

(D) Overcurrent Protection. Tap connections from conductors in auxiliary gutters shall be provided with overcurrent protection as required in 240.21.

366.58 Insulated Conductors.

(A) Deflected Insulated Conductors. Where insulated conductors are deflected within an auxiliary gutter, either at the ends or where conduits, fittings, or other raceways or cables enter or leave the gutter, or where the direction of the gutter is deflected greater than 30 degrees, dimensions corresponding to one wire per terminal in Table 312.6(A) shall apply.

(B) Auxiliary Gutters Used as Pull Boxes. Where insulated conductors 4 AWG or larger are pulled through an auxiliary gutter, the distance between raceway and cable entries enclosing the same conductor shall not be less than that required in 314.28(A) (1) for straight pulls and 314.28(A)(2) for angle pulls.

366.60 Grounding. Metal auxiliary gutters shall be connected to an equipment grounding conductor(s), to an equipment bonding jumper, or to the grounded conductor where permitted or required by 250.92(B)(1) or 250.142.

Part III. Construction Specifications

366.100 Construction.

(A) Electrical and Mechanical Continuity. Gutters shall be constructed and installed so that adequate electrical and mechanical continuity of the complete system is secured.

(B) Substantial Construction. Gutters shall be of substantial construction and shall provide a complete enclosure for the contained conductors. All surfaces, both interior and exterior, shall be suitably protected from corrosion. Corner joints shall be made tight, and where the assembly is held together by rivets, bolts, or screws, such fasteners shall be spaced not more than 300 mm (12 in.) apart.

(C) Smooth Rounded Edges. Suitable bushings, shields, or fittings having smooth, rounded edges shall be provided where conductors pass between gutters, through partitions, around bends, between gutters and cabinets or junction boxes, and at other locations where necessary to prevent abrasion of the insulation of the conductors.

(D) Covers. Covers shall be securely fastened to the gutter.

(E) Clearance of Bare Live Parts. Bare conductors shall be securely and rigidly supported so that the minimum clearance between bare current-carrying metal parts of different voltages mounted on the same surface will not be less than 50 mm (2 in.), nor less than 25 mm (1 in.) for parts that are held free in the air. A clearance not less than 25 mm (1 in.) shall be secured between bare current-carrying metal parts and any metal surface. Adequate provisions shall be made for the expansion and contraction of busbars.

366.120 Marking.

(A) Outdoors. Nonmetallic auxiliary gutters installed outdoors shall have the following markings:

- (1) Suitable for exposure to sunlight
- (2) Suitable for use in wet locations
- (3) Installed conductor insulation temperature rating

(B) Indoors. Nonmetallic auxiliary gutters installed indoors shall be marked with the installed conductor insulation temperature rating.

ARTICLE

368

Busways

Part I. General

368.1 Scope. This article covers service-entrance, feeder, and branch-circuit busways and associated fittings.

Exhibit 368.1 illustrates a section of busway with a plug-in device covered by this article. Busway of this type typically is used as a feeder to supply other feeders or to supply branch circuits for utilization equipment. The plug-in devices provide the means to connect feeders and branch circuits to the busway and contain the overcurrent protection for the connected feeder or branch circuit.

In addition to the power distribution busway illustrated in Exhibit 368.1, there are four special application busway designs covered by UL 857, *Standard for Safety for Busways*:

1. Lighting busway, with a maximum current rating of 50 amperes, supplies and supports industrial and commercial luminaires.
2. Trolley busway allows continuous contact with a trolley through a slot in the enclosure and might be marked as "Lighting Busway" if intended for use with industrial and commercial luminaires.
3. Continuous plug-in busway allows for the insertion of plug-in devices at any point along its length. This busway, limited to a maximum current rating of 225 amperes, is intended for general use and is permitted to be installed within reach of persons.
4. Short-run busway is intended primarily to feed switchboards and is limited to a run of 30 feet horizontal or 10 feet vertical.

Part II. Installation

368.10 Uses Permitted. Busways shall be permitted to be installed where they are located in accordance with 368.10(A) through (C).

Informational Note: See 300.21 for information concerning the spread of fire or products of combustion.

