ANSI/CAN/UL 2577:2024

JOINT CANADA-UNITED STATES
NATIONAL STANDARD

STANDARD FOR SAFETY

Suspended Ceiling Power Grid Systems and Equipment

Approved American National Standard

ANSI/UL 2577-2024

SCC FOREWORD

National Standard of Canada

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UL Standard for Safety for Suspended Ceiling Power Grid Systems and Equipment, ANSI/CAN/UL 2577

Second Edition, Dated August 21, 2024

Summary of Topics

This new Second Edition of ANSI/CAN/UL 2577 dated August 21, 2024 incorporates editorial changes including renumbering and reformatting to align with current style.

The new requirements are substantially in accordance with Proposal(s) on this subject dated September 1, 2023.

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1

ANSI/CAN/UL 2577:2024

Standard for Suspended Ceiling Power Grid Systems and Equipment

First Edition – February, 2013

Second Edition

August 21, 2024

This ANSI/CAN/UL Safety Standard consists of the Second Edition.

The most recent designation of ANSI/UL 2577 as an American National Standard (ANSI) occurred on August 21, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface or SCC Foreword.

This Standard has been designated as a National Standard of Canada (NSC) on date August 21, 2024.

No Text on This Page

CONTENTS

MARKINGS

Preface

This is the Second Edition of ANSI/CAN/UL 2577, Standard for Suspended Ceiling Power Grid Systems and Equipment.

ULSE is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL 2577 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

This Second Edition joint American National Standard and National Standard of Canada is based on, and now supersedes, the First Edition of UL 2577 and the First Edition of ULC S2577.

Comments or proposals for revisions on any part of the Standard may be submitted at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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This Edition of the Standard has been formally approved by the Technical Committee (TC) on Technical Committee For Solid State Lighting, TC 8752.

This list represents the TC 8752 membership when the final text in this Standard was balloted. Since that time, changes in the membership may have occurred.

TC 8752 Membership

Name	Representing	Interest Category	Region
Buoniconti, Ralph	SABIC	Supply Chain	USA
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TC 8752 Membership Continued

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Sullivan, Brad	Technical Safety BC	Authorities Having Jurisdiction	British Columbia
Venkataramanan, Venkat	University Of Toronto	General Interest	Ontario
Willis, Karen	National Electrical Manufacturers Association (NEMA)	Non-Voting	USA

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This Standard is intended to be used for conformity assessment.

The intended primary application of this Standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE

INTRODUCTION

1 Scope

1.1 These requirements cover suspended ceiling grid low voltage/extra-low voltage systems and equipment intended for installation and use in accordance with the:

a) In Canada:

1) Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, CSA C22.1;

b) In the United States:

1) National Electrical Code (NEC), NFPA 70.

1.2 The suspended ceiling grid low voltage/extra-low voltage systems covered by this Standard are intended to be installed as a suspended ceiling grid that provides mechanical support for the ceiling tiles and provides electrical connections between the low voltage/extra-low voltage power supply and the low voltage/extra-low voltage equipment. The low voltage/extra-low voltage system consists of the following components:

a) An isolating type low voltage/extra-low voltage power supply with output(s) not exceeding 30 Vac (42.4 V peak) or 60Vdc and not exceeding Class 2 power limits;

b) A grid rail power distribution system to provide power from the Class 2 power supply to one or more pieces of Class 2 powered equipment; and

c) Class 2 powered equipment that is electrically connected to the suspended ceiling grid low voltage/extra-low voltage system.

1.3 The suspended ceiling grid low voltage/extra-low voltage system is intended to be permanently connected, for indoor dry locations, and installed in accordance with the following requirements:

a) In Canada:

1) Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, CSA C22.1, and the National Building Code of Canada;

b) In the United States:

1) National Electrical Code (NEC), NFPA 70, the International Building Code (IBC), and the International Mechanical Code (IMC).

This Standard also covers suspended ceiling grid low voltage/extra-low voltage systems intended for use in air-handling spaces.

1.4 This Standard does not address any supplemental or alternative requirements for suspended ceiling grid low voltage/extra-low voltage systems intended for use in:

a) In Canada:

1) Hazardous locations as specified in the Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, CSA C22.1;

2) General patient care areas or critical patient care areas as defined by Section 24 of the Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, CSA C22.1; or

3) Emergency systems as defined by Section 46 of the Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, CSA C22.1;

b) In the United States:

a) Hazardous locations as specified in the National Electrical Code (NEC), NFPA 70;

b) General patient care areas or critical patient care areas as defined by Article 517 of the National Electrical Code (NEC), NFPA 70; or

c) Emergency systems as defined by Article 700 of the National Electrical Code (NEC), NFPA 70.

1.5 This Standard does not evaluate the suspended ceiling grid low voltage/extra-low voltage system for seismic requirements in accordance with the:

a) In Canada:

1) National Building Code of Canada;

b) In the United States:

1) International Building Code (IBC).

1.6 This Standard does not evaluate the suspended ceiling grid low voltage/extra-low voltage systems for fire resistance.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this Standard shall comply with the requirements for that component.

2.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this Standard; or

b) Is superseded by a requirement in this Standard.

2.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.4 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 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.

4.2 The following publications are referenced in this Standard:

ASTM E230/E230M, *Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples*

CSA C22.1, *Canadian Electrical Code, Part I, Safety Standard for Electrical Installations*

CSA C22.2 No. 0.15, *Standard for Adhesive Labels*

CSA C22.2 No. 0.17, *Standard for Evaluation of Properties of Polymeric Materials*

CSA C22.2 No. 65, *Standard for Wire Connectors*

CSA C22.2 No. 66.1, *Standard for Low Voltage Transformers – Part 1: General Requirements*

CSA C22.2 No. 66.3, *Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers*

CSA C22.2 No. 153, *Standard for Electrical Quick-Connect Terminals*

CSA C22.2 No. 184, *Standard for Solid-State Dimming Controls*

CSA C22.2 No. 188, *Standard for Splicing Wire Connectors*

CSA C22.2 No. 223, *Standard for Power Supplies with Extra-Low-Voltage Class 2 Outputs*

