Technical Data **TD01701003E**

Effective March 2015
Supersedes June 2013

Low voltage busway
Pow-R-Flex low ampere busway

Contents

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

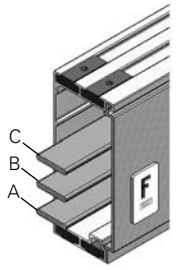
The Pow-R-Flex low-ampere busway is a maximum 600 V design that uses the latest in extrusion construction, providing appealing aesthetics without compromising heavy-duty performance.

The design consists of an extruded, all-aluminum housing with silver-plated copper or aluminum conductors. Copper conductors offer ratings from 225–600 A, and aluminum conductors offer ratings from 150–400 A. 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.

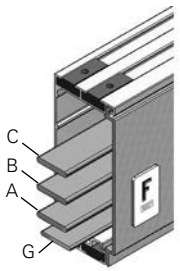
Standards

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.

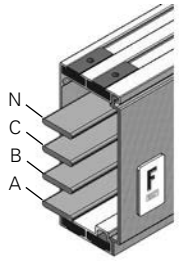
The Pow-R-Flex low-ampere busway is a three-phase design available in three-wire and four-wire configurations with integral housing, internal, and isolated internal ground options. Oversized neutral ratings are available on select current ratings. See **Table 5**.



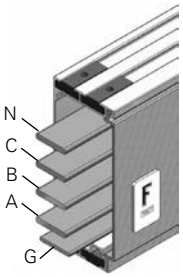
Three-wire housing ground assembly



Three-wire internal ground assembly



Four-wire housing ground assembly



Four-wire internal ground assembly

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 or aluminum 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 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 SmartBolt® or 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 inches (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

- 150–400 A aluminum
- 225–600 A 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

- 150–400 A aluminum
- 225–600 A 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

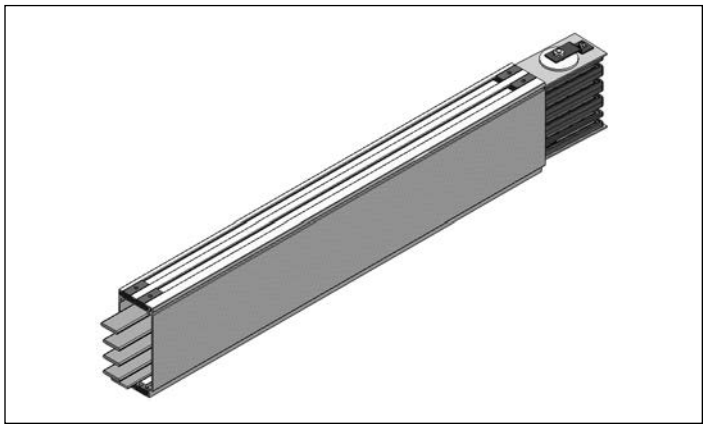


Figure 2. Feeder busway

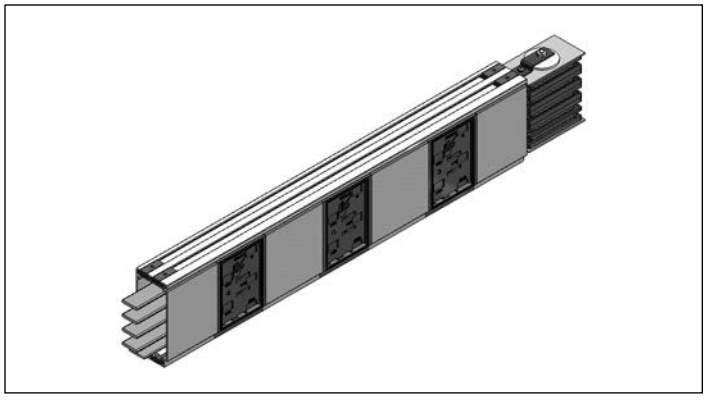


Figure 3. Plug-in busway

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 ft (30.5 m) 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 ft (30.5 m)

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 ft (30.5 m) 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 (30.5 m).

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)	3.60 x 8.30 (91.4 x 210.6)
225	0.28 x 1.25 (7.1 x 31.8)	0.20 x 1.75 (5.1 x 44.5)	3.60 x 8.30 (91.4 x 210.6)
300	0.28 x 1.25 (7.1 x 31.8)	0.20 x 1.75 (5.1 x 44.5)	3.60 x 8.30 (91.4 x 210.6)
400	0.28 x 1.75 (7.1 x 44.5)	0.20 x 1.75 (5.1 x 44.5)	3.60 x 8.30 (91.4 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)	3.60 x 8.30 (91.4 x 210.6)
400	0.28 x 1.25 (7.1 x 31.8)	0.20 x 1.75 (5.1 x 44.5)	3.60 x 8.30 (91.4 x 210.6)
500	0.28 x 1.75 (7.1 x 44.5)	0.20 x 1.75 (5.1 x 44.5)	3.60 x 8.30 (91.4 x 210.6)
600	0.28 x 1.75 (7.1 x 44.5)	0.20 x 1.75 (5.1 x 44.5)	3.60 x 8.30 (91.4 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	—

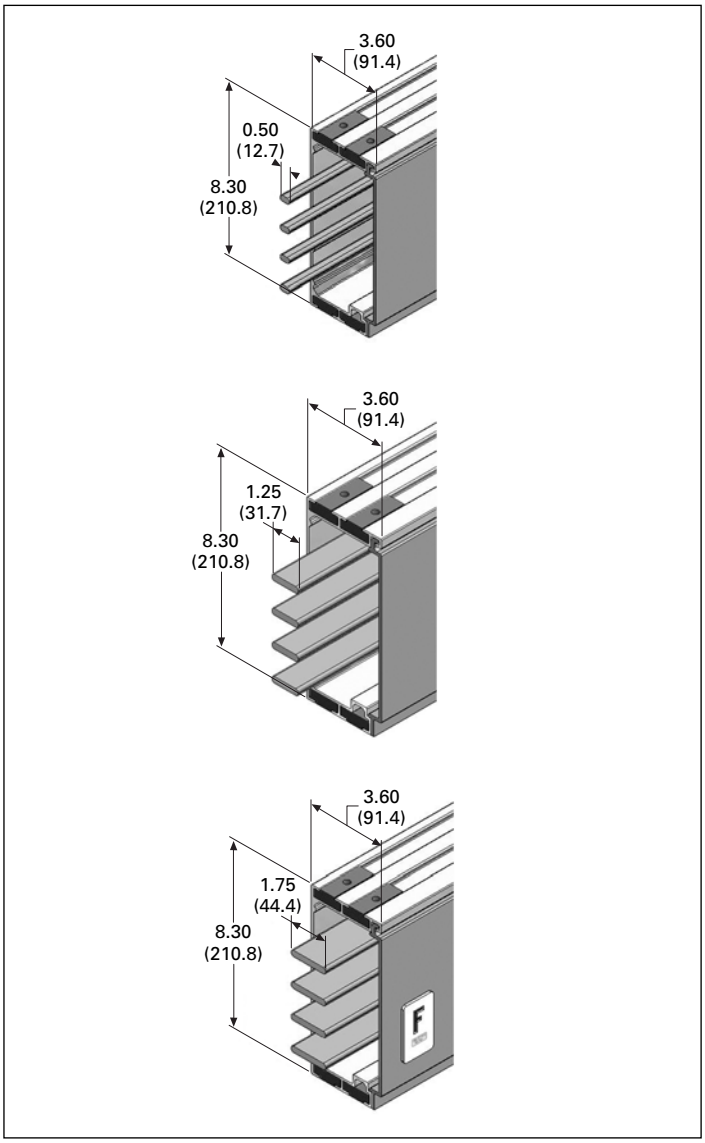


Figure 4. Conductor dimensions

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.

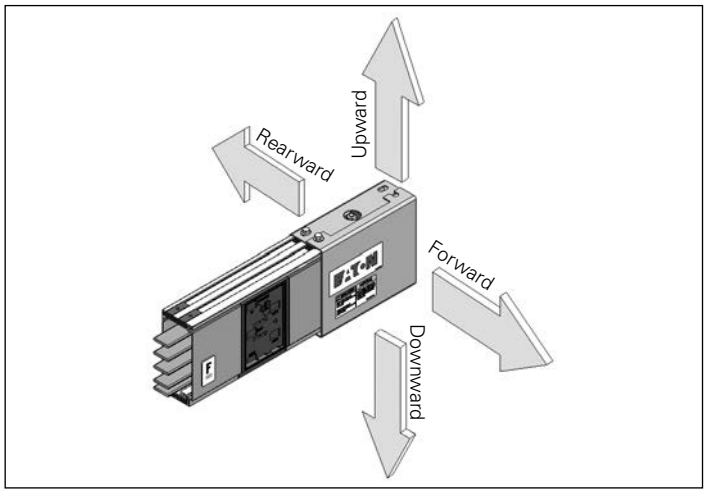


Figure 5. Busway orientation

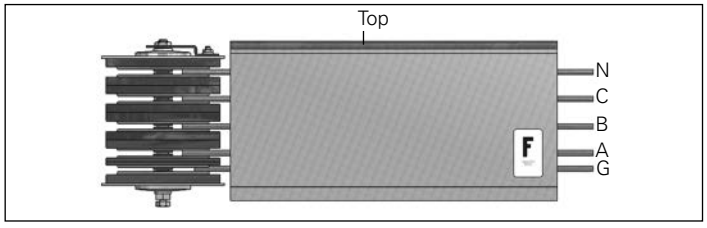


Figure 6. Busway phase sequence

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.