Busways are commonly used as feeders. They either are installed horizontally or, where used for power distribution in high-rise

EXHIBIT 368.1 A section of feeder busway with a plug-in tap device, one of the busway types used for power distribution covered by Article 368. (Courtesy of Square D™ by Schneider Electric)



buildings, are run vertically from floor to floor to supply transformers and other distribution equipment in “stacked” electric rooms or closets. See Exhibit 368.2 for an illustration of a busway installed horizontally in the space above a dropped or hung ceiling. The space is not being used as an “other space for environmental air (plenums)” covered by 300.22(C) and can contain the plug-in devices for supplying electrical equipment installed above, within, or below the ceiling.

Unless marked to indicate otherwise, busways and associated fittings containing a vapor seal have not been evaluated for passage through a fire-rated wall or floor. Listed firestop systems are available for making busway penetrations through fire-rated walls and floors.

See also

300.21, which provides requirements that are essential to limiting the spread of a fire and products of combustion

(A) Exposed. Busways shall be permitted to be located in the open where visible, except as permitted in 368.10(C).

(B) Behind Access Panels. Busways shall be permitted to be installed behind access panels, provided the busways are totally enclosed, of nonventilating-type construction, and installed so that the joints between sections and at fittings are accessible for maintenance purposes. Where installed behind access panels, means of access shall be provided, and either of the following conditions shall be met:

- (1) The space behind the access panels shall not be used for air-handling purposes.
- (2) Where the space behind the access panels is used for environmental air, other than ducts and plenums, there shall be no provisions for plug-in connections, and the conductors shall be insulated.

(C) Through Walls and Floors. Busways shall be permitted to be installed through walls or floors in accordance with 368.10(C)(1) and (C)(2).

(1) Walls. Unbroken lengths of busway shall be permitted to be extended through dry walls.

(2) Floors. Floor penetrations shall comply with 368.10(C)(2)(a) and (C)(2)(b).

(a) Busways shall be permitted to be extended vertically through dry floors if totally enclosed (unventilated) where

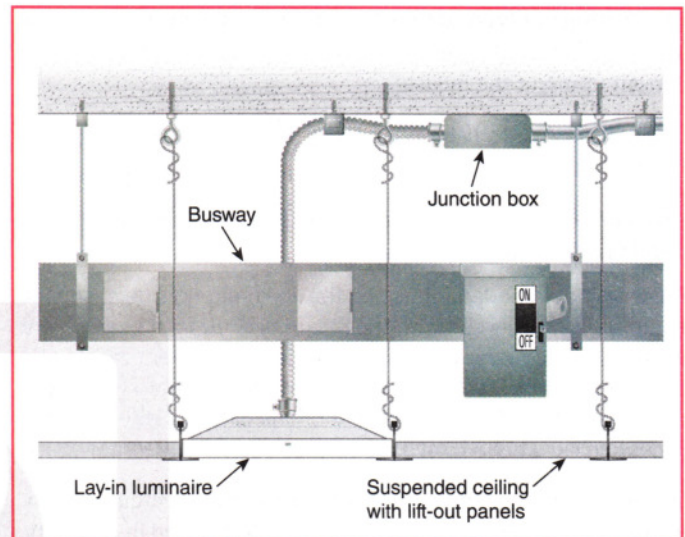


EXHIBIT 368.2 An example of a busway mounted horizontally in the space above a hung ceiling.

passing through and for a minimum distance of 1.8 m (6 ft) above the floor to provide adequate protection from physical damage.

(b) In other than industrial establishments, where a vertical riser penetrates two or more dry floors, a minimum 100-mm (4-in.) high curb shall be installed around all floor openings for riser busways to prevent liquids from entering the opening. The curb shall be installed within 300 mm (12 in.) of the floor opening. Electrical equipment shall be located so that it will not be damaged by liquids that are retained by the curb.

368.12 Uses Not Permitted.

(A) Physical Damage. Busways shall not be installed where subject to severe physical damage or corrosive vapors.

(B) Hoistways. Busways shall not be installed in hoistways.

(C) Hazardous Locations. Busways shall not be installed in any hazardous (classified) location, unless specifically approved for such use.

Informational Note: See 501.10(B).

(D) Wet Locations. Busways shall not be installed outdoors or in wet or damp locations unless identified for such use.

(E) Working Platform. Lighting busway and trolley busway shall not be installed less than 2.5 m (8 ft) above the floor or working platform unless provided with an identified cover.

368.17 Overcurrent Protection. Overcurrent protection shall be provided in accordance with 368.17(A) through (D).

See also

Section 240.21(E), which specifies that overcurrent protection for busways and busway taps is covered by the rules in 368.17

(A) Rating of Overcurrent Protection — Feeders. A busway shall be protected against overcurrent in accordance with the current rating of the busway.