CSA C22.2 No. 2459, *Standard for Insulated Multi-Pole Splicing Wire Connectors*

CSA C22.2 No. 60950-1, *Standard for Information Technology Equipment – Safety – Part 1: General Requirements*

CSA E60730-1, *Standard for Automatic Electrical Controls for Household and Similar Use – Part 1: General Requirements*

CSA E60730-2-9A-01, *Standard for Automatic Electrical Controls for Household and Similar Use – Part 2: Particular Requirements for Temperature Sensing Controls*

National Building Code of Canada, 2010

UL 13, *Power-Limited Circuit Cables*

UL 83, *Thermoplastic-Insulated Wires and Cables*

UL 94, *Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*

UL 244A, *Solid-State Controls for Appliances*

UL 310, *Electrical Quick-Connect Terminals*

UL 486A-486B, *Wire Connectors*

UL 486C, *Splicing Wire Connectors*

UL 486E, *Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors*

UL 723, *Test for Surface Burning Characteristics of Building Materials*

UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 746D, *Polymeric Materials – Fabricated Parts*

UL 758, *Appliance Wiring Material*

UL 796, *Printed-Wiring Boards*

UL 840, *Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment*

UL 969, *Marking and Labeling Systems*

UL 1059, *Terminal Blocks*

UL 1310, *Class 2 Power Units*

UL 1439, *Tests for Sharpness of Edges on Equipment*

UL 1598, *Luminaires*

UL 2043, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*

UL 2108, *Low Voltage Lighting Systems*

UL 4248-1, *Fuseholders – Part 1: General Requirements*

UL 5085-1, *Low Voltage Transformers – Part 1: General Requirements*

UL 5085-3, *Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers*

UL 60065, *Audio, Video and Similar Electronic Apparatus – Safety Requirements*

UL 60730-1, *Automatic Electrical Controls – Part 1: General Requirements*

UL 60950-1, *Information Technology Equipment – Safety – Part 1: General Requirements*

UL 61058-1, *Switches for Appliances – Part 1: General Requirements*

ULC 102, *Method of Test for Surface Burning Characteristics of Building Materials and Assemblies*

ULC 102.2, *Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies*

ULC S102.4, *Standard Method of Test for Fire and Smoke Characteristics of Electrical Wiring and Cables*

ULC S142, *Standard Method of Fire Test for Heat and Visible Smoke Release for Discrete Products*

5 Glossary

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

5.2 BUS BAR – A non-insulated conductor electrically connected to the source of supply and physically supported by an insulator. The bus bar provides a power rail for connection of the low voltage/extra-low voltage equipment.

5.3 BUS BAR SUPPORT – An insulator that runs the length of a section of suspended ceiling grid bus rail and serves to support the bus bars and to isolate them from the suspended grid rail.

5.4 CONNECTOR – A generic term used to refer to an electro-mechanical fitting:

a) Power Feed Connector – An electro-mechanical connector used to connect either the output from the Class 2 power supply to a power distribution cable, or directly to the bus bar, or from the power distribution cable to the bus bar;

b) Load Connector – An electro-mechanical connector used to tap power from the bus bar to the low voltage/extra-low voltage equipment. The load connector may be located above the ceiling grid plane, inline with the ceiling grid plane, or below the ceiling grid plane. A load connector may also be used to mechanically support the low voltage/extra-low voltage equipment.

5.5 GRID BUS RAIL – A combination of the bus bar, bus bar support and the structural suspended ceiling grid system.

5.6 INVERSE POLARITY PROTECTION – A system that prevents two interconnected Class 2 power supplies, when connected positive to negative, from allowing current to flow from one power source into the second power source.

5.7 LOW VOLTAGE/EXTRA-LOW VOLTAGE – Any voltage not exceeding 30 Vac or 60 Vdc

5.8 MANUFACTURER – The organization responsible for producing or distributing the product.

5.9 MOUNTING MEANS – Hardware (such as screws or clips) provided for mechanically securing low voltage/extra-low voltage equipment to the suspended ceiling grid low voltage/extra-low voltage system, or for mounting the grid to the building structure.

5.10 POWER SUPPLY – A Class 2 power unit connected between the branch circuit power distribution system and the suspended ceiling grid low voltage/extra-low voltage system.

5.11 RAIL – The structural support for the suspended ceiling grid system typically forming the ceiling grid supporting the ceiling grid tiles, bus bars, and low voltage/extra-low voltage equipment.

5.12 SUSPENDED CEILING GRID – A system that serves as a support for the grid bus rails. It may also support other low voltage/extra-low voltage equipment such as cables, luminaires, and similar equipment.

5.13 TERMINAL, WIRE-BINDING SCREW – A terminal in which a single conductor is clamped directly under the head of the screw when it is tightened. The single conductor is either bent around the screw in a 3/4 loop or is otherwise retained by interference fit.

MECHANICAL CONSTRUCTION

6 General

6.1 The suspended ceiling grid low voltage/extra-low voltage system shall consist of one or more pieces formed and constructed to make the system readily distinguishable from electrical conduit, electrical metallic tubing and electrical nonmetallic tubing.

6.2 The suspended ceiling grid low voltage/extra-low voltage system shall be formed and assembled so that it has the strength and rigidity required to resist the abuses to which it is subjected, without resulting in a risk of fire, electric shock, or injury to persons, due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts or other serious defects.

7 Assembly and Mounting

7.1 Provision shall be made for attaching the suspended ceiling grid low voltage/extra-low voltage system to the building structure. Such means shall provide for securing the system in accordance with the installation and operation instructions. Refer to the Installation and Operating Instructions, Section 38.

7.2 The grid rail system shall be provided with a means to mechanically secure powered rails to each other if it is intended that powered rails may be interconnected to distribute power.

7.3 A suspended ceiling grid low voltage/extra-low voltage system designed to be secured to the mounting surface by hanging wires, screws or bolts adjacent to any electrical conductor or connector shall not result in damage to the conductors or connectors. Trial installation in accordance with the installation instructions shall be used to determine compliance with this requirement.

7.4 Mounting hardware such as screws or bolts shall either be packaged with the suspended ceiling grid low voltage/extra-low voltage system; or the installation instructions shall specify the types of acceptable mounting fasteners and systems to be used. Refer to 38.1.3(d).