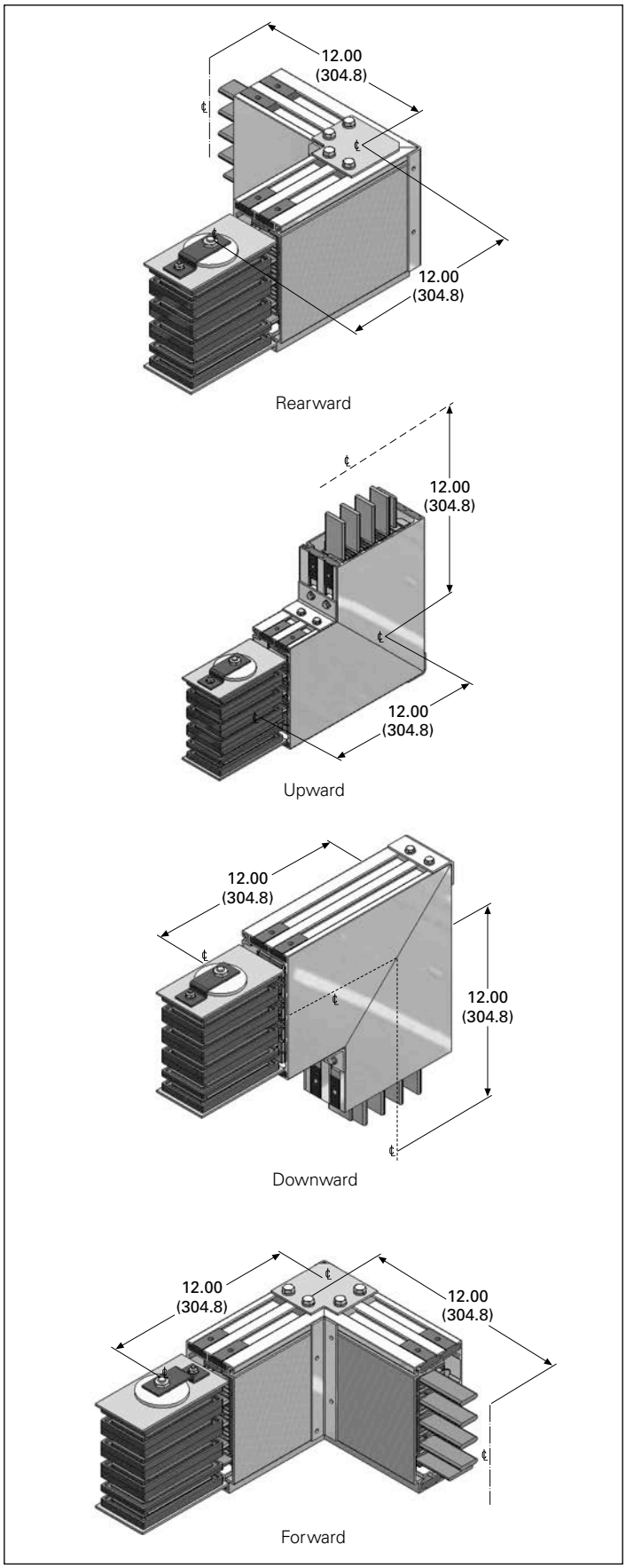


Figure 7. Traditional elbows

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.

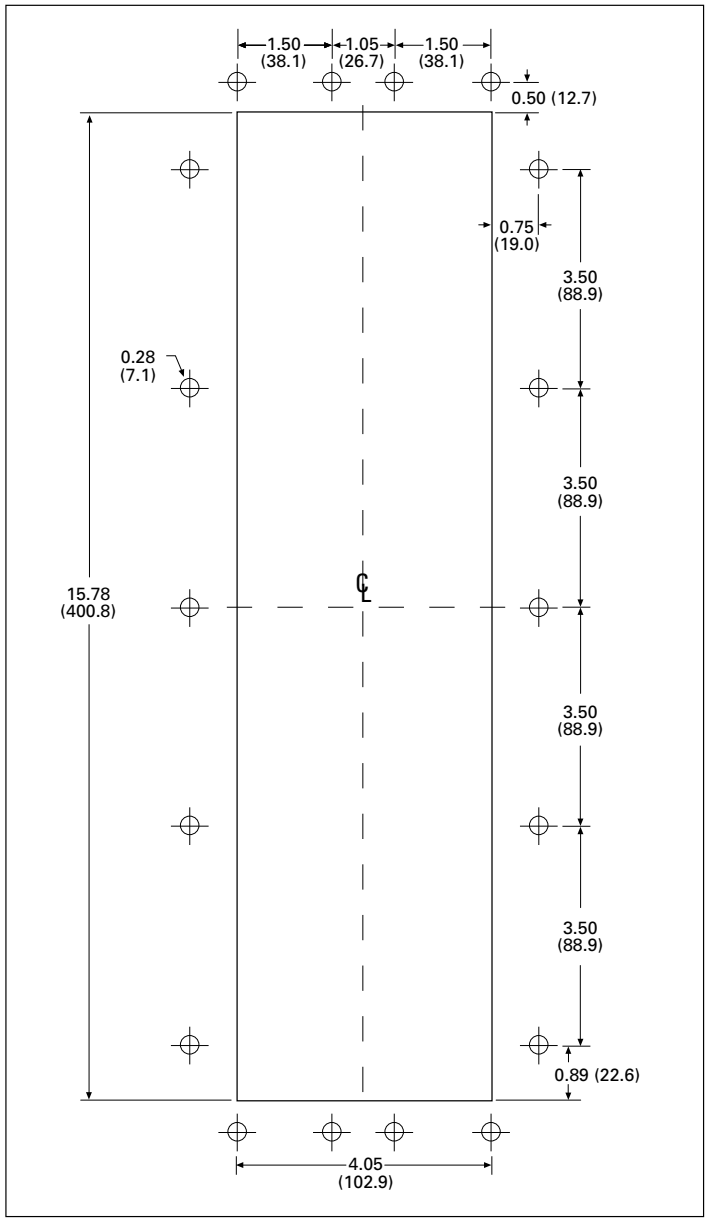


Figure 8. Flange cutout detail

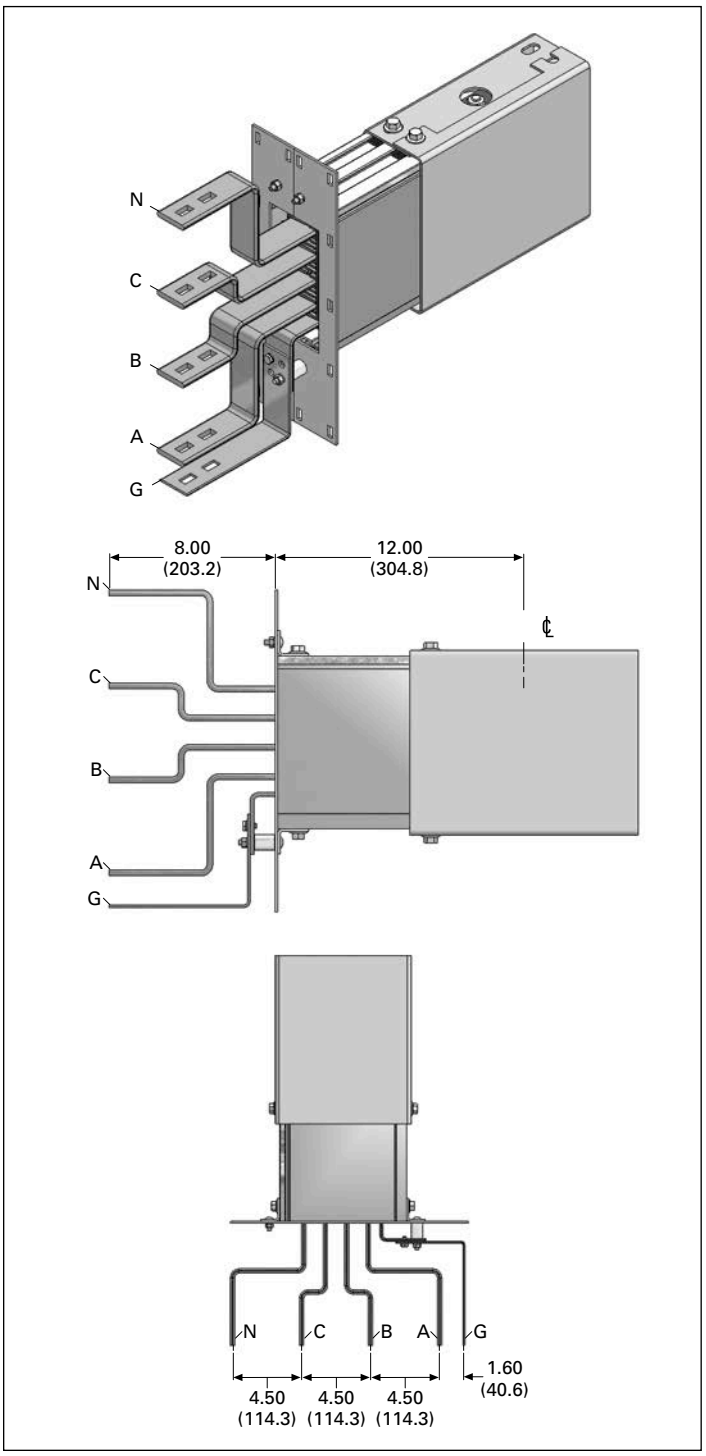


Figure 9. Standard flanges

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.

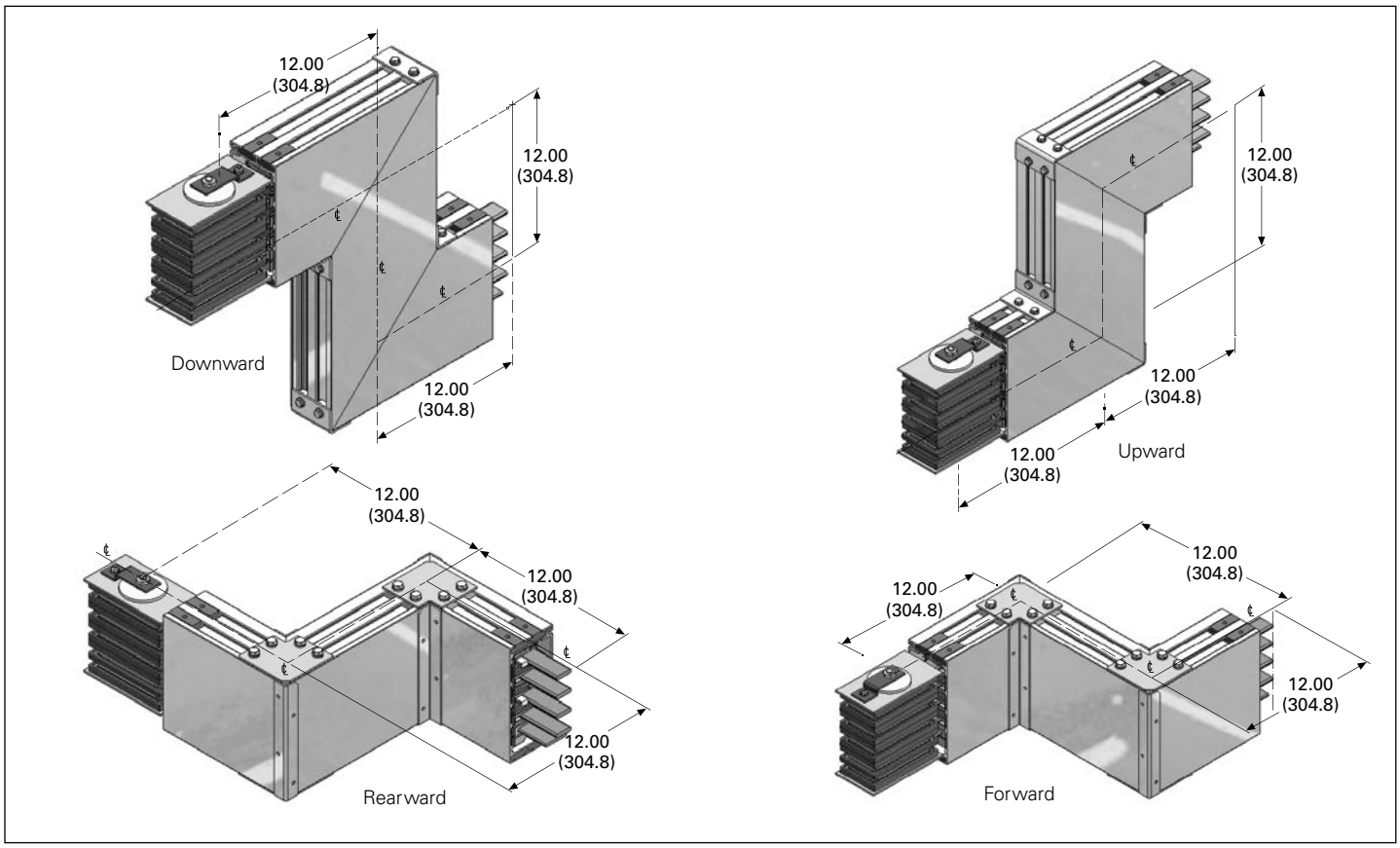


Figure 10. Offsets

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. There are two designs for end cable tap boxes. One is for a left-hand orientation and one for a right-hand orientation. The two separate designs allow for the bus to be mounted flush against the wall no matter which direction your busway is running. 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.