Exception No. 1: The applicable provisions of 240.4 shall be permitted.

Exception No. 2: Where used as transformer secondary ties, 450.6(A)(3) shall be permitted.

Busways not intended for use on the line (supply) side of service equipment are marked with the maximum rating of overcurrent protection required on the supply side. The current rating of a busway can be determined in the field only by reference to the nameplate data. The applicable sections of 240.4 referenced in Exception No. 1 are 240.4(B) and (C).

(B) Reduction in Ampacity Size of Busway. Overcurrent protection shall be required where busways are reduced in ampacity.

Exception: For industrial establishments only, omission of overcurrent protection shall be permitted at points where busways are reduced in ampacity, provided that the length of the busway having the smaller ampacity does not exceed 15 m (50 ft) and has an ampacity at least equal to one-third the rating or setting of the overcurrent device next back on the line, and provided that such busway is free from contact with combustible material.

In industrial establishments, where the size of a smaller busway is kept within the specified limits, providing overcurrent protection at the point where the size is changed is not required. For example, a busway protected by a 1200-ampere overcurrent device may be reduced in size, provided the smaller busway has a current rating of at least 400 amperes ($\frac{1}{3}$ of 1200 amperes) and does not extend more than 50 feet. Restricting the length of smaller busway and establishing a relationship between the busway current rating and the rating of the feeder overcurrent protective device (OCPD) provides a level of protection for the smaller section of busway in the event of a short circuit or a ground fault. These restrictions are analogous to those required by 240.21(B) for feeder taps.

(C) Feeder or Branch Circuits. Where a busway is used as a feeder, devices or plug-in connections for tapping off feeder or branch circuits from the busway shall contain the overcurrent devices required for the protection of the feeder or branch circuits. The plug-in device shall consist of an externally operable circuit breaker or an externally operable fusible switch. Where

such devices are mounted out of reach and contain disconnecting means, suitable means such as ropes, chains, or sticks shall be provided for operating the disconnecting means from the floor.

See also

Exhibit 100.1, which illustrates methods of operating elevated busway plug-in devices from floor level

Exception No. 1: As permitted in 240.21.

Exception No. 2: For fixed or semifixed luminaires, where the branch-circuit overcurrent device is part of the luminaire cord plug on cord-connected luminaires.

Exception No. 3: Where luminaires without cords are plugged directly into the busway and the overcurrent device is mounted on the luminaire.

Exception No. 4: Where the branch-circuit overcurrent plug-in device is directly supplying a readily accessible disconnect, a method of floor operation shall not be required.

Exception No. 4 allows alternative methods of providing ready access to disconnects with an equivalent level of safety. Receptacles may be used as a disconnecting means where permitted.

(D) Rating of Overcurrent Protection — Branch Circuits. A busway used as a branch circuit shall be protected against overcurrent in accordance with 210.20.

368.30 Support. Busways shall be securely supported at intervals not exceeding 1.5 m (5 ft) unless otherwise designed and marked.

Busways are marked if suitable for installation in a specified position, for use in vertical runs, or for support at intervals greater than 5 feet.

368.56 Branches from Busways. Branches from busways shall be permitted to be made in accordance with 368.56(A), (B), and (C).

Δ (A) General. Branches from busways shall be permitted to use any of the following wiring methods:

- (1) Type AC armored cable
- (2) Type MC metal-clad cable
- (3) Type MI mineral-insulated, metal-sheathed cable
- (4) IMC intermediate metal conduit
- (5) RMC rigid metal conduit
- (6) FMC flexible metal conduit
- (7) LFMC liquidtight flexible metal conduit
- (8) PVC rigid polyvinyl chloride conduit
- (9) RTRC reinforced thermosetting resin conduit
- (10) LFNC liquidtight flexible nonmetallic conduit
- (11) EMT electrical metallic tubing
- (12) ENT electrical nonmetallic tubing
- (13) Busways
- (14) Strut-type channel raceway
- (15) Surface metal raceway
- (16) Surface nonmetallic raceway

Where a separate equipment grounding conductor is used, connection of the equipment grounding conductor to the busway shall comply with 250.8 and 250.12.

