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Standard for Safety for Busways

Seventh Edition, Dated September 10, 2025

Summary of Topics

This new Edition dated September 10, 2025 includes Clarification of the Scope, Clarification of Requirements for Continuous Plug-In Busways, Revision of Minimum Clearance and Creepage Distances for 601 – 1000 V, Define Stabilization for Section [16](#) Temperature Rise Limits (Stabilization Method), Clarification for Short Circuit Sample Selection, Revise Markings to Reflect Limitation of One Service Disconnect in a Busway Fitting, Removal of Reference to Standard UL 512 from Annex [A](#), and Editorial Changes throughout this Standard.

Commitment for Amendments

This Standard is issued jointly by the Association of Standardization and Certification (ANCE), the Canadian Standards Association (operating as "CSA Group"), and ULSE Inc. (ULSE). Comments or proposals for revisions on any part of the standard may be submitted to ANCE, CSA Group, or ULSE at anytime. Revisions to this Standard will be made only after processing according to the standards development procedures of ANCE, CSA Group, and ULSE. CSA Group and ULSE will issue revisions to this Standard by means of a new edition or revised or additional pages bearing their date of issue. ANCE will incorporate the same revisions into a new edition of the standard bearing the same date of issue as the CSA Group and ULSE pages.

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This ANSI/UL Standard for Safety consists of the Fourteenth Edition. The most recent designation of ANSI/UL 857 as an American National Standard (ANSI) occurred on September 10, 2025. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

The Department of Defense (DoD) has adopted UL 857 on April 20, 1993. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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CONTENTS

PREFACE	5
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INTRODUCTION

1 Scope	7
2 Components	7
3 Units of Measurement	8
4 Referenced Publications	8
5 Definitions	9

CONSTRUCTION

6 General	10
7 Clearance and Creepage Distances	17
7.1 Busway and fittings not incorporating a switching mechanism	17
7.2 Fittings incorporating a switching mechanism	20
7.3 Short-run busway	21
8 Insulating Materials	21
9 Terminals for External Conductors	22
10 Enclosure and Degree of Protection	24
11 Temperature Rise	25
12 Protection Against Electric Shock	26
13 Short-Circuit Protection and Short-Circuit Withstand Strength	31
13.1 Fittings	31
13.2 Short-run busway	31
14 Electrical Connections in an Assembly	33
14.1 General	33
14.2 Dimensions and rating of bus bars and insulated conductors	34
14.3 Wiring	36

PERFORMANCE

15 Temperature Rise Test – General	41
16 Temperature Rise Test – Stabilization Method	41
17 Temperature Rise Test – Heat Cycling Method	42
17.1 General	42
17.2 Test arrangement	42
17.3 Results to be obtained	42
18 Dielectric Voltage Withstand Test	43
19 Clamped Joint Test	43
20 Reduced Insulation Thickness Test	44
21 Short-Circuit Withstand Test at Rated Voltage	44
21.1 General	44
21.2 Test arrangement	47
21.3 Current source characteristics	48
21.4 Results to be obtained	55
22 Short-Circuit Withstand Test at Reduced Voltage	57
22.1 General	57
22.2 Test arrangements	57
23 Enclosure Joint Short-Time Fault Current Test	62
24 Verification of Electrical Conductivity	62
24.1 Trolley busway	62

24.2	Test arrangement.....	63
24.3	Maximum resistance	63
25	Endurance Test for Trolley and Trolley Busway	63
26	Strain Relief Test	63
27	Rain Test	64
27.1	General.....	64
27.2	Exposure to rain simulation	64
27.3	Test results.....	67
28	Bending Resistance Test.....	67
29	Impact Strength Test.....	69
30	Crush Resistance Test.....	69
31	Resistance to Bus Bar Pull-Out Test	69
32	Overload and Endurance Tests for Non-Switching Plug-In Devices	70
33	Resistance to Aging Test.....	70
34	Metallic Coating Thickness Test.....	71
35	Insulating Base and Support Strength Test	72
36	Gasket Test.....	73

RATINGS

37	Electrical Characteristics of Assemblies	73
38	Rated Voltages.....	73
39	Rated Current of a Circuit of an Assembly	73
40	Rated Conditional Short-Circuit Current	73

MARKINGS

41	General	74
42	Nameplates	75
43	Mounting or Hanging Information.....	77
44	Service Equipment Information.....	77
45	Miscellaneous Information	78
46	Wire, Wire Connectors, and Wire Torque Information	79
47	Instructions for Installation, Operation, and Maintenance.....	81

ANNEX A (Informative) – STANDARDS FOR COMPONENTS

ANNEX B (Informative) – PRESSURE TERMINAL TIGHTENING TORQUE

ANNEX C (Informative) – APPLICABLE CLAUSES

ANNEX D – FRENCH AND SPANISH TRANSLATIONS AND MARKINGS(Normative for Canada and Informative for the US)

PREFACE

This is the harmonized ANCE, CSA Group, and ULSE standard for Busways. It is the fourth edition of NMX-J-148-ANCE, the seventh edition of CSA C22.2 No. 27, and the fourteenth edition of UL 857. This edition of NMX-J-148-ANCE supersedes the previous edition published on December 9, 2011. This edition of CSA C22.2 No. 27 supersedes the previous edition published on March 25, 2009. This edition of UL 857 supersedes the previous edition published on April 9, 2021.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), CSA Group, and ULSE. The efforts and support of the Technical Harmonization Committee for Connectors, of the Council on the Harmonization of Electrotechnical Standards of the Nations of the Americas (CANENA), are gratefully acknowledged.

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

The present Mexican Standard was developed by the CT CDI from the Comité de Normalización de la Asociación de Normalización y Certificación, A.C., CONANCE, with the collaboration of the busway manufacturers and users.

This Standard was reviewed by the CSA Subcommittee on Busways, under the jurisdiction of the CSA Technical Committee on Industrial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee. This Standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

NOTE: Although the intended primary application of this Standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of Harmonization

This Standard uses the IEC format but is not based on, nor is it considered equivalent to, an IEC standard.

This Standard is published as an equivalent standard for ANCE, CSA Group, and ULSE.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

No Text on This Page

Busways

INTRODUCTION

1 Scope

1.1 This Standard applies to service-entrance, feeder, and branch-circuit busways and associated fittings rated at 1000 V or less, 6000 A or less, and intended for use in accordance with the Canadian Electrical Code, Part I (CE Code, Part I), NFPA 70[®], *National Electrical Code*[®] (NEC[®]), and the Mexican Standard for Electrical Installations (Utility), NOM-001-SEDE. These requirements do not apply to metal enclosed bus intended for connecting switchgear assemblies for use in prefabricated electric distribution systems.

NFPA 70[®], *National Electrical Code*[®], and NEC[®] are registered trademarks of the National Fire Protection Association, Quincy, MA.

1.2 For the purpose of these requirements, a busway is considered to be a grounded metal enclosure containing factory-mounted conductors that are usually copper or aluminum bars, rods, or tubes.

1.3 Requirements stated throughout this Standard for fittings apply to tap boxes, feed boxes, plug-in devices, and similar fittings, but do not apply to busway elbows, tees, and crosses.

2 Components

2.1 A component of a product covered by this Standard shall:

- a) Comply with the requirements for that component as specified in this Standard;
- b) Be used in accordance with its rating(s) established for the intended conditions of use; and
- c) Be used within its established use limitations or conditions of acceptability.

See Annex A for a list of Standards covering components generally used in the products covered by this Standard. A component shall comply with the ANCE, CSA Group, or UL standards, as appropriate, for the country where the product is to be used.

2.2 A component of a product covered by this Standard is not required to comply with a specific component requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product;
- b) Is superseded by a requirement in this Standard; or
- c) Is separately evaluated when forming part of another component, provided the component is used within its established ratings and limitations.

2.3 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

3.2 Unless otherwise indicated, all voltage and current values mentioned in this Standard are root-mean-square (rms).

4 Referenced Publications

4.1 Products covered by this Standard shall comply with the reference installation codes and standards noted in this Section as appropriate for the country where the product is to be used. When the product is intended for use in more than one country, the product shall comply with the installation codes and standards for all countries where it is intended to be used. Combined references are separated by a slash (" / ") to denote the difference between the applicable requirements specified for use in Canada, Mexico, and the United States.