Table 10. Terminal conductor range

Rated current (A)	Number of lugs per phase
Copper	
225	Phase and neutral (1) #4–350 kcmil Ground (1) #8–1/0
400	Phase and neutral (2) #4–350 kcmil Ground (1) #8–1/0
500	Phase and neutral (2) #4–350 kcmil Ground (1) #8–1/0
600	Phase and neutral (2) #4–350 kcmil Ground (1) #8–1/0
Aluminum	
150	Phase and neutral(1) #4–350 kcmil Ground (1) #8–1/0
225	Phase and neutral (1) #4–350 kcmil Ground (1) #8–1/0
300	Phase and neutral (1) #4–350 kcmil Ground (1) #8–1/0
400	Phase and neutral (2) #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.

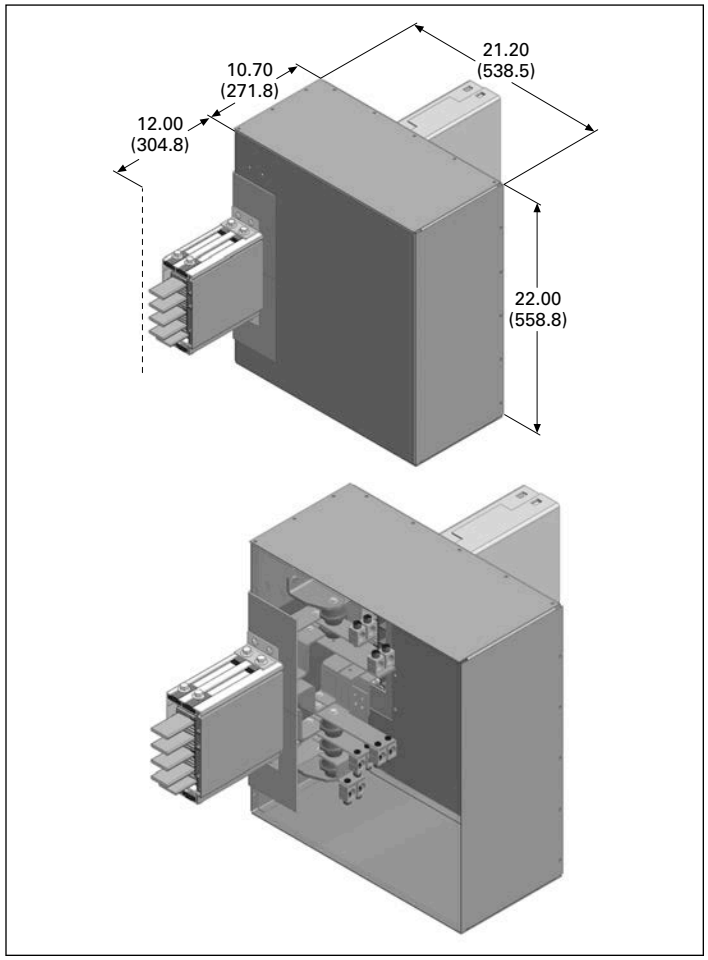


Figure 11. Center cable tap box

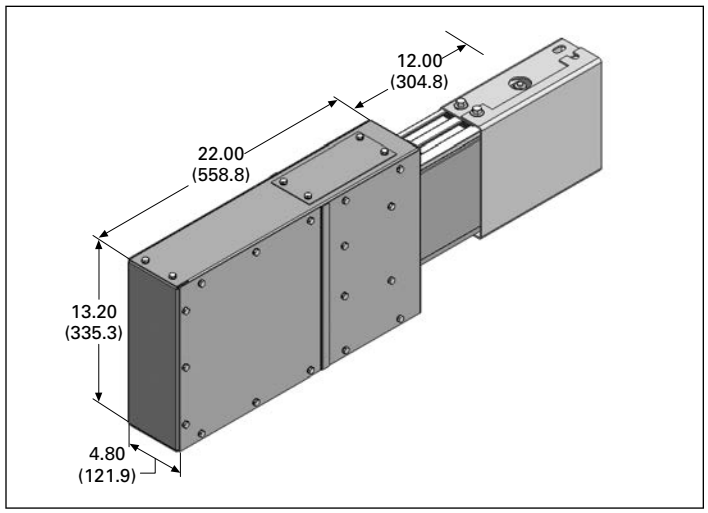


Figure 12. Left hand—end cable tap box

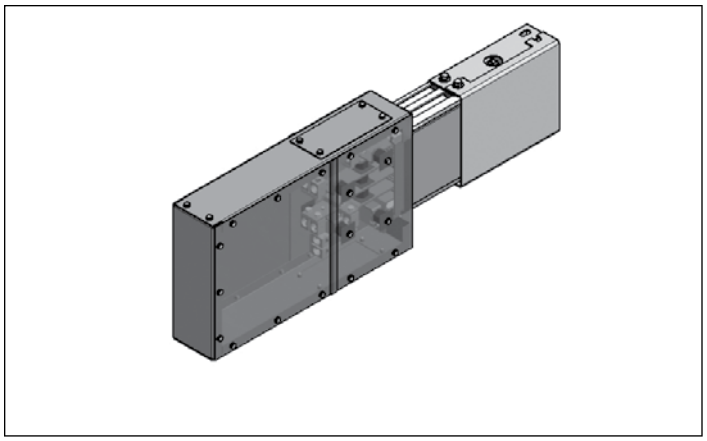


Figure 13. Left hand—end cable tap box detail view

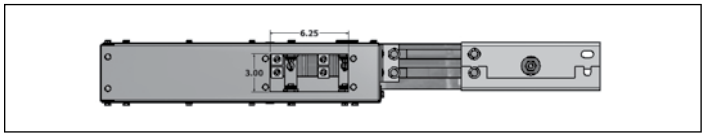


Figure 14. Left hand—tap box mechanical lug access

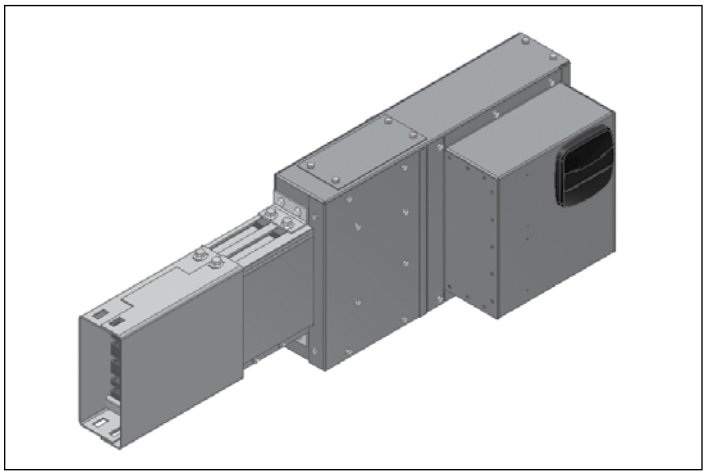


Figure 15. Right hand—end cable tap box with IQ power meter

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 11. IQ electronic power meters

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

Figure 16. IQ Meter (front)

Figure 17. IQ Power meter (rear)

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 ft (91 m) for copper and one every 225 ft (68 m) 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 18**.

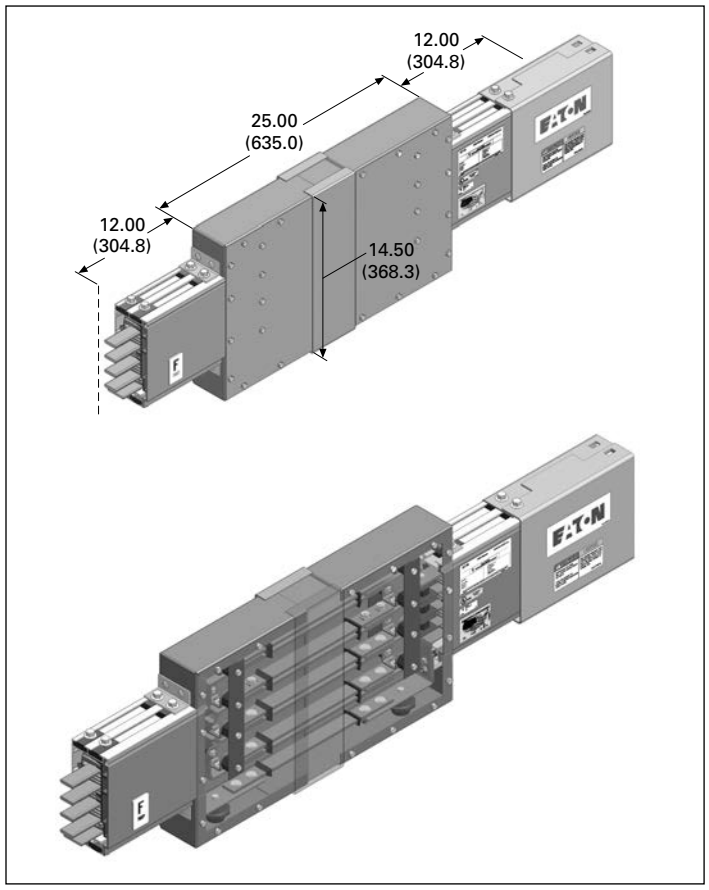


Figure 18. Expansion joint

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 **Figure 19** and **Figure 20** for minimum dimensions.