8 Metal Components

8.1 The suspended ceiling grid low voltage/extra-low voltage system shall have a smooth finish free from defects such as projections, sharp edges, burrs or fins likely to damage conductors or connectors when installed as intended, or to constitute a risk of injury to persons during normal maintenance and use.

8.2 Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, powder coating or other equivalent means, when corrosion of such parts results in a risk of fire, electric shock, or injury to persons.

Exception: This requirement does not apply to minor parts of iron or steel, such as washers, screws, or similar parts, edges, punched holes, and spot welds in prefinished steel, enclosed steel pipe, hanger locations for painting or plating in ferrous metals.

8.3 Copper, aluminum, and alloys of copper and aluminum, stainless steel, and similar materials having inherent resistance to atmospheric corrosion may be used without additional corrosion protection.

9 Polymeric Enclosure and Insulation Materials

9.1 General

9.1.1 All parts that act as the electrical insulation, support of uninsulated live parts or as an enclosure shall be made of an insulating material intended for the particular application and shall comply with the requirements in this section. Hard rubber materials shall not be employed.

9.1.2 A molded polymeric assembly used for electrical insulation, support of uninsulated live parts or as an enclosure of live parts shall be fabricated in accordance with UL 746D.

Exception No. 1: A polymeric material that is fabricated in the location where final assembly takes place and where no blending or compounding operations are involved is not required to comply with this requirement.

Exception No. 2: Assemblies that are integral to components previously evaluated and found suitable for the application in accordance with the standard covering that component need not be separately verified as conforming to UL 746D.

9.2 Flammability

9.2.1 A polymeric material used as an enclosure of live parts shall have a flame class rating of V-0 or 5VA in accordance with the requirements of UL 94. A polymeric material used for electrical insulation or for support of uninsulated live parts shall have a flame class rating of V-0, 5VA, or VTM-0. The flame class rating of the material shall be judged at the minimum thickness employed at the walls and barriers that are critical to the functioning of the electrical insulation, support of uninsulated live parts or as the enclosure of live parts.

9.3 Relative Thermal Index (RTI)

9.3.1 A polymeric material used for electrical insulation, support of uninsulated live parts or as the enclosure of live parts shall possess a mechanical with impact and electrical temperature index of at least that measured on the part during the normal temperature test when evaluated in accordance with:

a) In Canada:

1) CSA C22.2 No. 0.17;

b) In the United States:

1) UL 746C.

Exception: When the temperature measured during the normal temperature test is less than 50 °C (122 °F) the polymeric material is not required to comply with 9.3.1.

9.4 Electrical properties

9.4.1 A polymeric material used for electrical insulation, support of uninsulated live parts or as the enclosure of live parts shall have a comparative tracking index (CTI) rating of 100 V or greater or a performance level class of at least 4 when evaluated in accordance with:

a) In Canada:

1) CSA C22.2 No. 0.17;

b) In the United States:

1) UL 746C.

10 System Flammability

10.1 Grid rails with nonmetallic components shall comply with the System Flammability Test – Grid Rails, Section 28.

10.2 Discrete components with nonmetallic enclosures or nonmetallic enclosure parts, including supply and load connectors, intended to be installed in air-handling spaces and marked "Suitable for Use in Air-Handling Spaces," or equivalent, as indicated in 37.3.1, shall comply with the System Flammability Test – Discrete Components Located In Air-Handling Spaces, Section 29. The sample set for the test of 29.3 shall include any nonmetallic mating parts or appendages that will physically engage the discrete component and are anticipated to be within the 1.86 m^2 (20 ft^2) noted in 29.3.

10.3 The installation instructions shall contain the information on the components of the system as required in 38.1.3(f).

11 Adhesives

11.1 Parts of a suspended ceiling grid low voltage/extra-low voltage system and its accessories secured by adhesives and relied upon for structural integrity or securement of a component within the system shall be subjected to the specialized applications adhesives requirements in UL 746C.

11.2 These requirements do not cover adhesives used in the manufacture of printed-wiring boards that are covered by UL 796.

12 Strain Relief

12.1 A connector intended for individual conductors or cable and located where mechanical stress could be transmitted to the individual conductors during installation or use, shall be subjected to the Conductor Secureness Test, Section 33.

12.2 A strain relief device intended to prevent mechanical stress from being transmitted to individual conductors or cable during installation or use, shall be subjected to the Strain Relief Test, Section 34.

12.3 Means shall be provided to prevent the individual conductors or cable from being pushed into the enclosure through the entry hole when such displacement results in:

a) Subjecting the individual conductors or cable to mechanical damage;

b) Exposing the individual conductors or cable to a temperature higher than that for which it is rated;

c) Reducing spacings below the minimum required values; or

d) Damaging internal connections or components.

12.4 To determine compliance with 12.3, the individual conductors and cable shall be subjected the Push-Back Relief Test for Conductors or Cable, Section 35.

ELECTRICAL CONSTRUCTION

13 General

13.1 The low voltage/extra-low voltage Class 2 circuit of the suspended ceiling grid low voltage/extra-low voltage system are permitted to be grounded.

a) In Canada:

1) The low voltage/extra-low voltage Class 2 circuit of the suspended ceiling grid low voltage/extra-low voltage system shall not be grounded.

13.2 A rail incorporating a bus power distribution system shall be provided with no more than one power feed connector.

Exception: A suspended ceiling grid low voltage/extra-low voltage system supplied by direct current is permitted no more than two attachment points, provided that:

a) Inverse polarity protection is provided either integral to each DC power supply or as part of the power feed connector or the grid rail bus bar; and

b) The attachment points are identified and reliably keyed such that the polarity of the two power feed connectors when installed, are at opposite polarity to each other.

13.3 A bus bar insulator shall be secured to the grid rail by mechanical fit or adhesives. The insulator shall continue to perform its intended function after being subjected to the performance tests specified within this Standard.

14 Current-Carrying Parts

14.1 The current-carrying part of a system shall be of copper, a copper alloy, aluminum, or other material investigated and found to meet the performance requirements of this Standard.