4.2 Any undated reference to a code or standard appearing in the requirements of this Standard shall be interpreted as referring to the latest edition of that code or standard.

4.3 In Canada, general requirements are specified in CSA C22.2 No. 0, and Bonding requirements are specified in CSA C22.2 No. 0.4.

4.4 The following publications are referenced in this Standard:

United States	Canada	Mexico
NFPA 70, National Electrical Code	CSA C22.1, Canadian Electrical Code	NOM-001-SEDE, Electrical installations (utility)
ASME B1.1, Unified Inch Screw Threads	ASME B1.1, Unified Inch Screw Threads	N/A
IEEE C37.09, Standard Test Procedures for AC High-Voltage Circuit Breakers Rated Maximum Voltage Above 1000 V	IEEE C37.09, Standard Test Procedures for AC High-Voltage Circuit Breakers Rated Maximum Voltage Above 1000 V	N/A
ASTM Designation A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, Table 1 (titled "Weight [Mass] of Coating Requirements")	ASTM Designation A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, Table 1 (titled "Weight [Mass] of Coating Requirements")	NMX-J-148-ANCE, Busways – Specifications and test methods
ASTM Designation A 90/A 90M Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings	ASTM Designation A 90/A 90M Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings	N/A
UL 44, Thermoset-Insulated Wires and Cables	CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables	NMX-J-451-ANCE, Wires and cables – Thermoset insulated wires and cables – Specifications
UL 50, Enclosures for Electrical Equipment, Non-Environmental Considerations	CSA C22.2 No. 94.1, Enclosures for Electrical Equipment, Non-Environmental Considerations	NMX-J-235/1-ANCE, Enclosures for electrical equipment, Non-environmental considerations
UL 50E, Enclosures for Electrical Equipment, Environmental Considerations	CSA C22.2 No. 94.2, Enclosures for Electrical Equipment, Environmental Considerations	NMX-J-235/2-ANCE, Enclosures – Enclosures for electrical equipment – Part 2: Specific requirements – Specifications and test methods
UL 67, Panelboards	CSA C22.2 No. 29, Panelboards and Enclosed Panelboards	NMX-J-118/1-ANCE, Panelboards – Specifications and test methods

United States	Canada	Mexico
UL 94, Tests for Flammability of Plastic Material for Parts in Devices and Appliances	CSA C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials	N/A
UL 98, Enclosed and Dead-Front Switches	CSA C22.2 No. 4, Enclosed and Dead-Front Switches	NMX-J-162-ANCE, Switches, enclosed and deadfront switches – Specifications and test methods
UL 414, Meter Sockets	CSA C22.2 No. 115, Meter-Mounting Devices	N/A
UL 486A-486B, Wire Connectors	CSA C22.2 No. 65, Wire Connectors	NMX-J-543-ANCE, Wire Connectors – Specifications and test methods
UL 489, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures	CSA C22.2 No. 5, Molded Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures	NMX-J-266-ANCE, Molded case circuit breakers, molded-case switches, and circuit breaker enclosures – Specifications and test methods
UL 510, Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape	CSA C22.2 No 197, PVC Insulating Tape	N/A
UL 746A, Polymeric Materials – Short Term Property Evaluations	CSA C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials	N/A
UL 746C, Polymeric Materials – Used in Electrical Equipment Evaluations	CSA C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials	N/A
UL 869A, Reference Standard for Service Equipment	CSA C22.2 No. 14, Industrial Control Equipment	N/A
UL 969, Marking and Labeling Systems	CSA C22.2 No. 0.15, Adhesive Labels	N/A
UL 977, Fused Power – Circuit Devices	N/A	N/A
UL 1332, Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment	CSA C22.2 No. 94.2, Enclosures for Electrical Equipment, Environmental Considerations	N/A
N/A	CSA C22.2 No. 0, General Requirements	N/A
N/A	CSA C22.2 No. 0.4, Bonding of Electrical Equipment	N/A
N/A	CSA C22.2 No. 0.12, Wiring Space and Wire Bending Space in Enclosures for Equipment Rated 750 Volts or Less	N/A

5 Definitions

5.1 For the purpose of this Standard, the following definitions apply.

In Canada, the term "bonding bus" is used instead of "ground bus".

5.2 **CONTINUOUS PLUG-IN BUSWAY** – In Canada and Mexico, a continuous plug-in busway is rated at 400 A or less, has no exposed bus bars, and is intended for general use, including installation within the reach of persons. In the United States, a continuous plug-in busway is rated at 225 A or less.

NOTE: Busways designed with an opening to permit the plug-in of devices along the length of the busway that comply with the requirements for other than a continuous plug-in busway, and not marked as a "Continuous Plug-In Busway", are not limited to these ampere ratings.

5.3 **LIGHTING PLUG-IN BUSWAY** – A lighting plug-in busway is rated at 50 A or less and is intended to provide:

- a) Means for the support of luminaires; and
- b) Means by which the fixtures may be plugged into the power supply.

NOTE: In Canada, the rating of the plug-in lighting busway is limited to values below 50 A by lighting branch circuit overcurrent protection requirements of the CE Code, Part I.

5.4 SHORT-RUN BUSWAYS – Short-run busways are unventilated busways intended:

- a) Primarily to feed switchboards;
- b) To have no intermediate taps (except for transformer stubs); and
- c) For a maximum horizontal run of 9.14 m (30 feet) or a maximum vertical run of 3.05 m (10 feet).

Short-run busways include only straight lengths, elbows, fittings, and transformer taps (not necessarily end of run). A short-run busway is intended for horizontal runs, but one leg of any elbow may be installed in a vertical position.

5.5 TROLLEY BUSWAY – A trolley busway has provision for continuous contact with a trolley by means of a slot in the enclosure. Because the slot must accommodate a moveable trolley, the acceptable degree of exposure of uninsulated live parts in a trolley busway is necessarily larger than in a busway of another type.

- a) Means for the support of luminaires; and
- b) Means by which the fixtures may be plugged into the power supply.

CONSTRUCTION

6 General

6.1 A trolley (busway fitting) shall comply with the clauses of this Standard listed in Annex [C](#), [Table C.1](#).

6.2 A fitting shall comply with the clauses listed in Annex [C](#), [Table C.2](#).

6.3 An outdoor fitting shall comply with the clauses listed in Annex [C](#), [Table C.2](#) and [Table C.3](#).

6.4 Short-run busway need only comply with those requirements specifically stating their application to short-run busway.

6.5 A busway and fitting shall employ only those materials that have been determined acceptable for the particular use. A busway system shall include all fittings necessary to make a complete installation.

6.6 A busway system shall be constructed so that the busways and fittings, when properly interconnected, will constitute a complete mechanical assembly that provides electrical continuity.

6.7 Fastenings between parts of an enclosure shall be spot welds, continuous welds, machine- or self-threading screws engaging no less than two full threads, rivets, or other means. Screw fastenings that engage threads in nonmetallic materials shall be such that the threads will not be stripped by hand-tightening with the intended tool.

6.8 Sheet metal screws may be used for fastenings of a busway proper (but shall not be used for the enclosure of a plug-in device) if they are not intended to be subject to removal and replacement.

6.9 A surface of steel employed in an enclosure shall be made corrosion-resistant by painting, enameling, galvanizing, plating, or equivalent means.

6.10 A steel part, other than the enclosure, a screw, or other fastening part, shall have corrosion resistance equivalent to that required for the enclosure. A screw and any other steel fastening part shall be plated.

6.11 A busway, other than a short run-busway, shall be provided with means for support (not necessarily integral with the busway) at intervals of no more than 3.05 m (10 feet) for a horizontal run and no more than 4.88 m (16 feet) for a vertical run. If the intended interval between supports is more than 1.52 m (5 feet), the busway shall be subjected to the Bending Resistance Test described in Section [28](#) and the Crush Resistance Test in Section [30](#). A vertical busway with supports no more than 3.05 m (10 feet) apart need not be subjected to the verification of bending resistance.