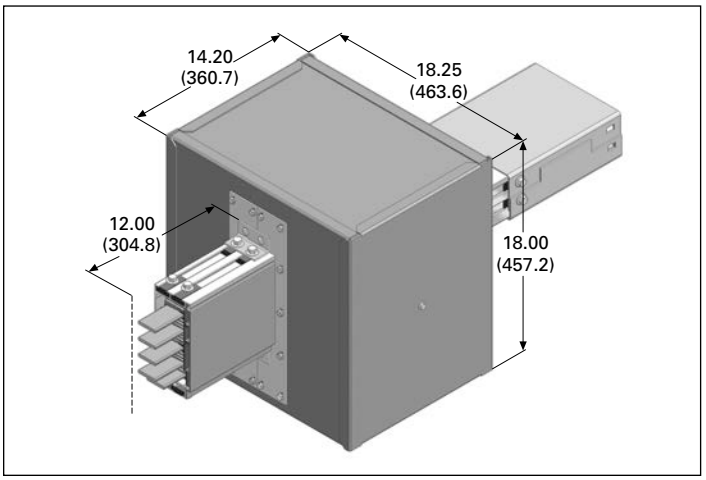


Figure 19. 90-Degree phase transposition

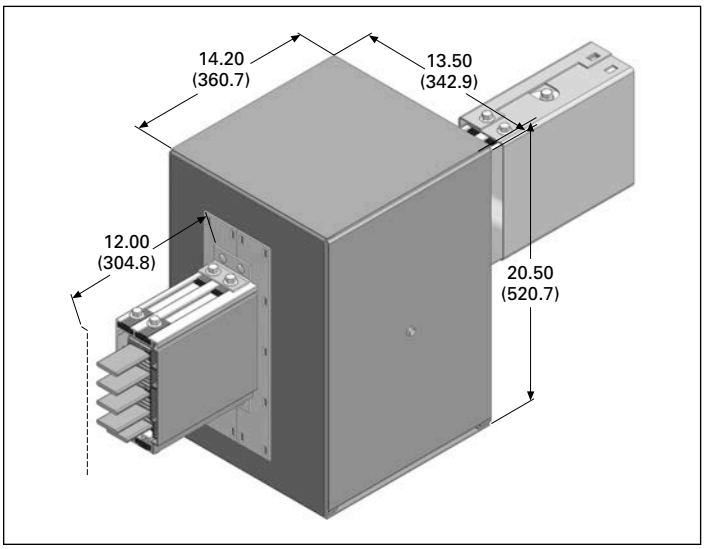


Figure 20. 180-Degree phase transposition

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 21** for minimum dimensions.

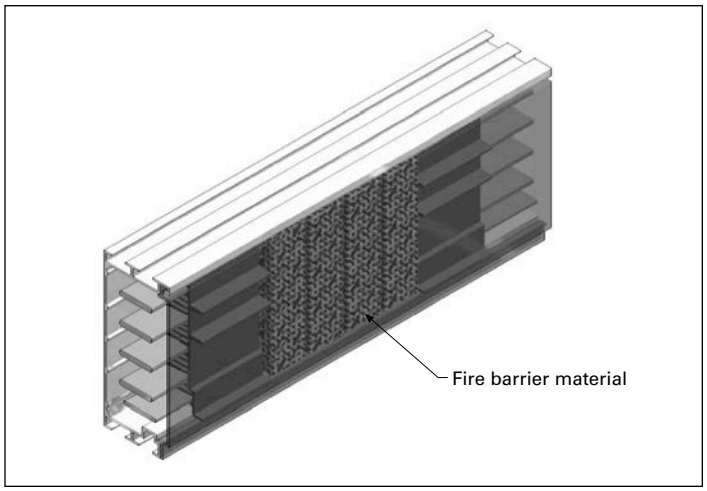


Figure 21. Vapor–fire barrier

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.

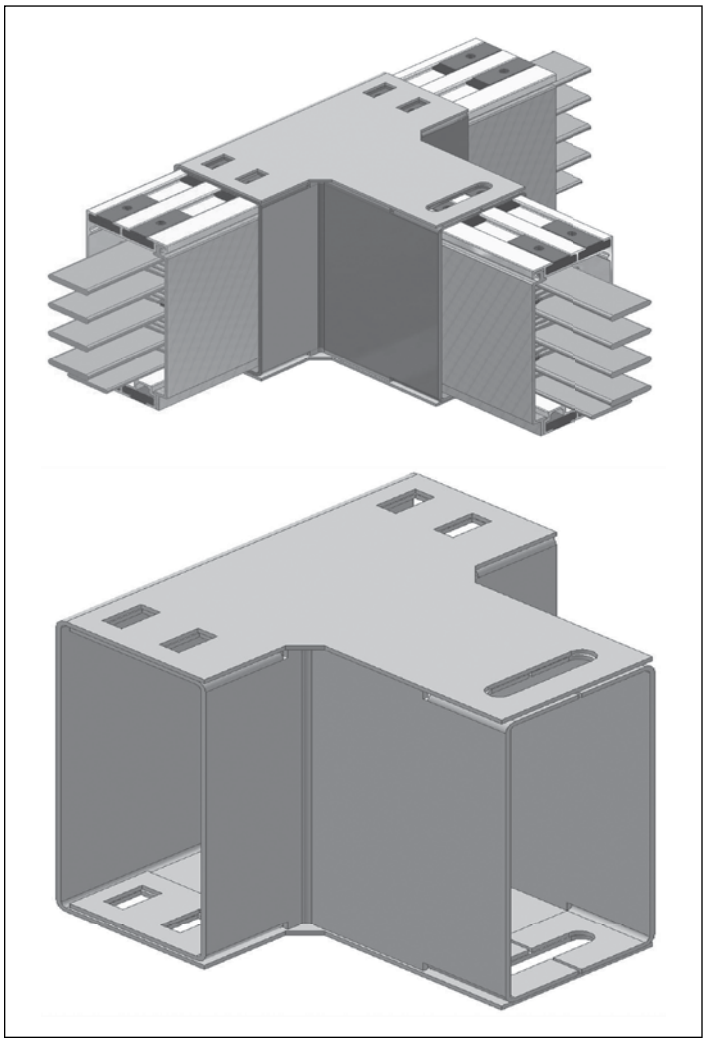


Figure 22. Horizontal tees

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 23**.

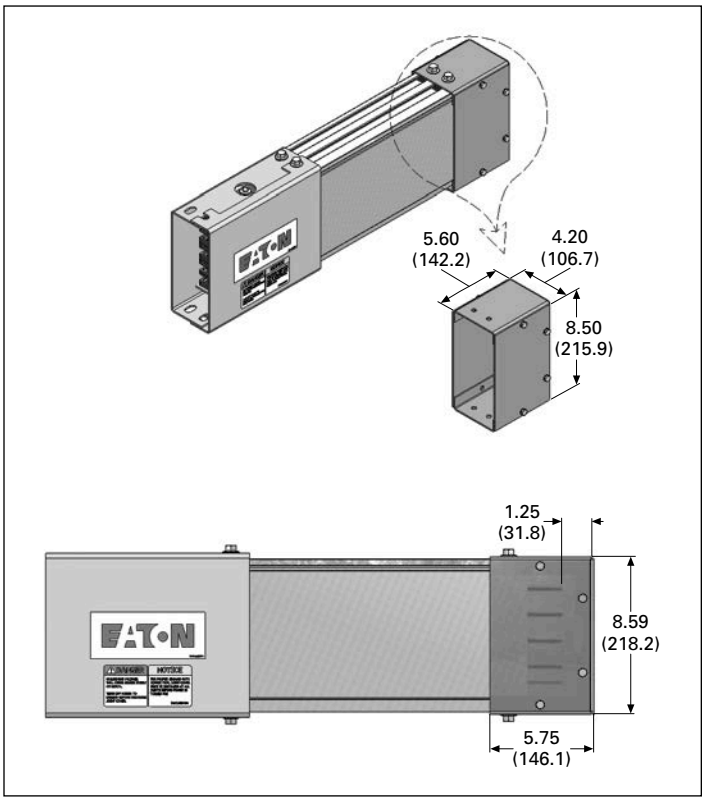


Figure 23. End closure

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 24**.

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.

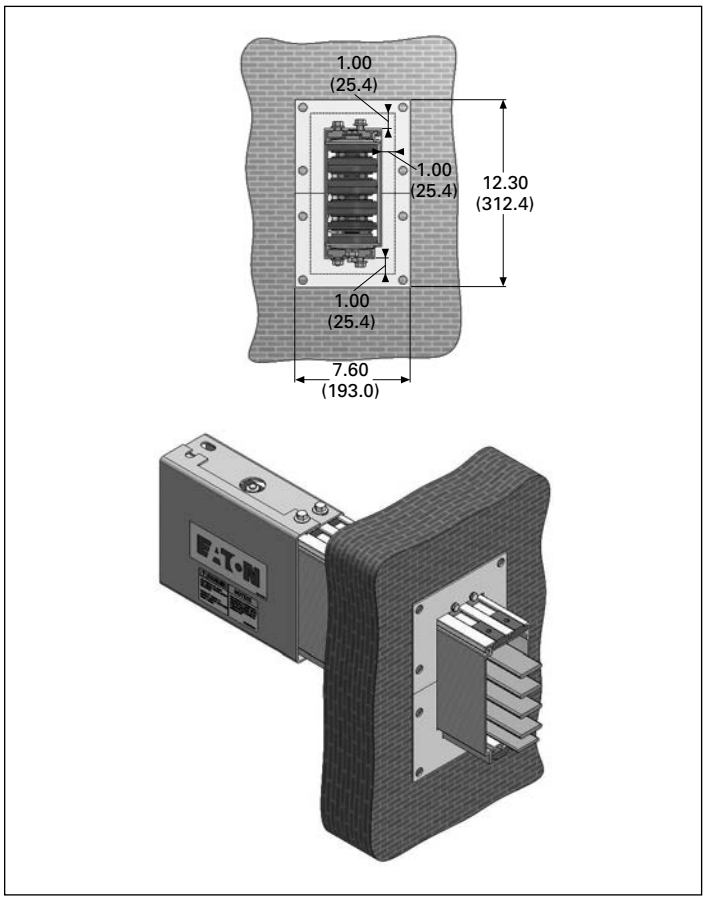


Figure 24. Wall flange

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 ft (3 m), and the busway span between hangers should not exceed 10 ft (3 m). See **Figure 25**.

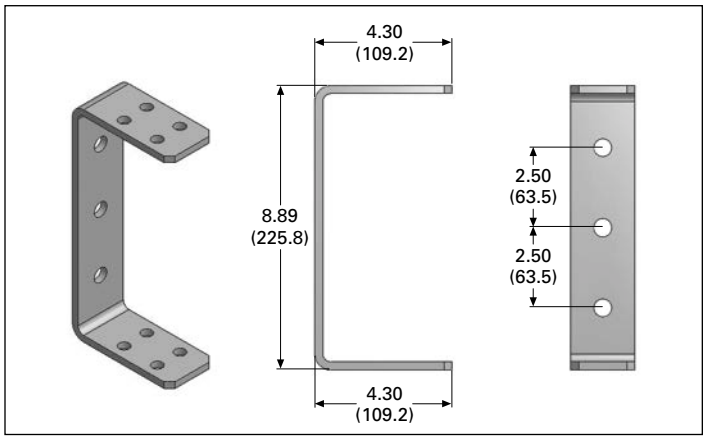


Figure 25. Type C wallmount hanger

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 ft (3 m), and the busway span between hangers should not exceed 10 ft (3 m). See **Figure 26**.