14.2 A current-carrying part shall have mechanical strength and ampacity for the intended use and shall be of metal or other material that is acceptable for the application.

14.3 Current-carrying parts shall be isolated from dead metal parts.

14.4 Conductors shall be 18 AWG (0.82 mm^2) minimum copper or equivalent cross sectional area.

Exception: Conductors of a size smaller than 18 AWG copper (0.82 mm^2) or equivalent, but not smaller than 24 AWG copper or equivalent, may be used for Class 2 circuits where they are completely enclosed and not subject to movement or strain under normal use or installation.

14.5 The power feed conductors shall be 16 AWG copper (1.3 mm^2) minimum or equivalent cross sectional area.

14.6 The bus bars shall be 16 AWG copper (1.3 mm^2) minimum or have an equivalent cross sectional area. For a bus bar with a circular cross section the diameter should be 1.29 mm (0.051 in) copper minimum or equivalent, and for a cross section other than circular the area should be 1.32 mm^2 (0.002 in^2) copper or equivalent.

14.7 A bus bar and connectors which have current carrying parts which are exposed or can be repositioned during use, shall be plated with silver, tin, nickel, or similar corrosion resistant material to withstand the long term effects of indoor atmospheric corrosion.

14.8 Iron or steel, if protected against corrosion, may be used for screws, plates, yokes, springs, or other parts that are employed as a means of clamping the conductor, if such parts are not the primary current-carrying members.

15 Securement of Components

15.1 An uninsulated live part, including a terminal, shall be secured to its supporting surface by a method other than friction between surfaces so that it will be prevented from turning or shifting in position if such motion may result in reduction of spacings below the minimum acceptable values. The security of a contact assembly shall maintain continued alignment of contacts.

15.2 The means for preventing the turning or shifting mentioned in 15.1 is to consist of more than friction between surfaces – for example, a properly applied lock washer is acceptable as the means for preventing a small stem-mounted switch or other device having a single-hole mounting means from turning.

15.3 A live screw head or nut on the underside of an insulating base shall be prevented from loosening and shall be acceptably insulated or spaced from the mounting surface.

16 Splices and Connections

16.1 A splice shall be provided with insulation and mechanical protection equivalent to that of the conductors involved.

16.2 In determining if splice insulation consisting of fabric, thermoplastic, or other type of tubing is acceptable, consideration is to be given to such factors as its dielectric properties, heat- and moisture-resistant characteristics. Thermoplastic tape wrapped over a sharp edge is not acceptable.

16.3 A soldered connection shall be made mechanically secure before being soldered.

16.4 A lead is considered to be mechanically secure when one or more of the following is provided prior to soldering:

a) A minimum of one full wrap is provided around a terminal;

b) A lead not integral with a component on a printed wiring board is passed through an eyelet or opening and if hand-soldered is bent 90° to the board;

c) A lead integral with a component is inserted through an opening of a printed wiring board;

d) A lead is twisted with other conductors; or

e) A lead is inserted into a U- or V-shaped slot in the terminal.

16.5 Placement of a lead along a flat surface and tack soldering is not acceptable unless the construction is such that a risk of fire, electric shock, or injury to persons does not result when the lead is detached.

16.6 Other means of securing leads, such as push-on terminals and spade-type connectors shall be investigated to determine if the means provides mechanical security. Quick-connect terminals shall comply with:

a) In Canada:

1) CSA C22.2 No. 153;

b) In the United States:

1) UL 310.

Mechanical splicing devices shall comply with:

a) In Canada:

1) Either CSA C22.2 No. 65;

2) CSA C22.2 No. 188; or

3) CSA C22.2 No. 2459;

b) In the United States:

1) Either UL 486A-486B;

2) UL 486C; or

3) Insulated Multi-Pole Splicing Connectors, UL 2459.

16.7 Where stranded wiring is connected to a wire-binding screw, the construction shall be such that loose strands of wire will not contact:

a) Other uninsulated live parts not always of the same polarity; or

b) Dead metal parts.

17 Electrical Spacings

17.1 Electrical spacings for the supply connection of the Class 2 power supply shall comply with Table 17.1.

Table 17.1
Electrical Spacings

Spacing involved			Minimum spacing							
			0 – 50 Volts rms[a]		51 – 150 Volts rms[a]		151 – 300 Volts rms[a]		301 – 600 Volts rms[a]	
			mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
Between uninsulated current-carrying parts and –	Uninsulated current-carrying parts of opposite polarity	Through air	1.6	(1/16)	3.2	(1/8)	6.4	(1/4)	9.5	(3/8)
		Over surface	1.6	(1/16)	6.4	(1/4)	9.5	(3/8)	12.7	(1/2)
	Exposed dead metal parts that are isolated (insulated)	Through air	1.6	(1/16)	3.2	(1/8)	6.4	(1/4)	9.5	(3/8)
		Over surface	1.6	(1/16)	6.4	(1/4)	9.5	(3/8)	12.7	(1/2)

[a] For peak voltages, multiply applicable rms voltage by the square root of 2.

17.2 Uninsulated Class 2 conductors on the load side and a Class 2 power source shall be reliably spaced apart so that current carrying parts are not inadvertently shorted out between the following points:

a) Uninsulated live parts of opposite polarity; and

b) An uninsulated live part and an accessible dead-metal part when the device is installed as intended, including a metal surface on which the device is mounted in the intended manner or a metal rail or enclosure.

17.3 Compliance with 17.2 shall be determined by conducting the Dielectric Voltage Withstand Test, Section 36.

18 Class 2 Power Supplies and Transformers

18.1 A Class 2 power supply or transformer for use with a suspended ceiling grid low voltage/extra-low voltage system shall be suitable for permanent connection to the building power source. The power conductors shall be segregated or separated from the Class 2 conductors in accordance with 23.2. Cord and plug connected power supplies or transformers shall not be used.

18.2 A Class 2 power unit or transformer shall be marked to indicate Class 2 and comply with the Class 2 requirements of the following standards:

a) In Canada:

1) CSA C22.2 No. 66.1, and CSA C22.2 No. 66.3; or

2) CSA C22.2 No. 223;

b) In the United States:

1) UL 5085-1, and UL 5085-3; or

2) UL 1310.