6.12 A transverse barrier or divider that restricts the free flow of air may be included in a busway section, but this acceptance shall not imply the barrier is a fire stop. The busway shall be marked in accordance with [45.2](#).

6.13 A busway intended for outdoor use and constructed to prevent the passage of water between adjoining sections shall be subjected to the Rain Test, Section [27](#).

6.14 A construction shall be evaluated for preventing the flow of water past the barrier and for resistance to a temperature of minus 10 °C (50 °F). In a ventilated outdoor busway, the barrier shall also be evaluated for resistance to the weather.

6.15 A bus bar support shall be of strong, moisture-resistant, insulating material having a thermal index of at least 105 °C (221 °F). The thermal index may be 85 °C (185 °F) if the temperature rise during a heating test is in accordance with [Table 11.1](#).

6.16 Porcelain, cold-molded composition, and phenolic composition are among the acceptable materials for bus bar supports. Butyl rubber having a thermal index of 90 °C (194 °F) may be used as a combination bus bar covering and support if it complies with the requirements for the Resistance to Aging Test, Section [33](#), Dielectric Voltage-Withstand Test, Section [18](#), and the Impact Strength Test, Section [29](#); and if it is no less than 1.2 mm (3/64 inch) thick at every point where it supports the bus bar.

6.17 For other than a short-run busway, the distance between centers of adjacent supports along the length of the bus bar shall be 762 mm (30 inches) or less.

6.18 An insulating covering for a bus bar shall have a thermal index no less than 95 °C (203 °F). The thermal index of an insulating covering on an unplated copper bus bar in an indoor-type lighting or continuous plug-in busway rated no more than 60 A may be 60 °C (140 °F). An insulating covering may have a thermal index of 85 °C (185 °F) if the temperature rise during a heating test is in accordance with [Table 11.1](#). See UL 746C / CSA C22.2 No. 0.17, for thermal index standards.

6.19 Varnished cloth is considered to have a thermal index of 85 °C (185 °F). A bus bar covering of thermoplastic splicing tape rated for general use at 80 °C (176 °F) is considered to have a thermal index of 85 °C (185 °F) if it complies with [33.2](#) and [33.3](#).

6.20 An insulating covering for a bus bar:

a) Shall be no less than 0.51 mm (0.020 inch) thick;

b) May be less than 0.51 mm (0.020 inch) thick but not less than 0.38 mm (0.015 inch) thick if, upon evaluation, the material:

1) Is determined to be acceptable for the application, considering such properties as ease of ignition, electrical resistance, dimensional stability, tensile strength, elongation, resistance to weathering, tear resistance, penetration, and abrasion; and

2) Withstands the application of a 5,000-V, 60-Hz test potential without breakdown. When conducting this test, the potential shall be brought up to the required value and held for one second. The potential shall be applied between the bus bar and metal foil wrapped around the covering; or

c) May be less than 0.38 mm (0.015 inch) thick if the busway meets requirements (b)(1) and (b)(2) as stated above and is subjected to and successfully passes the mechanical and short-circuit tests in accordance with Section [21](#), Short-Circuit Withstand Test at Rated Voltage, Section [28](#), Bending Resistance Test, Section [29](#), Impact Strength Test, Section [30](#), Crush Resistance Test, and Section [31](#), Resistance to Bus Bar Pull-Out Test.

6.21 Thermoplastic tubing may be used as an insulating material for bus bars if all of the following conditions are met:

- a) It is not subjected to compression, repeated flexure, or sharp bends;
- b) All edges of the conductor covered with the tubing are rounded and free from sharp edges;
- c) For chemically dilated tubing, a solvent recommended by the tubing manufacturer is used; and
- d) Its wall thickness (after assembly) is not less than 0.56 mm (0.022 inch) for tubing 12.7 mm (1.2 inches) or less in diameter, not less than 0.69 mm (0.027 inch) for tubing 14.3 or 15.9 mm (9/16 or 5/8 inch) in diameter, and not less than 0.71 mm (0.028 inch) for larger tubing.

6.22 The acceptability of insulating materials used for bus bar covering, other than those specified in [6.16](#), [6.19](#), or [6.21](#) shall be determined in accordance with the requirements specified in [8.2](#) and [Table 8.1](#).

6.23 The enclosure of a ventilated busway shall have openings intended for ventilation or shall be formed from perforated sheet metal, expanded metal mesh, or the like.

6.24 In the case of an outdoor-use ventilated busway in which the ventilating openings constitute a major part of the area of the enclosure, consideration shall be given to the need for corrosion protection at the edges of the openings.

6.25 A bus bar covering in a ventilated busway shall provide protection against physical injury of the bus bar by a means equivalent to that provided by a wrap of varnished cambric tape.

6.26 A plug-in busway intended for the support of luminaires shall provide means for such support.

6.27 A busway or fitting intended for outdoor use shall be subjected to the Rain Test in Section [27](#). The test shall be conducted in any mounting position indicated by markings.

6.28 The enclosure of any busway or fitting marked for outdoor use shall be provided with holes to drain accumulated water.

6.29 A gasket or vapor seal that is relied upon for the exclusion of moisture or the free flow of air shall be of a material rated for the purpose and shall be resistant to aging.

6.30 A gasket of rubber or rubber-like material that is considered to be resistant to aging shall comply with Section [36](#), Gasket Test.

6.31 A meter-socket base shall be mounted independently of the cover unless it is intended to be used with a current transformer.

6.32 A meter-socket base shall be mounted in an enclosure that completely houses all live parts, with an appropriate meter mounted in position.

6.33 A bare live part on a meter-socket base shall be recessed as follows:

- a) No less than 12.7 mm (1/2 inch) behind the plane of the outer edge of the meter mounting rim, or behind the plane of the meter mounting hole if a mounting rim is not provided; and
- b) Behind the plane of the cover, unless a barrier or the like is provided so that the cover may be removed without the likelihood of it contacting a bare live part.

6.34 If a busway fitting has provision for a watt-hour meter not intended for use with current transformers, the rating of the meter position shall be no less than the rating of the circuit in which it is used.

6.35 A busway fitting marked for service equipment use shall comply with UL 869A / CSA 22.2 No. 14, Clause 4.17, as follows:

- a) The line and grounding electrode conductor terminals shall be of the pressure wire connector type rated for a minimum wire size of 8 AWG (8.4 mm²). Line terminals may be omitted as specified in Section 25, Electrical Connections in an Assembly.
- b) Equipment intended for alternating-current service shall have a pressure terminal connector for connection of a grounded service conductor. A pressure terminal connector for a grounding electrode conductor shall also be provided at the same connection point. If provisions for load connections are made or intended, the connection point (neutral) shall be insulated from the enclosure unless the equipment is marked "Suitable only for use as service equipment."
- c) If the connection point described in (b) is not insulated from the enclosure, there shall be a bond to the equipment enclosure. If the connection point is insulated from the enclosure, provision for installing a main bonding jumper, consisting of a separate screw, strap, or other means, shall be provided to bond the enclosure to the connection point. The construction shall be such that when the bonding means is not used, at least the minimum acceptable spacings will exist. Unless the intended use and method of installation of the bonding means are obvious, instructions for its installation shall be provided.
- d) A fitting shall be constructed so that:
 - 1) All ungrounded load conductors can be disconnected from the source of supply;
 - 2) There is an overcurrent device (a fuse or circuit breaker) in series with each ungrounded service conductor; and
 - 3) With every service disconnect in the "off" position, ungrounded uninsulated live parts on the supply side of a serviced disconnect are protected against inadvertent contact by persons while servicing any field-connected load terminal, including a neutral load terminal, a branch circuit equipment grounding terminal, or the neutral disconnect link.
- e) Equipment marked for use as service equipment for 3-phase, 4-wire, wye-connected services rated in excess of 150 V to ground, but not exceeding 1000 V phase-to-phase, shall be provided with ground fault protection, if rated 1000 A or more, complying with UL 869A / CSA 22.2 No. 14, Clause 4.17.
- f) Markings as specified in Section 13, Service Equipment information, shall be provided.

6.36 A busway fitting of the plug-in type shall not be marked for service equipment use if:

- a) It is intended for use on the line side of the busway; and

- b) A live part would be exposed if the fitting could be disconnected from the busway with the switch or breaker in the "on" position.