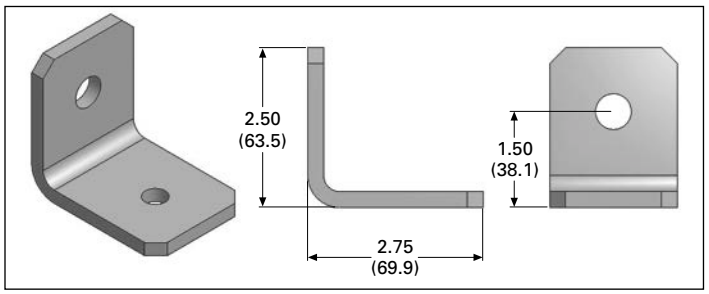


Figure 26. Type L wallmount hanger

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 ft (3 m), and the busway span between hangers should not exceed 10 ft (3 m). See **Figure 27**.

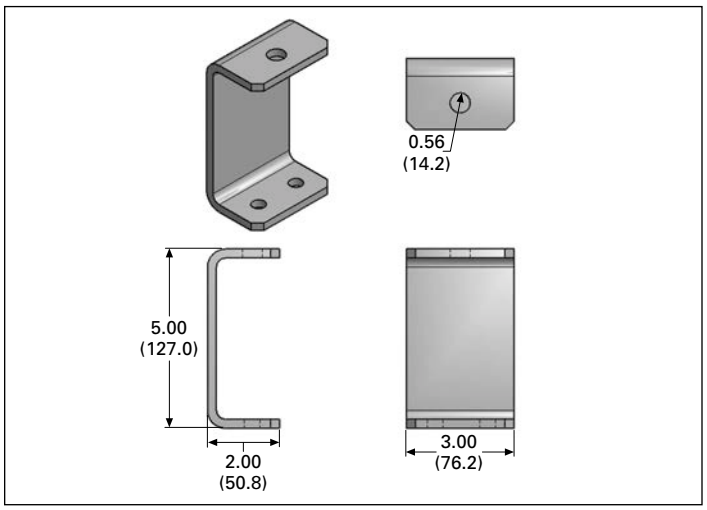


Figure 27. Single hanger

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 ft (3 m), and the busway span between hangers should not exceed 10 ft (3 m). See **Figure 28**.

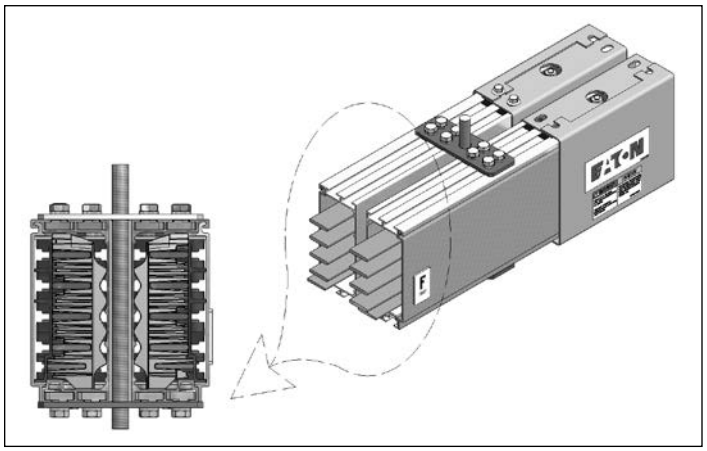


Figure 28. Back-to-back hanger

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 29**.

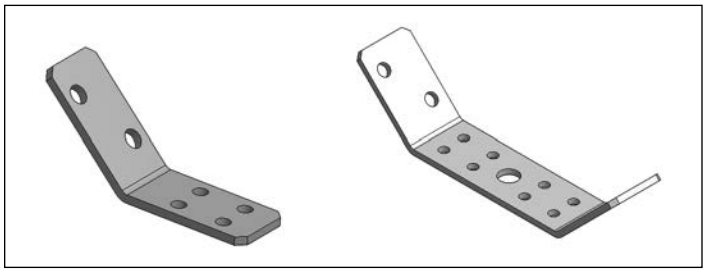


Figure 29. Sway braces

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

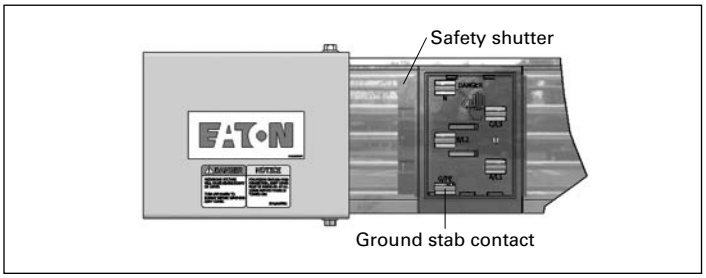


Figure 30. Plug-in outlet details

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 31**.

Table 12. Plug-in cable tap box details

Catalog number	Ampere rating	Mechanical lugs (standard)	Mechanical lugs (metric)
LAPTB100MG	100	—	—
LAPTB100MGN	100	—	—
LAPTB200MG	200	—	—
LAPTB200MGN	200	—	—

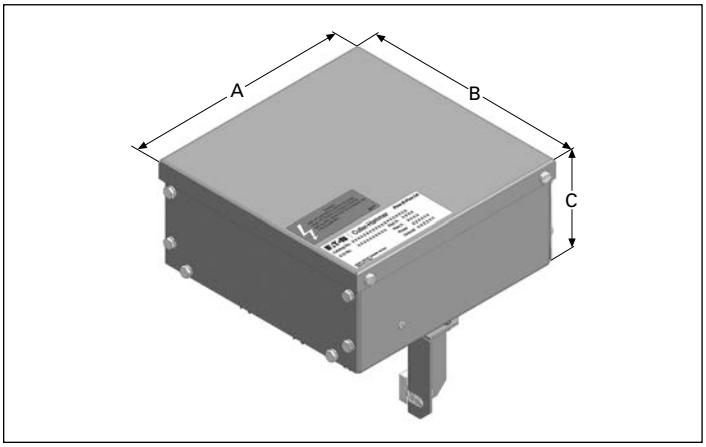


Figure 31. Plug-in cable tap box

Table 13. Plug-in cable tap box dimensions

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

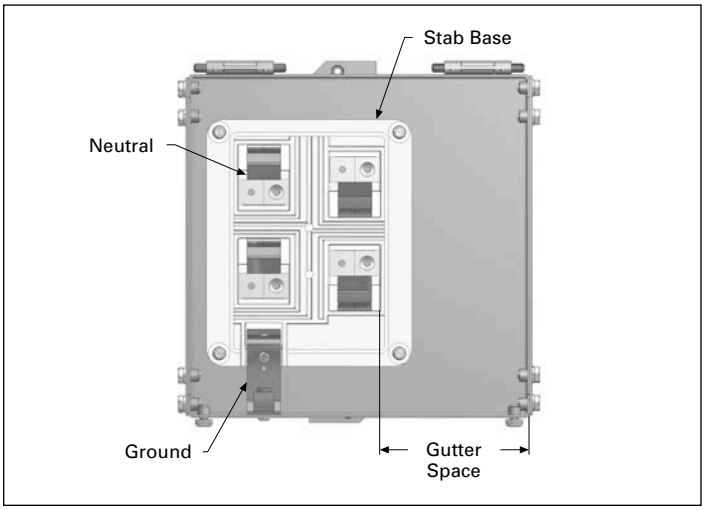


Figure 32. Plug-in cable tap box details

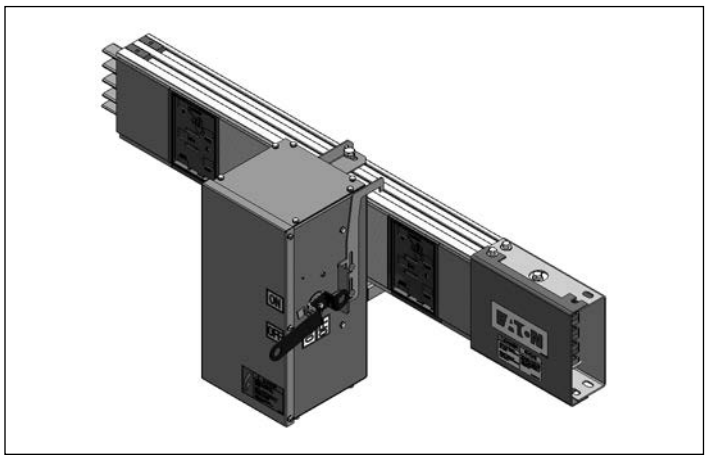


Figure 33. Plug-in device mounting

Circuit breaker plug-in units

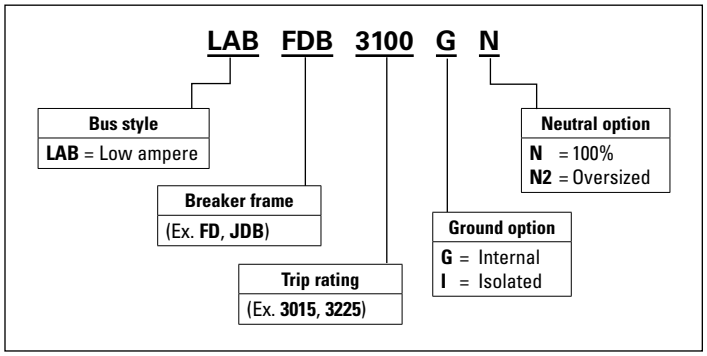
Circuit breaker plug-in units are stock and come with the circuit breaker fully installed, ready for installation and termination. All units are three-phase with three-pole Eaton Series C® molded-case circuit breakers.

Table 14. 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 15. Breaker unit catalog numbering system



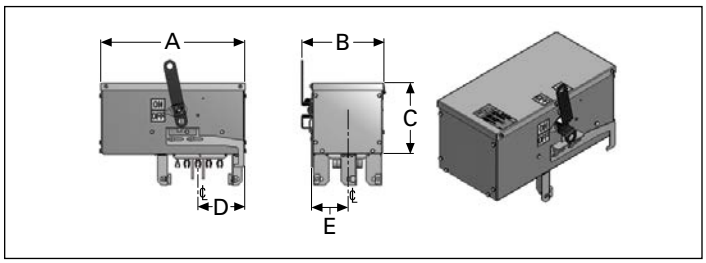


Figure 34. Circuit breaker plug-in unit dimensions

Table 16. Breaker plug-in unit dimensions

Plug-in unit	Maximum amperes	Maximum 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 17. 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

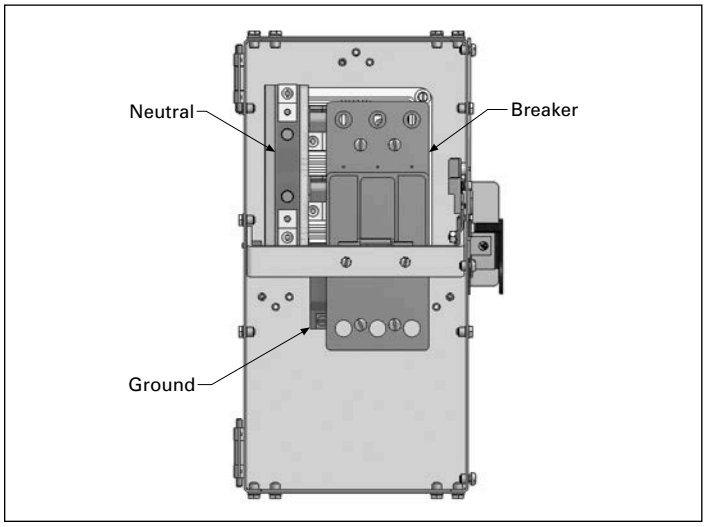


Figure 35. Circuit breaker plug-in unit details

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 varisters (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 18**.