18.3 A direct current Class 2 power unit or transformer intended for use with a suspended ceiling grid low voltage/extra-low voltage system with two attachment points as described in the exception to 13.2 shall be provided with integral inverse polarity protection.

Exception: Inverse protection may alternately be provided as part of the power feed connector or the grid rail bus bar.

18.4 A Class 2 power supply or transformer and intended to be installed in air-handling spaces shall be identified by being marked:

a) In Canada:

1) "Suitable for Use in Air-Handling Spaces," "Suitable for Use in Other Environmental Air Space in Accordance with Rule 12-010 of CSA C22.1;"

b) In the United States:

1) "Suitable for Use In Air-Handling Spaces," "Suitable for Use in Other Environmental Air Space in Accordance with Section 300.22(C) of the National Electrical Code (NEC), NFPA 70" or equivalent.

19 Luminaires

19.1 A Class 2 luminaire intended for use with the suspended ceiling grid low voltage/extra-low voltage systems shall comply with the applicable requirements for the specific type of luminaire in accordance with:

a) In Canada:

1) Lighting Systems, CSA C22.2 No. 250.2;

b) In the United States:

1) UL 2108.

19.2 A recessed Class 2 luminaire with nonmetallic enclosure or enclosure parts intended to be installed in air-handling spaces[a] shall additionally comply with the requirements in UL 2043.

[a] Products evaluated in accordance with these requirements are considered to comply with the fire retardant and low smoke producing requirements of Section 300 of National Electrical Code (NEC), NFPA 70; Chapter 4 of Standard for the Installation of Air-Conditioning and Ventilating Systems, NFPA 90A; Section 602 of the International Mechanical Code; and Section 602 of the Uniform Mechanical Code.

19.3 A recessed luminaire intended for installation in air-handling spaces shall be marked in accordance with 37.3.1.

20 Switches and Controls

20.1 A switch or other control device shall have a current and voltage rating not less than that of the load that it controls.

20.2 With reference to the requirement in 20.1, the current rating of a switch that controls an inductive load other than a motor, such as a transformer or an electric-discharge-lamp ballast, shall not be less than twice the rated full-load current of the transformer or ballast unless the switch has been investigated and found acceptable for the application.

20.3 A switch having an identified "off" function shall be either:

a) An air gap switching device having, in the "off" mode, an air gap between the line and load terminals; or

b) A solid-state switching device having a maximum let-through current of 0.5 mA.

20.4 A switch as mentioned in 20.3(b) shall not be used to provide a disconnect function and shall be marked as indicated in 37.1.4.

20.5 A switch, other than a through-cord switch, shall be securely mounted and shall be prevented from turning.

Exception: A switch need not be prevented from turning provided:

a) The switch is of a plunger or other type that does not tend to rotate when operated. A toggle switch is considered to be subject to forces that tend to turn the switch during normal operation of the switch;

b) The means for mounting the switch makes it unlikely that operation of the switch will loosen it;

c) The spacings are not reduced below the minimum required values if the switch rotates; and

d) The normal operation of the switch is by mechanical means rather than by direct contact by persons.

21 Control Circuits

21.1 A component used for the remote or automatic switching, dimming or control of another component within the suspended ceiling grid low voltage/extra-low voltage system shall comply with the following:

a) In Canada:

1) CSA C22.2 No. 184;

2) CSA E60730-1 and the applicable Part 2 standard from the CSA E60730 series;

3) CSA C22.2 No. 60950-1; or

4) Audio/Video, Information Technology, and Communication Technology Equipment – Part 1: General Requirements, CSA C22.2 No. 62368-1;

b) In the United States:

1) UL 244A;

2) UL 60730-1, and the applicable Part 2 standard from the UL 60730 series;

3) UL 60950-1; or

4) Audio/Video, Information Technology, and Communication Technology Equipment – Part 1: General Requirements, UL 62368-1.

22 Class 2 Supply and Load Connectors

22.1 General

22.1.1 Connectors intended to connect to the bus rail shall be provided with a securing mechanism attaching the connector to the bus rail system.

22.1.2 A connector designed for use with Class 2 or power limited cable shall enclose a portion of the cable jacket and provide mechanical protection over the individual conductors of the cable.

22.1.3 A Class 2 supply and load connector shall not accept a Class 1 permanent wiring method per:

a) In Canada:

1) CSA C22.1;

b) In the United States:

1) National Electrical Code (NEC), NFPA 70.

22.2 Power feed connector

22.2.1 Power feed connectors shall be keyed so that they can be applied to the bus rail in only one orientation in relationship to the polarity of the grid rail bus bars.

22.2.2 Power feed connectors not provided with installed conductors (cable) shall be designed for use with minimum 16 AWG copper (1.3 mm^2) or equivalent conductors of:

a) In Canada:

1) Type ELC, LVT, or an equivalent or better type as identified in CSA C22.1;

b) In the United States:

1) Type CL2, PLTC, or an equivalent or better type as identified in Table 722.135(E) of the National Electrical Code (NEC), NFPA 70.

22.2.3 Power feed connectors provided with installed conductors (cable) shall be minimum 16 AWG copper (1.3 mm^2) or equivalent stranded conductors.

22.2.4 Power feed connectors shall be marked in accordance with 37.2.1.

22.3 Load connectors

22.3.1 Load connectors not provided with installed conductors (cable) shall be designed for use with minimum 18 AWG copper or equivalent stranded conductors of:

a) In Canada:

1) Type ELC, LVT, or an equivalent or better type as identified in CSA C22.1;

b) In the United States:

2) Type CL2, PLTC, or an equivalent or better type as identified in Table 722.135(E) of the National Electrical Code (NEC), NFPA 70.

22.3.2 Load connectors provided with installed conductors (cable) shall be minimum 18 AWG copper or equivalent stranded conductors.

22.3.3 Polymeric load connectors which support low voltage/extra-low voltage equipment shall be evaluated for support under load in accordance with the Mechanical Assembly Load Test, Section 26.