6.37 Unless otherwise specified in this Standard, the enclosure of a busway fitting shall comply with the requirements in UL 50, UL 50E / CSA C22.2 No. 94.1, CSA C22.2 No. 94.2 / NMX-J-235/1-ANCE and NMX-J-235/2-ANCE. The enclosure of a plug-in device not incorporating a switching mechanism may be of sheet steel having a thickness no less than 1.0 mm (0.042 inches) if:

- a) The device is rated at no more than 100 A;
- b) The device is not intended for outdoor use;
- c) Neither the length nor the width of the enclosure is more than 152 mm (6 inches);
- d) The area of the largest surface of the enclosure is no more than 155 cm² (24 in²); and
- e) The depth of the enclosure is no more than 76.2 mm (3 inches).

6.38 A seam, joint, or splice at a corner or back edge of an enclosure of a fitting shall be closed and reinforced:

- a) By a flange formed of the material from which the box is made;
- b) By a separate flange; or
- c) By other means, such as a continuous weld that provides a construction equivalent to an integral flanged construction.

6.39 The method of attachment of a plug-in device to the busway shall be such that:

- a) After installation, there is no opening between the two enclosures larger than the size permitted in [10.5](#); and
- b) Positive metal-to-metal contact between the individual enclosures results unless the assembly complies with [24.3.1](#) and [24.3.3](#).

6.40 A busway plug-in device shall have provision for being secured to the busway in a manner that does not depend on friction alone.

6.41 A plug-in device not incorporating a switching mechanism shall require the use of a tool for removal from the busway and shall be marked in accordance with [45.8](#) unless the plug-in device complies with the requirements in Section [32](#), Overload and Endurance Tests for Non-Switching Plug-In Devices.

6.42 A fitting incorporating a disconnecting device (a switch or circuit breaker) with a separate, cover-mounted operating member shall be constructed so that the door, front, or cover cannot be secured in place as intended with the handle or operating member indicating "Off" and the disconnecting contacts in the closed position.

6.43 All live parts shall be mounted in place when a plug-in device is shipped from the factory. However, a busway plug intended for housing one or more circuit breakers may be shipped separately from the circuit breaker, the neutral bus, or both. The neutral bus of an enclosed switch plug-in device may be shipped separately from the remainder of the device if all of the following conditions are met:

- a) The parts involved are constructed so that the method of field installation of the separate parts is obvious and does not require installation of auxiliary parts to accomplish the mounting or provide the required spacings.

b) The construction is such that the installation of the circuit breaker or the neutral is unnecessary either:

- 1) To maintain spacings involving the means for connecting the plug-in unit to the bus bars (the stabs and mounting means), or to prevent such parts from turning or shifting; or
- 2) To maintain spacings involving connecting leads or bus bars inside the plug-in device, unless such leads or bus bars are appropriately insulated.

c) The fitting is marked in accordance with [45.4](#).

d) Instructions for installing the separate parts are provided.

6.44 Individual conductors (bus bars, wires, and the like) of an alternating-current circuit carrying more than 50 A shall not be run through separate openings in a ferrous metal wall.

6.45 A short-run busway shall be constructed so that electrical and mechanical continuity of the complete enclosure will result when the busway system is installed. The enclosure shall be of substantial construction and shall completely enclose the bus bars; the bus bars at an end fitting need not be enclosed. Openings for ventilation shall not be provided.

6.46 A short-run busway shall be provided with a ground bus located within the enclosure that complies with the requirements specified in [12.1](#) without including the cross-sectional area of the enclosure.

6.47 A short-run busway enclosure shall be constructed of galvanized sheet steel, painted sheet aluminum, or other sheet steel provided with corrosion protection as specified in [6.58](#). The thickness shall be in accordance with [Table 6.1](#).

Table 6.1
Thickness of Sheet Metal for Short-Run Busway

Maximum inside width		Minimum thickness of sheet metal			
mm	(inch)	mm	(inch)	mm	(inch)
152	(6)	1.42	(0.056)	1.91	(0.075)
457	(18)	1.78	(0.070)	2.41	(0.095)
762	(30)	2.46	(0.097)	3.09	(0.122)

6.48 Each longitudinal seam of a short-run busway enclosure shall be provided with fastenings spaced no more than 305 mm (12 inches) apart, as measured along the length of the duct.

6.49 Four or more 6.4 mm (0.25 inch) diameter drain holes shall be provided in each short-run busway section intended for outdoor use.

6.50 A short-run busway shall be provided with means for support at intervals of no more than 1.52 m (5 feet).

6.51 Short-run busway insulating supports for bus bars shall be spaced no more than 610 mm (24 inches) apart, as measured between centers of adjacent supports along the length of the busway. An insulator shall be glazed porcelain, molded phenolic, sheet phenolic composition, or other insulating materials that have been evaluated and determined to be rated for the purpose as described in [6.5](#) and [8.2](#).

6.52 An enclosure, an opening, a frame, a guard, a knob, a handle, or the like shall not be sufficiently sharp to constitute a risk of injury to persons during intended maintenance or use.

6.53 The enclosure shall contain all live parts and shall provide strength to maintain its shape when supporting a fitting intended for use with it. Every part shall be secured in place. A terminal to which an external connection will be made in a transformer tap or in a switchboard stub need not be enclosed.

6.54 An enclosure cover that prevents access to an overload protective device requiring renewal in its normal functioning shall be hinged, sliding, or otherwise attached to prevent its removal. To hold it closed, such a cover shall not depend solely upon screws or similar means requiring the use of a tool but shall be provided with a spring latch or catch. The requirement shall not apply to a plug-in device in which the enclosure is completed by the enclosure of the busway on which the device is mounted provided the thickness of metal and the means of attaching the plug-in device are such that the resulting assembly is the equivalent of what would be required for the enclosure of the plug-in device itself.

6.55 Sheet metal employed for a busway enclosure shall have a thickness no less than that specified in [Table 6.2](#) unless the busway complies with the requirements in Section [28](#), Bending Resistance Test, Section [29](#), Impact Strength Test, and Section [30](#), Crush Resistance Test. Sheet metal employed for a fitting enclosure shall have a thickness in accordance with [6.37](#). Sheet metal employed for a short-run busway shall have a thickness in accordance with [Table 6.1](#). A busway rated 100 A or less may employ an unventilated enclosure of sheet steel having a thickness of no less than 0.81 mm (0.032 inch) and may employ a formed, unventilated enclosure of sheet steel no less than 0.66 mm (0.026 inch) thick at any point if an insulating lining of vulcanized fiber, or the equivalent, no less 0.81 mm (0.032 inch) thick is provided. The lining may serve as the sole separation between the bus bar and the enclosure.

Table 6.2
Thickness of Sheet Metal for Busway Other Than Short-Run Busway

Maximum inside width of widest surface		Minimum thickness of sheet metal ^a			
		Steel		Aluminum	
mm	(inches)	mm	(inches)	mm	(inches)
305 ^b	(12 ^b)	1.35	(0.053)	1.91	(0.075)
457	(18)	1.70	(0.067)	2.41	(0.095)
762	(30)	2.36	(0.093)	3.10	(0.122)
More than 762	More than 30	3.12	(0.123)	3.89	(0.153)

^a The minimum thickness refers to the base material and does not include a coating thickness.

^b The maximum width may be 457 mm (18 inches) if the enclosure does not support the weight of the bus bar assembly.

6.56 The thickness of sheet metal to which a wiring system is to be connected shall be no less than 1.35 mm (0.053 inch) for steel, and no less than 1.91 mm (0.075 inch) for aluminum, excluding any coatings.

6.57 An enclosure consisting of metal other than sheet steel or aluminum shall comply with the requirements in [28.1](#), [29.1](#), and [30.1](#).