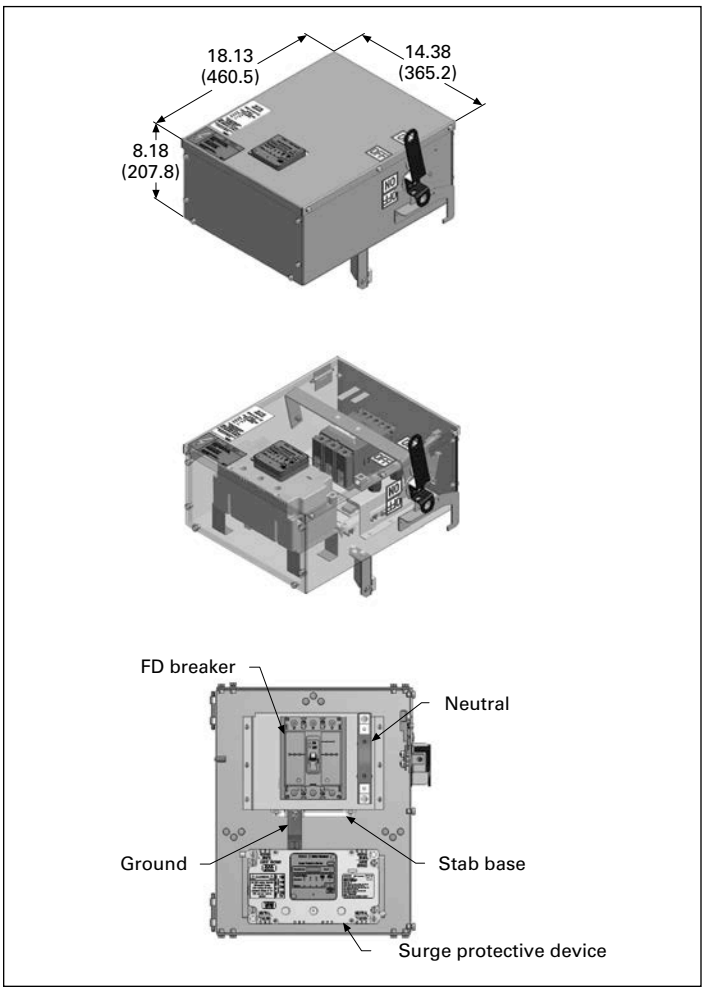


Figure 36. SPD plug-in unit

Table 18. SPD plug-in unit catalog numbering system

LABSPD 250 480Y 2 C

Fixed—do not change

Surge rating (kA/phase)
50
80
100
120
160
200
250
300
400

Voltage code
208Y = 208Y/120 V (four-wire + ground)
400Y = 400Y/230 V (four-wire + ground)
480Y = 480Y/277 V (four-wire + ground)
600Y = 600Y/347 V (four-wire + ground)
240D = 240 Delta (three-wire + ground)
480D = 240 Delta (three-wire + ground)
600D = 240 Delta (four-wire + ground)

Option code
1 = Basic—Dual-colored LED per phase to indicate protection status of the N-G mode on units with a neutral wire, single-colored LED to indicate the lack of a neutral wire connection on systems with a neutral wire.
2 = Standard—Dual-colored LED per phase to indicate protection status of the N-G mode on units with a neutral wire, single-colored LED to indicate the lack of a neutral wire connection on systems with a neutral wire, audible alarm with silence button, and Form C relay contact.
3 = Standard + Surge Counter—Dual-colored LED per phase to indicate protection status of the N-G mode on units with a neutral wire, single-colored LED to indicate the lack of a neutral wire connection on systems with a neutral wire, audible alarm with silence button, Form C relay contact, EMI/RFI filtering providing up to 50 dB of noise attenuation from 10 kHz to 100 MHz, and surge counter with reset button.

Fixed—do not change

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 19. Maximum 240 V 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 20. Maximum 400/480/600 V 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	240	60	4	Fixed/cord

Note: For receptacle options, see receptacle selection chart.

Table 21. Receptacle unit physical dimensions in inches (mm)

Plug-in unit type	Protective device	Voltage	Width	Height	Depth
Single	GHC	480	7.50 (190.5)	8.60 (218.4)	4.00 (101.6)
	FD	400	8.50 (215.9)	11.50 (292.1)	6.50 (165.1)
	FD	480	8.50 (215.9)	11.50 (292.1)	6.50 (165.1)
	CCP switch	400	7.50 (190.5)	8.60 (218.4)	4.00 (101.6)
	CCP switch	480	7.50 (190.5)	8.60 (218.4)	4.00 (101.6)
Double	GHC	480	11.80 (299.7)	8.75 (222.3)	4.00 (101.6)
	FD	400	11.00 (279.4)	12.00 (304.8)	6.40 (162.6)
	FD	480	11.00 (279.4)	12.00 (304.8)	6.40 (162.6)
	CCP switch	400	11.80 (299.7)	8.75 (222.3)	4.00 (101.6)
	CCP switch	480	11.80 (299.7)	8.75 (222.3)	4.00 (101.6)
Quad	FD	240	20.50 (520.7)	11.30 (287.0)	7.10 (180.3)
	FD	400	20.50 (520.7)	11.30 (287.0)	7.10 (180.3)
	FD	480	20.50 (520.7)	11.30 (287.0)	7.10 (180.3)

Table 22. Receptacle unit short-circuit withstand rating (rms symmetrical)

Plug-in unit type	Breaker type	240 V	400 V	480 V
Single	GHC	10,000 A	10,000 A	10,000 A
	FD ①	22,000 A	10,000 A	10,000 A
	CCP switch ②	42,000 A	42,000 A	42,000 A
Double	GHC	10,000 A	10,000 A	10,000 A
	FD ①	22,000 A	10,000 A	10,000 A
	CCP switch ②	42,000 A	42,000 A	42,000 A
Quad	GHC	10,000 A	10,000 A	10,000 A
	FD ①	22,000 A	10,000 A	10,000 A
	CCP switch ②	42,000 A	42,000 A	42,000 A

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

② The short-circuit rating of the plug-in unit will match that of the busway that it is installed.

NEMA receptacle configurations

Table 23. Straight-blade receptacles

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

① Available in a duplex configuration.

Table 24. Twist-lock receptacles

Phase	Voltage	Configuration	15 A	20 A	30 A	50 A	60 A
Single	125 V	Two-pole, three-wire, grounded	L5–15R ①	L5–20R	L5–30R	CS6360 ②	—
	250 V	Two-pole, three-wire, grounded	L6–15R ①	L6–20R	L6–30R	CS8264 ②	—
	277 V	Two-pole, three-wire, grounded	L7-15R	L7–20R	L7–30R	—	—
	480 V	Two-pole, three-wire, grounded	—	L8–20R	L8–30R	—	—
Three	250 V	Three-pole, four-wire, grounded	—	L15–20R	L15–30R	CS8364 ②	—
	208/120 V	Three-pole, five-wire, grounded	—	L21–20R	L21–30R	—	—
	480/277 V	Three-pole, five-wire, grounded	—	L22–20R	L22–30R	—	—

① Available in a duplex configuration.

② California standard receptacles.

Table 25. Pin and sleeve connectors (UL and IEC 309)

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

Notes: For other receptacle options, contact the factory.
480/277 V receptacles may be applied at 400/230 V.

Single receptacle unit (480 V maximum)

The single receptacle unit shown in **Figure 37** is configured to order based upon the receptacle type and rating. These units are three-phase and can service single- or three-phase loads, 120 V, 240 V, 208/120 V, 400/230 V, and 480/277 V. They use Type GHC Series C molded-case breaker (10 kAIC), single-, two-, 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 38**. Cord drop lengths may be 1–15 ft in one-ft increments. Consult NEC® Sections 368, 400, and 645 for cord drop applications.

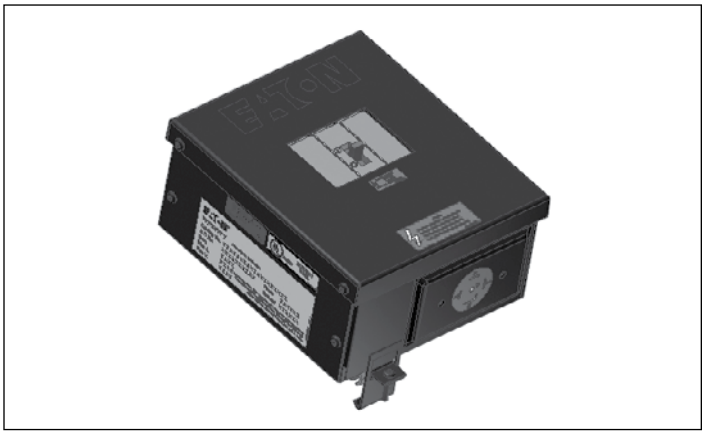


Figure 37. Single receptacle unit (enclosure mounted)

Figure 38. Single receptacle unit (cord mounted)

Double receptacle unit (480 V maximum)

The double receptacle unit shown in **Figure 39** is configured to order based upon each receptacle type and rating. These units are three-phase and can service single- or three-phase loads, 120 V, 240 V , and 208/120 V, 400/230 V, and 480/277 V. They use Type GHC Series C molded-case breaker (10 kAIC), single-, two-, 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 40**. Cord drop lengths may be 1–15 ft in one-ft increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.