22.3.4 Load connectors shall be marked in accordance with 37.2.1.

23 Field Wiring

23.1 Field wiring terminals

23.1.1 A field-wiring terminal is any terminal to which a supply conductor or other wire is intended to be connected in the field by an installing qualified person (electrician) and shall be marked in accordance with 37.2.1.

23.1.2 A terminal plate tapped for a wire-binding screw shall be of a metal not less than 1.27 mm (0.050 in) thick, except that a plate not less than 0.76 mm (0.030 in) thick is acceptable if the tapped threads have two or more full threads in the metal, which may be extruded if necessary to provide the threads.

23.1.3 A wiring terminal shall not employ a wire-binding screw having a head less than 6.4 mm (0.275 in) in diameter. If a pre-tapped hole is not provided, a self-tapping screw having not less than 1.26 threads per mm (32 threads per in) shall be used.

23.1.4 Means shall be provided to retain all strands of the conductors. If used, an upturned lug or cupped washer shall be capable of retaining a supply conductor of the size intended.

23.1.5 A wiring terminal shall be prevented from turning.

23.2 Separation for CEC/NEC Class 2 circuits

23.2.1 Insulated factory-installed conductors in:

a) In Canada:

1) CEC Class 2;

b) In the United States:

1) NEC Class 2.

circuits shall be segregated or separated from Class 1 and non-power-limited circuits and conductors by barriers.

Exception: A barrier is not required when all conductors are provided with insulation rated for the highest voltage involved and physical separation is reliably maintained.

23.2.2 With reference to 23.2.1, segregation of conductors shall be accomplished by clamping, routing, or an equivalent means that provides a minimum permanent 50.8 mm (2 in) separation from an insulated conductor of a non-Class 2 limited circuit.

23.2.3 The equipment shall be constructed so that a field-installed conductor of any circuit shall be segregated or separated by a barrier from:

a) Field-installed conductors connected to any other circuit, unless both circuits are insulated for the maximum voltage of either circuit;

b) Uninsulated live parts of any other circuit of the equipment; and

c) Factory-installed conductors connected to any other circuit, unless the conductors of both circuits are insulated for the maximum voltage of either circuit.

PERFORMANCE

24 Connector Tests

24.1 General

24.1.1 The supply and load connectors shall be subjected to the applicable tests as specified in 24.2 – 24.4.

24.2 Movable connector cycle conditioning and temperature test

24.2.1 The connector cycle conditioning described in 24.2 applies to supply and load connectors that may be repositioned along the grid rail bus bar during use in accordance with the installation instructions to facilitate repositioning of system components.

24.2.2 A minimum of 3 samples of each type of connectors, with leads installed, shall be subject to 50 cycles of connection and disconnection from a section of the grid rail bus bar. A cycle consists of one connection and one disconnection from the grid rail.

24.2.3 During this test, the appropriate Class 2 power shall be applied to a section of the grid rail bus bar through a supply connector and a resistive load or the rated load applied to the output of the load connector. The electrical load shall cause the rated current of the sample connector to be drawn through the connector at the system rated voltage. The sample connector shall be applied in a manner so that the polarity remains the same throughout the test. The load connector may be relocated along the bus bar throughout the 50 cycles.

24.2.4 There shall be no damage to the connections, leads, or separation of the conductors from the terminals. Afterwards they shall be subjected to the temperature test in accordance with 24.2.5.

24.2.5 Upon conclusion of the 50 cycles, the sample connector shall be installed on the grid rail bus and thermocouples attached to the terminals and the insulation adjacent to the termination points. The power and load shall be adjusted to draw the maximum rated current of the sample connector through the system. The test shall be conducted for 7 h.

24.2.6 Upon the completion of the temperature test, the maximum rise temperature of the terminals shall not exceed 30 °C (86 °F) and the temperatures measured on the insulating materials shall not exceed the material's relative thermal index when adjusted for 25 °C (77 °F) ambient.

24.3 Field-installed conductors conditioning and temperature test

24.3.1 The field-installed connector conductor conditioning described in this section applies to power and load connectors requiring field-installed connections.

24.3.2 A minimum of 3 samples of each type of connectors shall be tested. Each lead of a connector is to be assembled to the terminal in accordance with the manufacturer's instructions using the method and tools specified. After being assembled, each terminal of a device shall be subjected to a direct pull of 89 N (20 lbf) applied to each conductor for a period of 1 min. The pull is to be applied gradually and in the direction most likely to result in failure of the connection.

24.3.3 A terminal intended for connection to a range of wire sizes is to be tested using both the maximum and the minimum wire size.

24.3.4 There shall be no damage to the connections or separation of the conductors from the terminal. Afterwards they shall be subjected to the temperature test in accordance with 24.3.5.

24.3.5 Upon conclusion of the test in 24.3.2, the connector shall be installed on the grid rail bus and thermocouples attached to the connector terminals and the insulation adjacent to the termination points. The power and load shall be adjusted to draw the maximum rated current of the connector through the system. The test shall be conducted for 7 h.

24.3.6 Upon completion of the temperature test, the maximum rise temperature of the terminals shall not exceed 30 °C (86 °F) and the temperatures measured on the insulating materials shall not exceed the material's relative thermal index when adjusted for 25 °C (77 °F) ambient.

24.4 Fixed connector cycling test

24.4.1 The field-installed connector cycling test described in this section applies to supply and load connectors that are intended to be field installed in the grid rail bus bar during use, but not intended to be

repositioned after installation. This test is not required for connectors that have been previously subjected to the test in 24.2.

24.4.2 A minimum of 3 samples of each type of connectors, with leads installed, shall be subject to 10 cycles of connection and disconnection from a section of the grid rail bus bar. A cycle consists of one connection and one disconnection from the grid rail.

24.4.3 There shall be no damage to the connections, leads, or separation of the conductors from the terminals.

25 System Temperature Test

25.1 General

25.1.1 A complete grid rail system shall tested together as a system and shall not attain a temperature at any point to present a risk of fire, to damage any materials in the system, or to exhibit greater temperature rises at specific points than indicated in Table 25.1.