6.58 An outdoor busway sheet steel enclosure shall be made corrosion-resistant by one of the following coatings:

- a) Hot-dipped, mill-galvanized sheet steel conforming with the coating designation G90 in the Table for Weight [Mass] of Coating Requirements (Total Both Sides) of ASTM A653/A653M / NMX-J-148-ANCE, with no less than 40 % of the zinc on any side, based on the minimum single-spot test requirement in the reference. The weight of zinc coating may be determined by any method

deemed acceptable; however, in case of question, the weight of the coating shall be established in accordance with the test method in ASTM Designation A 90/A 90M.

b) A zinc coating, other than that provided on hot-dipped, mill-galvanized sheet steel, uniformly applied to an average thickness of no less than 0.0155 mm (0.00061 inch) on each surface with a minimum thickness of 0.0137 mm (0.00054 inch). The thickness of the coating shall be established by the requirements in [34.1](#).

c) A zinc coating conforming with (1) or (2) below and with one coat of an organic finish of the epoxy or alkyd-resin type or other outdoor paint on both surfaces after forming. If necessary, the acceptability of the paint may be determined by consideration of its composition or by corrosion tests. The paint may be omitted at the adjoining surfaces at joints between enclosure sections of a busway not having a ground bus.

1) Hot-dipped, mill-galvanized sheet steel conforming with the coating designation G60 or A60 in the Table for Weight [Mass] of Coating Requirements (Total Both Sides) of ASTM A653/A653M / NMX-J-148-ANCE, with no less than 40 % of the zinc on any side, based on the minimum single-spot test requirement in the reference. The weight of zinc coating may be determined by any method deemed acceptable; however, in case of question, the weight of coating shall be established in accordance with the test method of Designation A 90/A 90M.

2) A zinc coating, other than that provided on hot-dipped, mill-galvanized sheet steel, uniformly applied to an average thickness of no less than 0.0104 mm (0.00041 inch) on each surface with a minimum thickness of 0.0086 mm (0.00034 inch). The thickness of the coating shall be established by the requirements in [34.1](#).

d) Other finishes, including paints, special metallic finishes, and combinations of the two may be used if they comply with UL 1332 / CSA C22.2 No. 94.2 / NMX-J-235/2-ANCE.

6.59 An annealed coating on sheet steel that is bent or similarly formed or extruded or rolled at edges of holes after annealing shall be additionally painted in the affected area if the process damages the zinc coating.

6.60 If flaking or cracking of the zinc coating at the outside radius of the bent or formed section is visible at 25 power magnification, the zinc coating shall be considered to be damaged. Simple sheared or cut edges and punched holes are not required to be additionally protected.

6.61 If the hot-dipped, mill-galvanized G90 coating on drawn, formed, extruded, or rolled sheet steel becomes damaged during handling or fabrication to the extent that the base metal is exposed, at least one coat of an organic finish of the epoxy or alkyd-resin type, or other outdoor paint, shall be applied after fabrication to the entire area where the damage to the coating occurred. Exposed base metal of an uncoated cross-section surface at a cut edge or at a drilled opening is not required to be painted.

7 Clearance and Creepage Distances

7.1 Busway and fittings not incorporating a switching mechanism

7.1.1 The clearance and creepage distances in a busway and in a fitting not incorporating a switching mechanism shall be no less than those indicated in [Table 7.1](#). Two busways shall be connected together in the intended manner to permit the distances to be measured at the joint.

7.1.2 The creepage distances in a ventilated busway incorporating any uninsulated live parts shall be no less than 150 % of the values in [Table 7.1](#).

7.1.3 Short-run busway clearance and creepage distance requirements shall be as specified in [7.3.1](#).

Table 7.1
Clearance and Creepage Distances

Current rating, A	Location	Voltage between parts involved, V	Minimum distances			
			Clearances		Creepage	
			mm	(inch)	mm	(inch)
0 – 60	Between a live part and the enclosure	0 – 300	3.2	(1/8)	6.4	(1/4)
		301 – 600	12.7	(1/2)	12.7	(1/2)
		601 – 1000	20.3	(0.8)	25.4	(1)
0 – 60	Between a live part and a grounded metal part other than the enclosure	0 – 300	3.2	(1/8)	6.4	(1/4)
		301 – 600	9.5	(3/8)	12.7	(1/2)
		601 – 1000	14.0	(0.55)	21.6	(0.85)
0 – 60	Between live parts of opposite polarity	0 – 150	3.2	(1/8)	6.4	(1/4)
		151 – 300	6.4	(1/4)	9.5	(3/8)
		301 – 600	9.5	(3/8)	12.7	(1/2)
		601 – 1000	14.0	(0.55)	21.6	(0.85)
0 – 60	Between a live part and grounded metal in a take-off device	0 – 300	3.2	(1/8)	4.8	(3/16)
		301 – 600	9.5	(3/8)	12.7	(1/2)
		601 – 1000	14.0	(0.55)	21.6	(0.85)
61 – 100	Between a live part and the enclosure	0 – 600	12.7	(1/2)	12.7	(1/2)
		601 – 1000	20.3	(0.8)	25.4	(1)
61 – 100	Between live parts of opposite polarity and between a live part and a grounded or exposed metal part other than the enclosure	0 – 150	3.2	(1/8)	6.4	(1/4)
		151 – 300	6.4	(1/4)	9.5	(3/8)
		301 – 600	9.5	(3/8)	12.7	(1/2)
		601 – 1000	14.0	(0.55)	21.6	(0.85)
More than 100	Between a live part and a grounded metal part including the enclosure	0 – 600	12.7	(1/2)	12.7	(1/2)
		601 – 1000	12.7	(1/2)	25.4	(1)
More than 100	Between live parts of opposite polarity	0 – 150	12.7	(1/2)	19.1	(3/4)
		151 – 300	19.1	(3/4)	31.8	(1-1/4)
		301 – 1000	25.4	(1)	50.8	(2)

7.1.4 [Table 7.1](#) is applicable to a take-off device on the basis of the current rating of the highest rated busway with which that device can be installed.

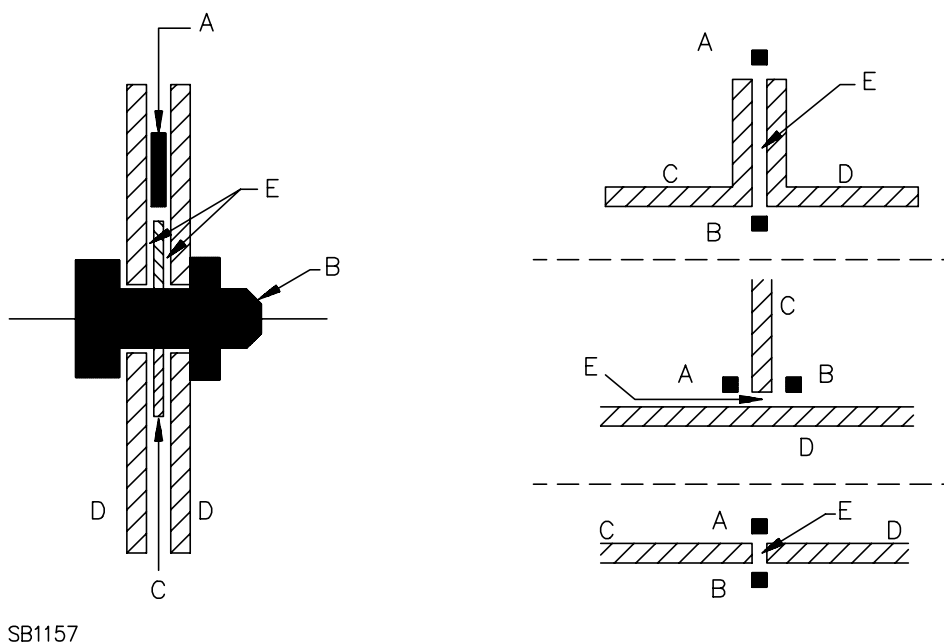
7.1.5 A part intended to be electrically connected to a grounded circuit conductor is considered to be a live part. However, the clearance and creepage distance between such a part and the enclosure need be no larger than that required for the lowest voltage rating category of the ampere-rating bracket in [Table 7.1](#) that includes the rating of the device involved. A part bonded to the enclosure is not considered a live part if the enclosure is marked in accordance with [44.6](#).

7.1.6 If a bus bar covering employs a non-adhesive tape, clearance and creepage distances measured through the cracks between layers of tape shall be no less than those indicated in [Table 7.1](#).