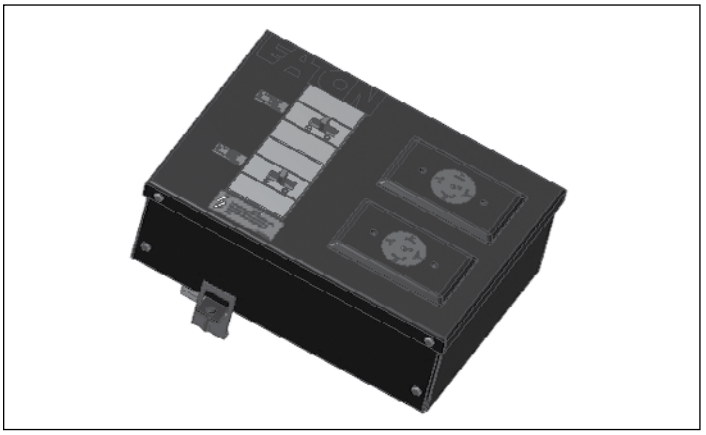


Figure 39. Double receptacle unit (enclosure mounted)

Figure 40. Double receptacle unit (cord mounted)

Single receptacle unit (600 V maximum)

The single receptacle unit shown in **Figure 41** 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 600 V maximum (120 V, 240 V, 400 V, 480 V, 600 V, 208Y/120 V, 400/230 V, 480/277 V, 600/347 V). They use the compact circuit protector (CCP switch) and CUBEFuse® ①, which can be rated to match the busway that it is being installed on (see **Table 2** on **page 4** for details). It can be used in a single-, two-, or three-pole fusible switch configuration. Each unit comes with one receptacle, with the switch 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 42**. Cord drop lengths may be 1–15 ft in one-ft increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.

① Information on CUBEFuse can be found on **page 21.**

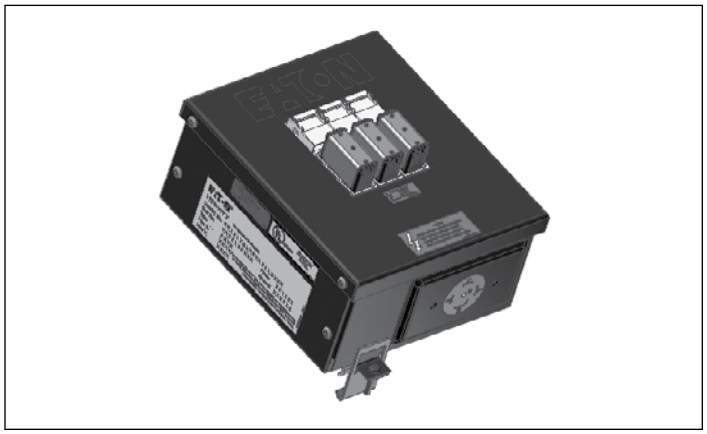


Figure 41. Single receptacle unit (enclosure mounted)

Figure 42. Single receptacle unit (cord mounted)

Double receptacle unit (600 V maximum)

The double receptacle unit shown in **Figure 43** 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 600 V maximum (120 V, 240 V, 400 V, 480 V, 600 V, 208Y/120 V, 400/230 V, 480/277 V, 600/347 V). They use the compact circuit protector (CCP switch) and CUBEFuse ①, which can be rated to match the busway that it is being installed on (see **Table 2** on **page 4** for details). It can be used in a single-, two-, or three-pole fusible switch configuration. Each unit comes with one receptacle, with the switch 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 44**. Cord drop lengths may be 1–15 ft in one-ft increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.

Figure 43. Double receptacle unit (enclosure mounted)

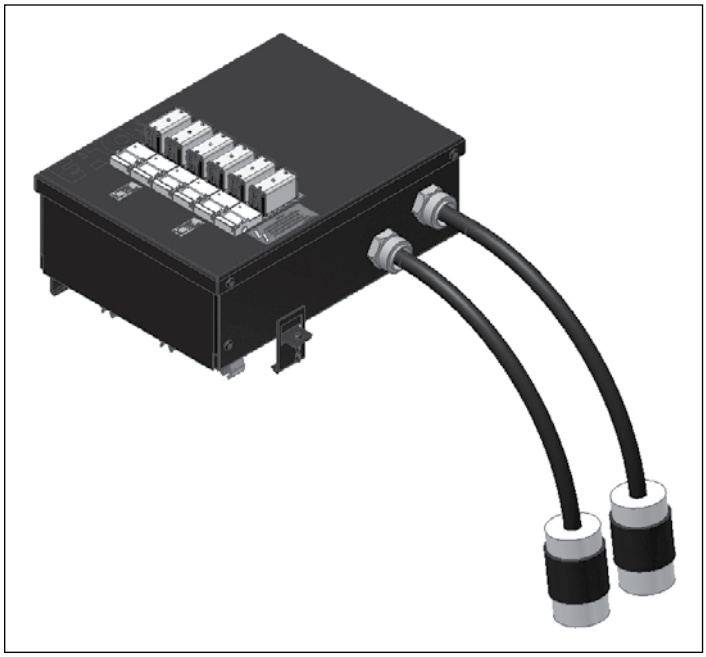


Figure 44. Double receptacle unit (cord mounted)

CUBEFuse

The innovative CUBEFuse is available in ampere ratings up to 60 A installed in Pow-R-Flex receptacle plugs. These fuses allow the bus plug to match the short-circuit rating of the bus system that they are installed on. These fuses have been available for over a decade and have the smallest footprint in the industry as well as being finger-safe. The CUBEFuse is available in a time-delay version (TCF), which has a 600 Vac rating and a fast-acting (non-time-delay) (FCF), which also has a 600 Vac rating. Both CUBEFuse versions are very current limiting, resulting in excellent equipment short-circuit protection and arc flash incident energy mitigation. The TCF fuse is available in an on-board indicating version and a non-indicating version. The FCF is available in a non-indicating version.

Features and benefits

- The world's first finger-safe power fuse system
- Meets Class J time-delay electrical performance requirements
- Faster response to damaging faults to help reduce destructive thermal and magnetic forces
- No venting of arc or molten gases during opening
- Low let-through currents under fault conditions
- Easy selective coordination with any other Eaton Bussmann® Low-Peak® Class L, J, and RK1 fuse with simple 2:1 amp ratio between upstream and downstream fuses

Figure 45. CUBEFuse

Table 26. CUBEFuse catalog numbers (ampere rating)

Catalog number					
Indicating					
TCF6	**TCF10**	**TCF15**	**TCF17-1/2**	**TCF20**	**TCF25**
TCF30	**TCF35**	**TCF40**	**TCF45**	**TCF50**	**TCF60**
TCF70	**TCF80**	**TCF90**	**TCF100**	—	—
Non-indicating					
TCF1RN	**TCF3RN**	**TCF6RN**	**TCF10RN**	**TCF15RN**	**TCF17-1/2RN**
TCF20RN	**TCF25RN**	**TCF30RN**	**TCF35RN**	**TCF40RN**	**TCF45RN**
TCF50RN	**TCF60RN**	**TCF70RN**	**TCF80RN**	**TCF90RN**	**TCF100RN**

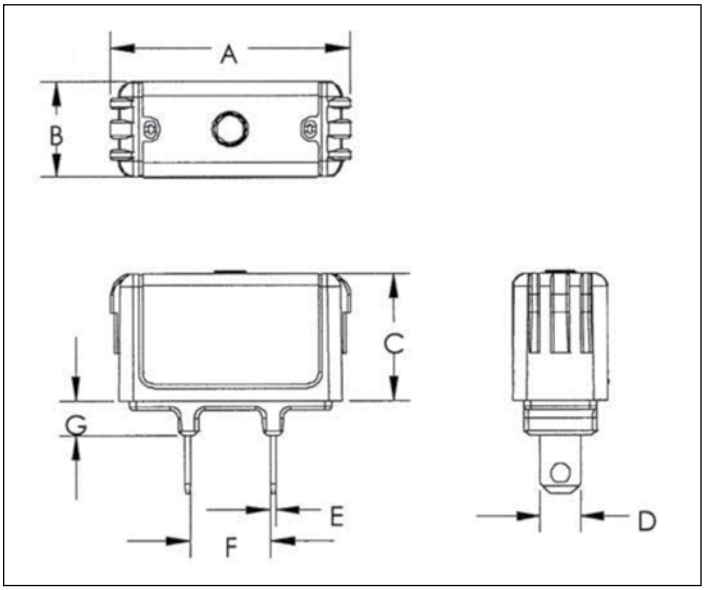


Figure 46. CUBEFuse dimensions

Table 27. CUBEFuse dimensions in inches (mm)

Fuse amperes	A	B	C	D	E	F	G
1–15	1.88 (47.8)	0.75 (19.1)	1.00 (25.4)	0.23 (5.8)	0.04 (1.0)	0.63 (16.0)	0.27 (6.9)
17.5–20	1.88 (47.8)	0.75) (19.1)	1.00 (25.4)	0.27 (6.9)	0.04 (1.0)	0.63 (16.0)	0.27 (6.9)
25–30	1.88 (47.8)	0.75 (19.1)	1.00 (25.4)	0.31 (8.0)	0.04 (1.0)	0.63 (16.0)	0.27 (6.9)
35–40	2.13 (54.1)	1.00 (25.4)	1.13 (28.7)	0.36 (9.1)	0.04 (1.0)	0.63 (16.0)	0.38 (9.7)
45–50	2.13 (54.1)	1.00 (25.4)	1.13 (28.7)	0.40 (10.2)	0.04 (1.0)	0.63 (16.0)	0.38 (9.7)
60	2.13 (54.1)	1.00 (25.4)	1.13 (28.7)	0.44 (11.2)	0.04 (1.0)	0.63 (16.0)	0.38 (9.7)

Single receptacle unit (600 V maximum)

The single receptacle unit shown in **Figure 47** 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 600 V maximum (120 V, 240 V, 400 V, 480 V, 600 V, 208Y/120 V, 400/230 V, 480/277 V, 600/347 V). 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 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 48**. Cord drop lengths may be 1–15 ft in one-ft increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.

Figure 47. Single receptacle unit (enclosure mounted)

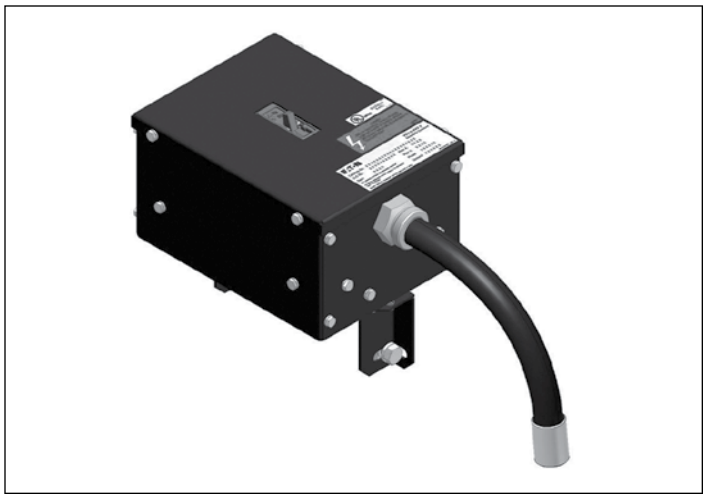


Figure 48. Single receptacle unit (cord mounted)

Double receptacle unit (600 V maximum)

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 600 V maximum (120 V, 240 V, 400 V, 480 V, 600 V, 208Y/120 V, 400/230 V, 480/277 V, 600/347 V). 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 50**. Cord drop lengths may be 1–15 ft in one-ft increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.

