for servicing and maintaining equipment per manufacturer's recommendations and NEMA publication BU.1.

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Printed in USA  
Publication No. TD01701003E / Z10239  
October 2010



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