(B) Cord and Cable Assemblies. Suitable cord and cable assemblies identified for extra-hard usage or hard usage and listed bus drop cable shall be permitted as branches from busways for the connection of portable equipment or the connection of stationary equipment to facilitate their interchange in accordance with 400.10 and 400.12 and the following conditions:

- (1) The cord or cable shall be attached to the building by an approved means.
- (2) The length of the cord or cable from a busway plug-in device to a suitable tension take-up support device shall not exceed 1.8 m (6 ft).
- (3) The cord and cable shall be installed as a vertical riser from the tension take-up support device to the equipment served.
- (4) Strain relief cable grips shall be provided for the cord or cable at the busway plug-in device and equipment terminations.

Exception to (B)(2): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, lengths exceeding 1.8 m (6 ft) shall be permitted between the busway plug-in device and the tension take-up support device where the cord or cable is supported at intervals not exceeding 2.5 m (8 ft).

Exhibit 368.3 illustrates a flexible cable or cord branch from a busway installed according to the requirements of 368.56(B)(2). Exhibit 368.4 illustrates a flexible cable or cord branch from a busway installed according to 368.56(B)(2), Exception.

(C) Branches from Trolley-Type Busways. Suitable cord and cable assemblies identified for extra-hard usage or hard usage and listed bus drop cable shall be permitted as branches from trolley-type busways for the connection of movable equipment in accordance with 400.10 and 400.12.

368.58 Dead Ends. A dead end of a busway shall be closed.

368.60 Grounding. Busway shall be connected to an equipment grounding conductor(s), to an equipment bonding jumper, or to the grounded conductor where permitted or required by 250.92(B)(1) or 250.142.

The metal enclosure of a listed busway is intended for use as an equipment grounding conductor (EGC). In some cases, an additional grounding bus may also act as an EGC.

Part III. Construction

368.120 Marking. Busways shall be marked with the voltage and current rating for which they are designed, and with the manufacturer's name or trademark in such a manner as to be visible after installation.

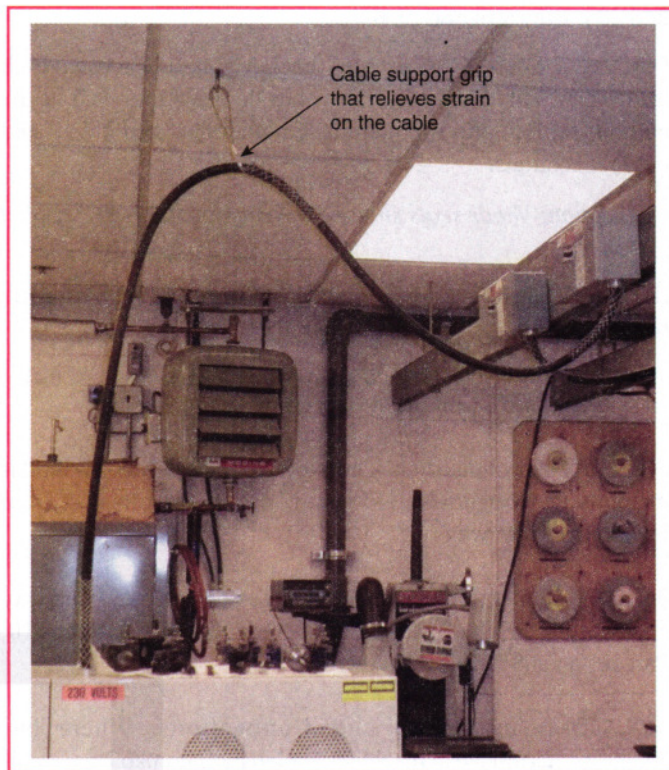


EXHIBIT 368.3 An example of a flexible cable or cord branch from busway installed according to 368.56(B).

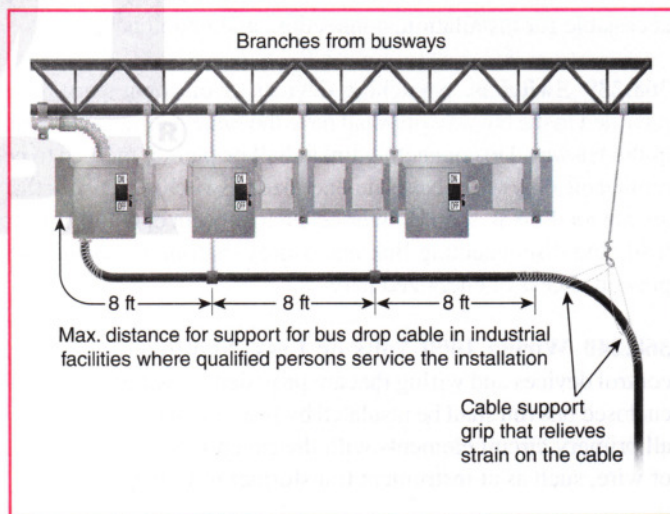


EXHIBIT 368.4 An example of bus drop cable supported by a tension take-up support device attached to the structure of an industrial building.