Figure 49. Double receptacle unit (enclosure mounted)

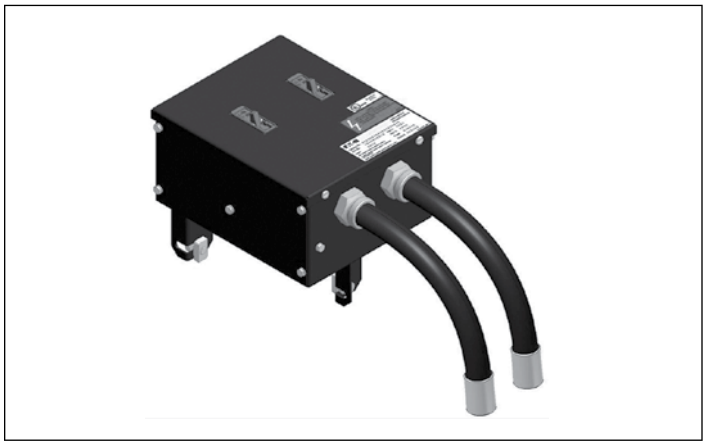


Figure 50. Double receptacle unit (cord mounted)

Quad receptacle units (600 V maximum)

The quad receptacle unit shown in **Figure 51** 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 600 V maximum (120 V, 240 V, 400 V, 480 V, 600 V, 208Y/120 V, 400/230 V, 480/277 V, 600/347 V). 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 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 51**. Cord drop lengths may be 1–15 ft in one-ft increments. Consult NEC Sections 368, 400, and 645 for cord drop applications.

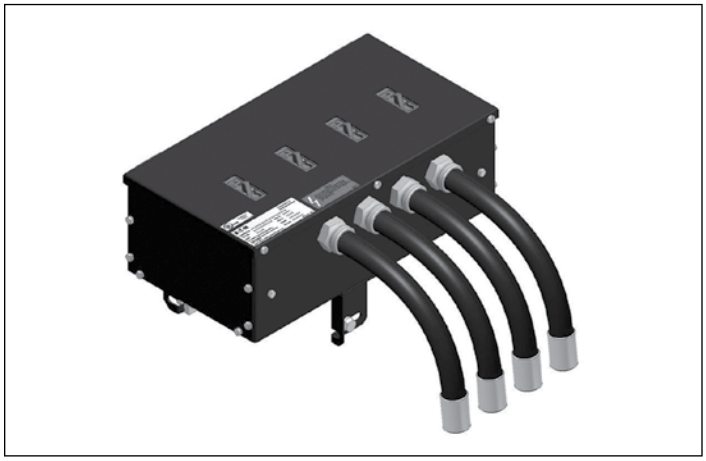
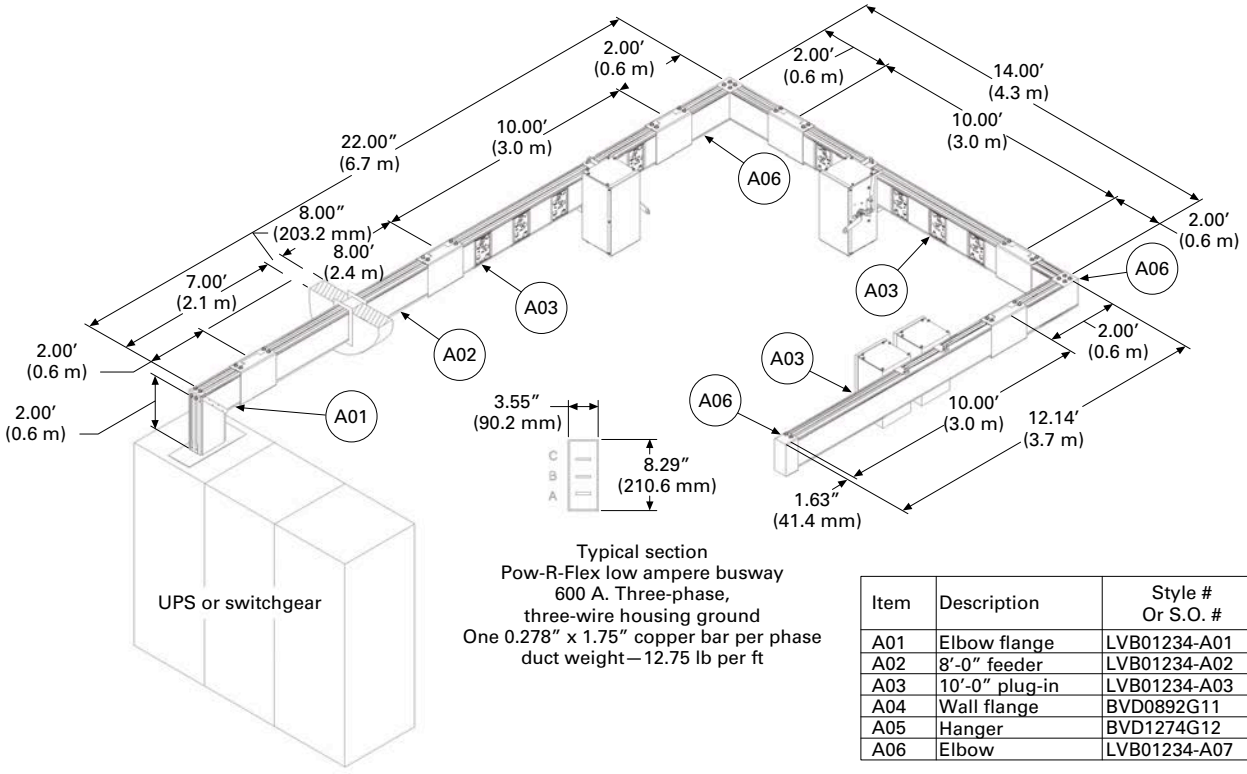


Figure 51. Quad receptacle unit (cord mounted)

Installation drawing information



Typical section
Pow-R-Flex low ampere busway
600 A. Three-phase,
three-wire housing ground
One 0.278″ x 1.75″ copper bar per phase
duct weight—12.75 lb per ft

Item	Description	Style # Or S.O. #	Req.
A01	Elbow flange	LVB01234-A01	1
A02	8′-0″ feeder	LVB01234-A02	1
A03	10′-0″ plug-in	LVB01234-A03	3
A04	Wall flange	BVD0892G11	2
A05	Hanger	BVD1274G12	8
A06	Elbow	LVB01234-A07	2

Figure 52. 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 52**. 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 ft) 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

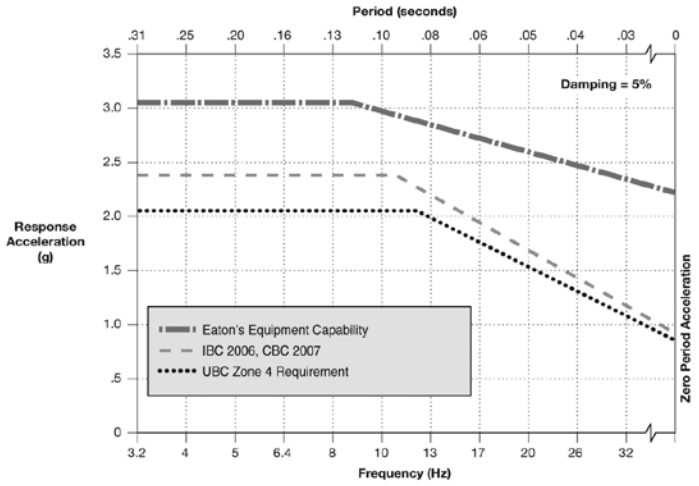
The installer should review the installation drawings prior to and during the installation process. Please note that plug-in units are generally not shown on the installation drawings. The installer will also receive installation instruction leaflets and operation and maintenance manuals with the drawings.

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.

Pow-R-Flex™ Low Voltage Busway



The frequency sweep tests revealed that the lowest equipment natural frequency is:

N/A Hz*

*Busway is rigid — hanging system is flexible.

3RD PARTY TEST ENGINEER IN CHARGE

Nathan Glenn, PE
Westinghouse Electric Company, LLC

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

Powering Business Worldwide

For interpretation of testing data refer to Eaton Publication SA12501SE

Drawing Number PU01700001E

Figure 53. Test certificate of seismic withstand capability

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 225 A 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 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

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 three-cycle short-circuit rating of 22 kA rms symmetrical for 225 A ratings, 35 kA rms symmetrical for 400 A ratings, 42 kA rms symmetrical for 500 and 600 A ratings.
C. Aluminum busway shall have a minimum of three-cycle short-circuit rating of 22 kA rms symmetrical for 150 A ratings, 35 kA rms symmetrical for 225 A ratings, 42 kA rms symmetrical for 300 and 400 A ratings.

2.03 CONSTRUCTION

A. The busway and associated fittings shall consist of copper or aluminum conductors totally enclosed, non-ventilated, two-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-ft sections with special sections and fittings provided to suit the installation. Horizontal runs shall be suitable for hanging on 10-ft maximum centers. Provide one hanger for every ten (10) ft 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 a tension-indicating SmartBolt and Belleville washer except for 150 A Al and 225 A Cu, which will utilize the traditional double-headed torque-indicating bolt. The bridge joint shall utilize 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 internal tension. 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 two-piece design fabricated from extruded aluminum. The two-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-ft 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 plug-in opening outlets per ten ft 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 utilized 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.

2.08 CIRCUIT BREAKER TYPE PLUG-IN DEVICES

A. Where required, plug-in units of the types and ratings indicated on the plans and specifications shall be supplied. 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 busbars. All 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.
B. All plug-in unit types and ratings must be fully interchangeable for use on all busway ampere ratings.

C. 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.

2.09 PLUG-IN DEVICES WITH RECEPTACLES

A. Where required, plug-in units of the types and ratings indicated on the plans and the specifications shall be supplied. 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 busbars. All 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 the 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 a chain. All plug-in units shall be interchangeable without alteration or modification of plug-in duct.

B. All plug-in unit types and ratings must be fully interchangeable for use on all busway ampere ratings.

C. Receptacle type plugs shall have fused or circuit breaker over-current protection. Circuit breakers shall be plug-on or bolt-on type with an interrupting rating of 10 kA or 22 kA three-phase at 240 V, 25 kA single-phase at 240 V, 10 kA at 400 V and 480 V, and 10 kA at 600 V. Fused switches will have an interrupting rating that matches that of the busway it is attached to and shall limit the let-through current from the plug through the receptacle to less than 10 kA IR. All fault current ratings shall be symmetrical rms amperes. Circuit breakers and fusible switches 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 240 V or 10 kA at 400 V, and/or 480 V, the connector/receptacle and breaker combination must be tested to UL 231 and be UL approved.

2.10 SURGE SUPPRESSION DEVICES

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

2.11 END CABLE TAP BOXES

A. End cable tap boxes shall be configured to accept up to two 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.

2.12 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 electron 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 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 ft for copper conductors and 225 ft 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 year from the date of installation of the product or 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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