7.1.7 Clearance and creepage distances shall be measured through the cracks of a clamped joint if the joint has not passed the Clamped Joint Test specified in Section [11](#). A clamped joint, as shown in

[7.1](#), is a joint between two pieces of insulating material that are under pressure. An adhesive, cement, or the like, used to effect a seal in lieu of a tightly mated joint shall be evaluated to the requirements of UL 746C / CSA C22.2 No. 0.17.

Figure 7.1
Clamped Joint



Parts A, B – Live parts of opposite polarity or a live part and grounded metal part with clearance and creepage distances through the crack between parts C and D less than required in [Table 7.1](#).

Parts C, D – Insulating barriers clamped tightly together so that the dielectric strength between A and B is greater than the equivalent clearance distance.

Part E – The clamped joint.

7.1.8 In measuring a creepage distance, any slot, groove, or the like, 0.33 mm (0.013 inch) wide or less in the contour of an insulating material shall be disregarded. Also, a clearance distance of 0.33 mm (0.013 inch) or less between a live part and an insulating surface shall be disregarded and the part shall be considered in contact with the insulating material when measuring clearance and creepage distances.

7.1.9 A metallic part, such as a washer or the head of a screw, interposed between parts of opposite polarity or between a live part and grounded metal shall be considered a reduction of the clearance and creepage distances by an amount equal to the dimensions of the metal along the line of measurement.

7.1.10 Clearance and creepage distances shall be measured with all terminals wired with conductors of sizes appropriate for the current rating of the busway or fitting.

7.2 Fittings incorporating a switching mechanism

7.2.1 A clearance and/or creepage distance inside the overall enclosure of a fitting that incorporates a circuit breaker or switch shall be no less than the value indicated in [Table 7.2](#).

Table 7.2
Clearance and Creepage Distances in Switch and Circuit Breaker Fittings

Voltage between parts involved, V	Minimum clearance and creepage distances between					
	Uninsulated live parts of opposite polarity			An uninsulated live part and a grounded metal part		
	Clearance		Creepage		Clearance	
	mm	(inches)	mm	(inches)	mm	(inches)
0 – 130	12.7	(1/2)	19.1	(3/4)	12.7	(1/2)
131 – 300	19.1	(3/4)	31.8	(1-1/4)	12.7	(1/2)
301 – 600	25.4	(1)	50.8	(2)	12.7	(1/2)
601 – 1000	25.4	(1)	50.8	(2)	25.4	(1)

7.2.2 Clearance and creepage distances shall be measured with the fitting and all its components mounted and installed in the intended manner. If the fitting involves a field-wiring terminal, the clearance and creepage distances shall be measured with wire of the proper ampacity installed.

7.2.3 In a fitting that incorporates a switch, the clearance and creepage distances between screwshells of plug fuseholders that are protected by surrounding walls of insulating material and between such screwshells and a metal cover plate may be less than those indicated in [Table 7.2](#), but no less than 6.4 mm (1/4 inch) in any case, if the depth of the receptacle as measured from the top of the wall to the plane of the center contact is no less than 19.1 mm (3/4 inch).

7.2.4 In a fitting that incorporates a switch, the clearance distances given in [Table 7.2](#) are not required to be maintained between switch blades and the enclosure cover when the switch is in the "off" position and the blades are deenergized, but such clearance distance shall be no less than 3.2 mm (1/8 inch).

7.2.5 In a fitting that incorporates a switch, the clearance distance between a door or cover over a fuseholder and:

- a) The center contact of an Edison-base plug fuseholder shall be no less than 39.7 mm (1-9/16 inch).
- b) The center contact of a Type S plug fuseholder shall be no less than 33.3 mm (1-5/16 inch).

7.2.6 In a fitting that incorporates a switch, there shall be a clearance or creepage distance of no less than 3.2 mm (1/8 inch) between line and load terminals of the same polarity.

7.3 Short-run busway

7.3.1 The clearance and creepage distances in a short-run busway shall be no less than those indicated in [Table 7.3](#). Two sections shall be connected together in the intended manner to permit the distances to be measured at the joint.

Table 7.3
Clearance and Creepage Distances in Short-Run Busways

Location	Minimum distances			
	Clearance		Creepage	
	mm	(inches)	mm	(inches)
Between a live part and a grounded metal part	25.4	(1)	25.4	(1)
Between live parts of opposite polarity	25.4	(1)	50.8	(2)

8 Insulating Materials

8.1 Insulating material, other than wire insulation, tape, thermoplastic tubing, or continuous bus bar insulation, relied upon for over-surface spacing shall be resistant to arc-tracking under wet contaminated surface conditions and shall be:

- a) A ceramic-type material; or
- b) A material having a Comparative Tracking Index (CTI) no less than 175 as determined in accordance with UL 746A / CSA C22.2 No. 0.17.

8.2 An insulating material other than those specified in [6.16](#) shall have ratings as specified in [Table 8.1](#), or an insulating material may be used based on the end-product tests specified in UL 746C / CSA C22.2 No. 0.17.

NOTE: The specified values in [Table 8.1](#) are derived from UL 746C / CSA C22.2 No. 0.17.

Table 8.1
Insulating Material Ratings

Test specified	Flammability rating of material ^a			
	V-0	V-1	V-2	HB
Comparative Tracking Index under moist conditions (CTI) ^b (volts)	≥ 175	≥ 175	≥ 175	≥ 175
High Current Arc Resistance to Ignition (HAI) ^b (mean number of arcs to cause ignition)	≥ 15	≥ 30	≥ 30	≥ 60
Hot Wire Ignition (HWI) ^b (mean ignition time in seconds)	≥ 7	≥ 15	≥ 30	≥ 30
NOTES:				
1. The following additional parameters shall be considered for distortion under load and mold stress relief properties:				

Table 8.1 Continued on Next Page

Table 8.1 Continued

Test specified	Flammability rating of material ^a			
	V-0	V-1	V-2	HB
a) For the heat deflection temperature test^b, the minimum levels related to flammability classification shall be 10 °C (50 °F) greater than use temperature, but not less than 90 °C (194 °F); or b) For the vicat softening point test^b, the minimum levels related to flammability classification shall be 10 °C (50 °F) greater than use temperature, but not less than 90 °C (194 °F); or c) For the ball pressure temperature test^b, the minimum levels related to flammability classification shall be (40 °C (104 °F) minus the ambient temperature) greater than the use temperature, but not less than 95 °C (203 °F). 2. A material having a comparative tracking index greater than 100 may be used if the voltage involved is 250 V or less. ^a These flammability ratings are derived from UL 94 / CSA C22.2 No. 0.17. ^b See UL 746A / CSA C22.2 No. 0.17, for this specified test.				

9 Terminals for External Conductors

9.1 There shall be ample space within an enclosure for the accommodation of field-installed conductors. The adequacy of wiring space shall be evaluated using the size and conductor material of a wire used at a terminal in accordance with [Table 14.2](#) and [Table 14.3](#). If a terminal is determined to be acceptable for use with two or more combinations of conductors in multiple, each of which would be appropriate for that terminal, the combination necessitating the largest wiring space shall be used. If a terminal is provided for conductors in multiple, the size of each of the conductors shall be based on the use of multiple circuits. For ampacities of 110 A or less, the size may be based on 60 °C (140 °F) insulated conductors even if the marking specifies 60 °C (140 °F) or 75 °C (167 °F) wire.

9.2 The wire bending space provided in a busway or busway fitting shall be in accordance with [Table 9.1](#) for the largest conductor entering or exiting the enclosure opposite the terminal. The wire bending space provided in a busway or busway fitting shall be in accordance with [Table 9.2](#) if the conductor does not enter nor exit the enclosure through the wall opposite the terminal.