Part IV. Requirements for Over 1000 Volts, Nominal

368.214 Adjacent and Supporting Structures. Metal-enclosed busways shall be installed so that temperature rise from induced circulating currents in adjacent ferrous metal parts will not be hazardous to personnel or constitute a fire hazard.

368.234 Barriers and Seals.

(A) **Vapor Seals.** Busway runs that have sections located both inside and outside of buildings shall have a vapor seal at the building wall to prevent interchange of air between indoor and outdoor sections.

Exception: Vapor seals shall not be required in forced-cooled bus.

(B) **Fire Barriers.** Fire barriers shall be provided where fire walls, floors, or ceilings are penetrated.

Informational Note: See 300.21 for information concerning the spread of fire or products of combustion.

368.236 Drain Facilities. Drain plugs, filter drains, or similar methods shall be provided to remove condensed moisture from low points in busway run.

368.237 Ventilated Bus Enclosures. Ventilated busway enclosures shall be installed in accordance with Article 110, Part III, and 495.24.

368.238 Terminations and Connections. Where bus enclosures terminate at machines cooled by flammable gas, seal-off bushings, baffles, or other means shall be provided to prevent accumulation of flammable gas in the busway enclosures.

All conductor termination and connection hardware shall be accessible for installation, connection, and maintenance.

368.239 Switches. Switching devices or disconnecting links provided in the busway run shall have the same momentary rating as the busway. Disconnecting links shall be plainly marked to be removable only when bus is de-energized. Switching devices that are not load-break shall be interlocked to prevent operation under load, and disconnecting link enclosures shall be interlocked to prevent access to energized parts.

368.240 Wiring 1000 Volts or Less, Nominal. Secondary control devices and wiring that are provided as part of the metal-enclosed bus run shall be insulated by fire-retardant barriers from all primary circuit elements with the exception of short lengths of wire, such as at instrument transformer terminals.

368.244 Expansion Fittings. Flexible or expansion connections shall be provided in long, straight runs of bus to allow for temperature expansion or contraction, or where the busway run crosses building vibration insulation joints.

368.258 Neutral Conductor. Neutral bus, where required, shall be sized to carry all neutral load current, including harmonic currents, and shall have adequate momentary and short-circuit current rating consistent with system requirements.

368.260 Grounding. Metal-enclosed busway shall be grounded.

368.320 Marking. Each busway run shall be provided with a permanent nameplate on which the following information shall be provided:

- (1) Rated voltage.
- (2) Rated continuous current; if bus is forced-cooled, both the normal forced-cooled rating and the self-cooled (not forced-cooled) rating for the same temperature rise shall be given.
- (3) Rated frequency.
- (4) Rated impulse withstand voltage.
- (5) Rated 60-Hz withstand voltage (dry).
- (6) Rated momentary current.
- (7) Manufacturer's name or trademark.

Informational Note: See IEEE C37.23-2015, *IEEE Standard for Metal-Enclosed Bus*, for construction and testing requirements for metal-enclosed bus assemblies.

ARTICLE 369

Insulated Bus Pipe (IBP)/Tubular Covered Conductors (TCC) Systems

N Part I. General

N 369.1 Scope. This article covers the use, installation, and construction specifications for insulated bus pipe (IBP) systems.

New Article 369 has been created to establish requirements for the installation of insulated bus pipe (IBP), which is also known as tubular covered conductor (TCC). This article requires IBP to be listed and installed by qualified persons. A manufacturer supplied terminating means must be utilized for all system connections or terminations. All documentation must be available to the AHJ.

N 369.2 Reconditioned Equipment. IBP and IBP systems shall not be reconditioned.

N 369.6 Listing Requirements. IBP and IBP systems shall be listed.

N Part II. Installation

N 369.10 Uses Permitted. IBP systems shall be permitted for use on power systems in accordance with the following:

- (1) As exposed runs in accordance with 305.3.
- (2) In wet or damp locations only when listed for such use.
- (3) Installed through walls, in unbroken lengths. Where IBP penetrates an exterior wall, the entire length that penetrates the wall shall be listed for outdoor use, and the opening in the wall shall be sealed by an approved method.