Table 25.1
Maximum Acceptable Temperature Rise

Thermocouple location		°C	(°F)
1.	Conductors (bare or insulated) without a nickel coating or equivalent protection	125	(257)
2.	Copper or aluminum current-carrying parts of a lampholder	175	(347)
3.	Nickel plated copper current-carrying parts of a lampholder	225	(437)
4.	Nickel alloy current-carrying parts of a lampholder	290	(554)
5.	Supply and load connector terminals	30	(86)
6.	Polymeric materials	[b]	[b]
7.	Conductors (bare or insulated) that can contact combustible materials[a]	65	(149)
8.	Wire or cord	[d]	[d]
9.	Lampholder enclosure of thermosetting material[c]	125	(257)
10.	Metal ballast enclosure	65	(149)
11.	Fuse	65	(149)
12.	Enclosure of a potted, metal-enclosure coil type device; Class 105 insulation system	65	(149)
13.	Coil of device employing		
	Class 105 insulation system:		
	1. Thermocouple method	65	(149)
	2. Change of resistance method	75	(167)
	Class 130 insulation system:		
	1. Thermocouple method	85	(185)
	2. Resistance method	95	(203)
14.	Capacitors[c]		
	1. Electrolytic	40	(104)
	2. Other types	65	(149)

Table 25.1 Continued on Next Page

Table 25.1 Continued

Thermocouple location	°C	(°F)
15. Fiber employed as electrical insulation	65	(149)
16. Varnished cloth insulation	60	(140)
17. Wood	65	(149)
18. Ceiling tile	65	(149)
19. Recessed housing of luminaire	125	(257)

[a] Examples of conductors that could contact combustible materials would be grid rail conductors adjacent to ceiling tiles.

[b] The investigation of a polymeric material shall comply with the appropriate requirements in 9.3.

[c] These limitations do not apply to compounds or components that have been investigated and found acceptable for a higher temperature.

[d] The maximum temperature measured on the wire or cord, when corrected to a 25 °C (77 °F) ambient temperature, is not to exceed the temperature rating of the wire or cord used.

25.1.2 Tests are to be conducted at an ambient temperature of 25 ±5 °C (77 ±9 °F). The values for temperature rise in Table 25.1 are based on an assumed ambient temperature of 25 °C (77 °F). The ambient temperature is to be monitored by means of a thermocouple immersed in 15 mL (1/2 oz) of light mineral oil in a glass container.

25.1.3 Temperature measurements to determine compliance with Table 25.1 are to be obtained by the thermocouple method. Temperature measurements for enclosed-coil type devices are to be obtained by the change-of-resistance method. Temperature measurements are to be made 3.5 h after the start of the test at 0.5-h intervals. A temperature is considered to be constant when three successive readings taken at 0.5-h intervals indicate no further change.

25.1.4 Thermocouples are to consist of wires no larger than 24 AWG (0.21 mm^2) and no smaller than 30 AWG (0.05 mm^2). It is standard practice to employ thermocouples consisting of 30 AWG iron and constantan wires and a potentiometer type instrument; such equipment is also to be used whenever referee temperature measurements by thermocouples are necessary. Thermocouple wires are to conform with the requirements specified in the Initial Calibration Tolerances for Thermocouples table in ASTM E230/E230M.

25.1.5 A thermocouple junction and the adjacent thermocouple lead wire are to be held securely in thermal contact with the surface of the material and should be placed on the hottest parts. Tape used to secure a thermocouple shall not be located within 76.2 mm (3 in) of the thermocouple junction.

25.1.6 The temperature of a polymeric part is to be measured by placing one or more thermocouples in contact with the part so the thermocouple is between the part and any metallic material or other source of conducted heat. Temperatures generated by a source of radiated or convective heat are to be measured by inserting the thermocouples into holes in the enclosure and positioning them so the thermocouple tips are flush with the plane of the inside surface. The thermocouples are to be sealed in place with fullers earth and sodium silicate (waterglass).

25.1.7 A device used with a luminaire such as a shutter, an iris, or a barndoor that is:

a) Permanently mounted to; or

b) Intended to be used with a lighting assembly and is intended to alter the light beam

is to be adjusted so the aperture is uniformly reduced in area by 70 %.

Exception: If the aperture opening cannot be uniformly reduced in area by 70 %, it may be adjusted to the smallest possible opening.

25.2 Test setup – grid rail system

25.2.1 The grid rail bus bars with the maximum length of grid rails and maximum number of connectors shall be connected and assembled as specified in the installation instructions, with a power feed connector and at least one load connector positioned at the maximum distance from the power supply connector allowed by the construction. The load connector shall be connected to a representative low voltage/extra-low voltage equipment load (see 25.3.2), with additional resistive loads if necessary, and adjusted to draw the maximum rated current of the connector through the system.

25.2.2 If more than one connector is required to load the system to rated current multiple connectors are to be positioned adjacent to each other at the maximum distance from the power source. A connector that uses a crimp or spring type contact to retain the conductor shall be tested with the minimum and maximum wire size intended to be used with the connector.

25.3 Test setup – power supplies and low voltage/extra-low voltage equipment

25.3.1 The Class 2 power supply should be mounted in accordance with the manufacturer's instructions and connected to rated supply voltage. The output of the power supply should be connected to the grid rail system as noted in 25.2.

25.3.2 The Class 2 low voltage/extra-low voltage equipment shall be mounted in accordance with manufacturer's instructions and connected to the grid rail system as noted in 25.2. If the low voltage/extra-low voltage equipment is adjustable, it should be positioned to cause the highest temperature on the low voltage/extra-low voltage equipment and then repositioned to cause the highest temperatures on the grid rail system, mounting surface, or both.

26 Mechanical Assembly Load Test

26.1 A connector, grid rail or other component part used to support low voltage/extra-low voltage equipment shall be subjected to the load tests as specified in 26.2 and 26.3. Compliance criteria are described in 26.4.

26.2 The load connector is to be mounted to an individual grid rail in accordance with the installation instructions at the maximum support spacing. If there is a point in the grid rail that is less reinforced than at other points, the connector shall be positioned at that point. A connector shall be tested with each conductor size intended to support the low voltage/extra-low voltage equipment weight. A weight equal to two times the weight of the heaviest low voltage/extra-low voltage equipment assembly, but no less than 4.5 kg (10 lbs), is to be suspended from the load connector for 1 h.