Table 9.1
Minimum Wire Bending Distance at Connectors

Wire size		Wires per terminal (pole) ^a			
		1	2	3	4
AWG or kcmil	mm ²	mm (inches)	mm (inches)	mm (inches)	mm (inches)
14 – 10	2.1 – 5.3	Not specified	– –	– –	– –
8	8.4	38.1 (1-1/2)	– –	– –	– –
6	13.3	50.8 (2)	– –	– –	– –
4	21.2	76.2 (3)	– –	– –	– –
3	26.7	76.2 (3)	– –	– –	– –
2	33.6	88.9 (3-1/2)	– –	– –	– –
1	42.4	114 (4-1/2)	– –	– –	– –
1/0	53.5	140 (5-1/2)	140 (5-1/2)	178 (7)	– –
2/0	67.4	152 (6)	152 (6)	191 (7-1/2)	– –

Table 9.1 Continued on Next Page

Table 9.1 Continued

Wire size		Wires per terminal (pole) ^a							
		1		2		3		4	
AWG or kcmil	mm ²	mm	(inches)	mm	(inches)	mm	(inches)	mm	(inches)
3/0	85	165 [12.7]	(6-1/2) [1/2]	165 [12.7]	(6-1/2) [1/2]	203	(8)	—	—
4/0	107	178 [25.4]	(7) [1]	191 [38.1]	(7-1/2) [1-1/2]	216 [12.7]	(8-1/2) [1/2]	—	—
250	127	216 [50.8]	(8-1/2) [2]	216 [50.8]	(8-1/2) [2]	229 [25.4]	(9) [1]	254	(10)
300	152	254 [76.2]	(10) [3]	254 [50.8]	(10) [2]	279 [25.4]	(11) [1]	305	(12)
350	177	305 [76.2]	(12) [3]	305 [76.2]	(12) [3]	330 [76.2]	(13) [3]	356 [50.8]	(14) [2]
400	203	330 [76.2]	(13) [3]	330 [76.2]	(13) [3]	356 [76.2]	(14) [3]	381 [76.2]	(15) [3]
500	253	356 [76.2]	(14) [3]	356 [76.2]	(14) [3]	381 [76.2]	(15) [3]	406 [76.2]	(16) [3]
600	304	381 [76.2]	(15) [3]	406 [76.2]	(16) [3]	457 [76.2]	(18) [3]	483 [76.2]	(19) [3]
700	355	406 [76.2]	(16) [3]	457 [76.2]	(18) [3]	508 [76.2]	(20) [3]	559 [76.2]	(22) [3]
750	380	432 [76.2]	(17) [3]	483 [76.2]	(19) [3]	(559) [76.2]	(22) [3]	610 [76.2]	(24) [3]
800	405	457	(18)	508	(20)	559	(22)	610	(24)
900	456	483	(19)	559	(22)	610	(24)	610	(24)
1 000	507	508	(20)	—	—	—	—	—	—
1 250	633	559	(22)	—	—	—	—	—	—
1 500	760	610	(24)	—	—	—	—	—	—
1 750	887	610	(24)	—	—	—	—	—	—
2 000	1 010	610	(24)	—	—	—	—	—	—

^a Wire bending space may be reduced by the number in brackets under the following conditions:

- 1) Only lay-in or removable wire connectors receiving one wire each are used (there may be more than one lay-in or removable wire connector per terminal); and
- 2) The removable wire connectors can be removed from their intended location without disturbing structural or electrical parts other than a cover, and can be reinstalled with the conductor in place.

Table 9.2
Wire Bending Space

Size of wire		Wire per terminal (pole)									
		1		2		3		4		5	
AWG or kcmil	(mm ²)	mm	(in)	mm	(in)	mm	(in)	mm	(in)	mm	(in)
14 – 10	(2.1 – 5.3)	—	—	—	—	—	—	—	—	—	—
8 – 6	(8.4 – 13.3)	38.1	(1-1/2)	—	—	—	—	—	—	—	—

Table 9.2 Continued on Next Page

Table 9.2 Continued

Size of wire		Wire per terminal (pole)									
AWG or kcmil	(mm ²)	1		2		3		4		5	
		mm	(in)	mm	(in)	mm	(in)	mm	(in)	mm	(in)
4 – 3	(21.1 – 26.7)	50.8	(2)	–	–	–	–	–	–	–	–
2	(33.6)	63.5	(2-1/2)	–	–	–	–	–	–	–	–
1	(42.4)	76.2	(3)	–	–	–	–	–	–	–	–
1/0 – 2/0	(53.5 – 67.4)	88.9	(3-1/2)	127	(5)	178	(7)	–	–	–	–
3/0 – 4/0	(85.0 – 107)	102	(4)	152	(6)	203	(8)	–	–	–	–
250	(127)	114	(4-1/2)	152	(6)	203	(8)	254	(10)	–	–
300 – 350	(152 – 177)	127	(5)	203	(8)	254	(10)	305	(12)	–	–
400 – 500	(203 – 253)	152	(6)	203	(8)	254	(10)	305	(12)	356	(14)
600 – 700	(304 – 355)	203	(8)	254	(10)	305	(12)	356	(14)	406	(16)
750 – 900	(380 – 456)	203	(8)	305	(12)	356	(14)	406	(16)	457	(18)
1 000 – 1 250	(507 – 633)	254	(10)	–	–	–	–	–	–	–	–
1 500 – 2 000	(760 – 1 013)	305	(12)	–	–	–	–	–	–	–	–
NOTES:											
1 – The table includes only those multiple-conductor combinations that are likely to be used. Combinations not mentioned may be given further consideration.											
2 – Alternatively, the values in CSA C22.2 No. 0.12 may be used for a product intended for use only in Canada.											

9.3 The distance mentioned in [9.2](#) shall be measured in a straight line from the edge of the wire terminal closest to the wall, barrier, or obstruction in a direction perpendicular to the wall, barrier, or obstruction. The terminal shall be turned so that the axis of the wire opening in the connector is perpendicular to the wall of the enclosure without defeating any means provided to prevent its turning (such as a boss, shoulder, walls of a recess, multiple bolts securing the connector, or the like). A barrier, shoulder, or the like shall be disregarded when the measurement is being made if it does not reduce the radius to which the wire must otherwise be bent. The main connection for a neutral is considered to be a pole; neutral branch terminals are not counted in this determination.

10 Enclosure and Degree of Protection

10.1 No opening in the enclosure of a ventilated busway shall permit passage of a 16.3 mm (41/64 inch) diameter rod.

10.2 An uninsulated live part in a ventilated busway shall be inaccessible to contact from outside the enclosure by a 6.7 mm (17/64 inch) diameter rod.

10.3 The enclosure of an unventilated busway shall have no opening for ventilation and no opening with a minor dimension exceeding 1.6 mm (1/16 inch) unless the opening for a plug-in device, the drain opening specified in [6.28](#), and the opening between two enclosures specified in [6.39](#) may have a larger minor dimension.

10.4 Other than the opening for the trolley, the enclosure of a trolley busway shall comply with [10.3](#).

10.5 An opening for a plug-in device in other than a continuous plug-in busway or a lighting busway shall:

a) Be provided with a cover that is hinged, sliding, or otherwise secured against removal and with a latch or the equivalent to hold the cover in a closed position; or

b) Have each uninsulated live part inside the enclosure recessed behind the plane of the opening by a distance no less than the smaller dimension of the opening; and

1) The opening is no larger than 9.5 mm by 15.9 mm (3/8 in by 5/8 inch); or

2) If the opening has one dimension larger than 15.9 mm (5/8 inch), it will not admit a 6.7 mm (17/64 inch) diameter rod.

10.6 In a continuous plug-in busway or a lighting busway that is not also rated as a trolley busway, the size of the openings that accommodate plug-in devices, the insulation on the bus bars, or both, shall be such that adequate guarding against unintentional contact with a bare live part will be provided.

11 Temperature Rise

11.1 Assemblies shall be constructed such that temperature rises do not exceed the limits of [Table 11.1](#) as determined by the tests in Sections [15](#) – [17](#). The verification of temperature rise limits tests need not be performed on short-run busways complying with [14.2.2](#) – [14.2.6](#).

Table 11.1
Maximum Temperature Rises

Materials and components	°C (°F)
1. Unplated copper bus or any riveted joint ^a	30 (86 °F)
2. Any part that may be contacted by field wiring	50 ^b (122 °F)
3. Pressure terminal connectors for field-installed conductors	50 (122 °F)
4. Pressure terminal connectors used in circuits rated 110 A or less and marked for use with 75 °C (167 °F) wire	65 ^c (149 °F)
5. Pressure terminals or wire connectors for internal wiring involving aluminum conductors unless the connector has been evaluated for higher temperatures	50 (122 °F)
6. Plated bus bar except as covered in item 2	55 (131 °F)
7. Wire insulation or insulating tubing	20 ^e (68 °F)
8. Electrical tape	40 ^d (104 °F)
9. Varnished cloth insulation	45 ^d (113 °F)
10. Fiber employed as electrical insulation	50 ^d (122 °F)
11. Phenolic or cold molded composition employed as electrical insulation or as a part whose failure would result in an undesired condition	110 ^d (230 °F)
12. Other insulation materials	see footnote e

^a See [14.1.4](#).

^b A plated bus at the connection of field wiring using 75 °C (167 °F) wire for circuits rated 110 A or less may have a 65 °C (149 °F) rise.

^c The temperature rise specified is applicable to a connector for copper wire. It is also applicable to a connector for aluminum wire or an aluminum-bodied connector provided the connector has a temperature rating of 90 °C (194 °F).

^d This limitation does not apply to an insulated conductor or other material as described in [6.15](#), [6.18](#), [6.19](#), [6.22](#), or [8.2](#) that has been evaluated and rated for a higher temperature as specified in footnote e.

^e In the United States, the temperature rise shall be 30 °C (86 °F) less than the thermal index of the material for a lighting or continuous plug-in busway as covered in [5.2](#) and [5.3](#) and 40 °C (104 °F) less than the thermal index of the material for other busways. In Canada and Mexico, the temperature rise shall be 30 °C (86 °F) less than the thermal index of the material for a lighting or continuous plug-in busway rated 225 A or less as covered in [5.2](#) and [5.3](#) and 40 °C (104 °F) less than the thermal index of the material for other busways.

11.2 The heating test on an elbow or tee may be represented by the heating test conducted on a similar straight length of busway. Among the items to be considered when comparing the similarities of the straight lengths to the elbows or tees are the current density in the bus bars, and the cross-sectional area and ventilation of the enclosures.

12 Protection Against Electric Shock

12.1 A busway, busway fitting, or a plug-in or bolt-on unit shall be provided with one of the following means of grounding:

- a) A ground bus, located within the enclosure, that is sized as specified in [Table 12.2](#);
- b) A ground bus located within the enclosure that is sized as specified in [Table 12.1](#) if the busway, busway fittings, or plug-in or bolt-on units have been evaluated in accordance with [21.1.10](#), [21.1.11](#), and [21.2](#) and are marked as specified in [42.14](#) or [42.15](#); or
- c) The sum of the cross-sectional areas of the enclosure metal and the ground bus is in compliance with [Table 12.2](#) (or [Table 12.1](#) and [42.14](#)) and the joints are tested as described in:
 - 1) [21.3.17](#); or
 - 2) Section [23](#), Enclosure Joint Short-Time Fault Current Test, for a busway, busway fitting, or a plug-in or bolt-on unit having an rms symmetrical short-circuit current rating of 10,000 A or less.

Table 12.1
Size of Ground Bus or Enclosure

Ampere rating of overcurrent protection on line side of busway or fitting, A	Minimum cross-sectional area of material ^a					
	Copper		Aluminum		Steel enclosure	
	mm ²	(in ²)	mm ²	(in ²)	mm ²	(in ²)
15	1.94	(0.003)	3.23	(0.005)	14.19	(0.022)
20	3.23	(0.005)	5.16	(0.008)	22.58	(0.035)
60	5.16	(0.008)	8.39	(0.013)	38.71	(0.060)
100	8.39	(0.013)	13.55	(0.021)	58.06	(0.090)
200	13.55	(0.021)	21.29	(0.033)	90.32	(0.140)
300	21.29	(0.033)	33.55	(0.052)	141.94	(0.220)
400	26.45	(0.041)	42.58	(0.066)	180.64	(0.280)
500	33.55	(0.052)	53.55	(0.083)	225.81	(0.350)
600	42.58	(0.066)	67.74	(0.105)	290.32	(0.450)
800	53.55	(0.083)	85.16	(0.132)	361.29	(0.560)
1 000	67.74	(0.105)	107.1	(0.166)	458.06	(0.710)
1 200	85.16	(0.132 ^b)	126.45	(0.196 ^b)	580.64	(0.900)
1 600	107.1	(0.166 ^b)	177.42	(0.275 ^b)	729.03	(1.130)
2 000	126.45	(0.196 ^b)	202.58	(0.314 ^b)	858.06	(1.330)
2 500	177.42	(0.275 ^b)	303.87	(0.471 ^b)	1 206.45	(1.870)
3 000	202.58	(0.314 ^b)	303.87	(0.471 ^b)	1 380.64	(2.140)

Table 12.1 Continued on Next Page

Table 12.1 Continued

Ampere rating of overcurrent protection on line side of busway or fitting, A	Minimum cross-sectional area of material ^a					
	Copper		Aluminum		Steel enclosure	
	mm ²	(in ²)	mm ²	(in ²)	mm ²	(in ²)
4 000	253.55	(0.393 ^b)	405.16	(0.628 ^b)	1 722.58	(2.670)
5 000	354.84	(0.550 ^b)	608.39	(0.943 ^b)	2 412.90	(3.740)
6 000	405.16	(0.628 ^b)	608.39	(0.943 ^b)	2 754.83	(4.270)

NOTE – The table applies only if the busway or fitting is marked in accordance with [42.14](#).

^a If of the same metal, the cross-sectional areas of a ground bus and the enclosure may be added together.

^b The cross-sectional area of a ground bus or enclosure fabricated of the same material as the main bus may be reduced to 12.5 % of the combined areas of the main bus bars of one leg of a busway or fitting rated 1,200 A or more.

Table 12.2
Size of Ground Bus or Enclosure

Minimum ampere rating of busway or fitting, A	Copper		Aluminum		Steel enclosure	
	mm ²	(in ²)	mm ²	(in ²)	mm ²	(in ²)
90	8.39	(0.013)	13.55	(0.021)	58.06	(0.09)
150	13.55	(0.021)	21.29	(0.033)	90.32	(0.14)
200	21.29	(0.033)	33.55	(0.052)	141.94	(0.22)
225	33.55	(0.052)	53.55	(0.083)	225.81	(0.35)
500	53.55	(0.083)	85.16	(0.132)	361.29	(0.56)
800	67.74	(0.105)	107.10	(0.166)	451.61	(0.70)
1 000	85.16	(0.132)	126.45	(0.196)	580.64	(0.90)
1 200	114.19 ^a	(0.177 ^a)	146.45	(0.227)	774.19	(1.20)
1 600	152.26 ^a	(0.236 ^a)	189.68	(0.294 ^a)	1 032.26	(1.60)
2 000	189.68 ^a	(0.294 ^a)	227.74	(0.353 ^a)	1 290.32	(2.00)
2 500	227.74 ^a	(0.353 ^a)	332.26	(0.515 ^a)	1 548.38	(2.40)
3 000	265.81 ^a	(0.412 ^a)	380.00	(0.589 ^a)	1 806.45	(2.80)
4 000	380.00 ^a	(0.589 ^a)	522.58	(0.810 ^a)	2 580.64	(4.00)
5 000	456.13 ^a	(0.707 ^a)	823.22	(1.276 ^a)	3 096.77	(4.80)
6 000	570.32 ^a	(0.884 ^a)	1 013.55	(1.571 ^a)	3 870.96	(6.00)

NOTE – If of the same metal, the cross-sectional areas of a ground bus and the enclosure may be added together.

^a The cross-sectional area of a ground bus or enclosure fabricated of the same material as the main bus may be reduced to 12.5 % of the combined area of the main bus bars of one leg of a busway rated 1,200 A or more.

12.2 A busway or fitting shall have provision in accordance with [24.3.2](#) for bonding all metal parts that are exposed or that are likely to be touched by a person during operation or adjustment of the device and that can become energized, but are not intended to be energized.

12.3 In a busway and in a fitting other than a plug-in fitting, an insulating lining or barrier of fiber or similar material employed where a clearance or creepage distance would otherwise be less than the required value shall be no less than 0.71 mm (0.028 inch) thick.

12.4 An insulating covering on a bus bar employed in place of the minimum clearance distance shall comply with requirements for insulating coverings specified in [6.20](#).