26.3 If the adjoining grid system is needed to stabilize the grid and to reduce the twisting, the ceiling grid for 26.2 may consist of not less than 3 maximum length parallel powered grid rails and the maximum length and maximum spaced interconnecting cross members.

26.4 Test results are acceptable if the grid rail or connector is not deformed in a manner that would:

a) Allow the release of the low voltage/extra-low voltage equipment from the grid rail; or

b) Affect compliance with Electrical Spacings, Section 17.

27 Moment Test

27.1 A load connector that supports low voltage/extra-low voltage equipment for which the center of gravity is not located directly vertically below the grid rail load connector is to be subjected to the test described in 27.2 – 27.4 and shall comply with the test results in 27.5.

27.2 A representative assembly of the suspended ceiling grid system shall be installed in accordance with the installation instructions at the maximum support spacing. The ceiling grid shall consist of not less than 3 parallel maximum length powered grid rails and maximum length and maximum spaced interconnecting cross members.

27.3 The load connector and stem, low voltage/extra-low voltage equipment, or other rigid object (for example, a luminaire head and stem) of a length equal to the maximum length of stem intended to be provided on the load connector are to be installed as intended on the grid rail.

27.4 The maximum weight that the assembly is intended to support is to be applied to the end of the stem farthest from the grid rail and parallel to the plane of the grid rail ceiling grid surface for 1 h. The stem may be positioned in any orientation determined to be most severe but shall be at least positioned as follows:

a) Parallel to grid rail; and

b) Perpendicular to the grid rail.

27.5 Test results are acceptable if the grid rail is not deformed in a manner that would:

a) Allow the release of the low voltage/extra-low voltage equipment from the grid rail; or

b) Affect compliance with Electrical Spacings, Section 17.

28 System Flammability Test – Grid Rails

28.1 Representative samples of suspended ceiling grid rails incorporating nonmetallic components intended to be installed in air-handling spaces shall comply with the requirements in:

a) In Canada:

1) ULC 102;

b) In the United States:

1) UL 723, when tested as indicated in 28.2.

The specific ceiling grid finish material(s) shall be installed and tested as a ceiling grid system. For the purpose of establishing the flame spread and smoke developed indices, typically a minimum of three tests each are to be conducted on the finished and unfinished sides of the system. Compliance criteria are described in 28.3.

28.2 Samples are to be positioned in the 7.62 m (25 ft) long fire test chamber. The grid rails and representative ceiling grid finish materials shall be connected end-to-end to form a continuous length 7.3 m ±12.7 mm (24 ft ±1/2 in) long. The rail is to be centered in the fire test chamber. Cross grid rails shall be inserted, typically at 90° to the main grid rail, every 0.6 m or 1.2 m (2 or 4 ft) along the side of the main grid rail based on the manufacturers installation instructions.

The cross grid rails shall span the width of the fire test chamber [451 ±6.3 mm (19-3/4 ±1/4 in)] and rest on the ledges. The finish ceiling tile material shall rest on the grid system. When required, 6.4-mm (1/4-in) diameter steel rods shall be used to support the constructions. When supporting rods are used, they are to be spaced between 0.6 m and 1.2 m (2 ft and 4 ft) apart as required for support of the samples.

28.3 The system shall have a flame-spread rating of not more than 25 without evidence of continued progressive combustion and a smoke-developed rating of not more than 50.

29 System Flammability Test – Discrete Components Located In Air-Handling Spaces

29.1 Discrete components of the system with nonmetallic enclosures or enclosure parts intended to be installed in air-handling spaces shall comply with 29.2 – 29.5.

29.2 Nonmetallic enclosures and other nonmetallic, discrete objects with an overall size less than 710 mm wide by 1220 mm long (28 in wide by 48 in long) intended to be installed in air-handling spaces shall comply with the requirements in:

a) In Canada:

1) ULC 2043;

b) In the United States:

1) ULC S142.[a]

[a] Products evaluated in accordance with these requirements are considered to comply with the fire retardant and low smoke producing requirements of Section 300 of National Electrical Code, NEC), NFPA 70; Chapter 4 of Standard for the Installation of Air-Conditioning and Ventilating Systems, NFPA 90A; Section 602 of the International Mechanical Code; and Section 602 of the Uniform Mechanical Code.

29.3 The sample set for this test shall be the maximum number and type of discrete components that will be within any 6-m (20-ft) square suspended ceiling grid area, as specified in the installation and operation instructions. Grid rail connectors shall be tested in sample sets of five (5), unless the installation instructions for the connector identify a larger number. See 38.1.3(f)(1).

29.4 The sample set shall not include:

a) Ceiling grid rails evaluated per System Flammability Test – Grid Rails, Section 28; or

b) Cables that have separately been evaluated and found suitable for use in air-handling spaces, in accordance with:

1) In Canada:

i) ULC S102.4;

2) In the United States:

i) Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces, NFPA 262.

29.5 Each sample set shall comply with the following parameters:

a) The peak rate of heat release (HRRc) measured during each test shall be 100 kW or less;

b) The peak normalized optical density measured during each test shall be 0.50 or less;

c) The average normalized optical density (10 min test duration) shall be 0.15 or less.

30 Mold Stress-Relief Distortion Test

30.1 One sample of the grid rail with bus bar insulator and one sample of each connector type constructed of thermoplastic materials shall be tested in accordance with 30.2. Compliance criteria is described in 30.3.

30.2 Each sample shall be placed in a full draft circulating air oven maintained at a uniform temperature at least 10 °C (18 °F) higher than the maximum temperature of the material measured under actual operating conditions, but not less than 70 °C (158 °F). The sample is to remain in the oven for 7 h.

30.3 Test results are acceptable if the samples are not deformed in a manner that would:

a) Allow the release of the luminaire or component from the grid rail; or

b) Affect compliance with Electrical Spacings, Section 17.

31 Connector Drop Test

31.1 Three samples of each type of connector constructed of polymeric materials shall be tested in accordance with 31.2 – 31.5. Compliance criteria is described in 31.6.

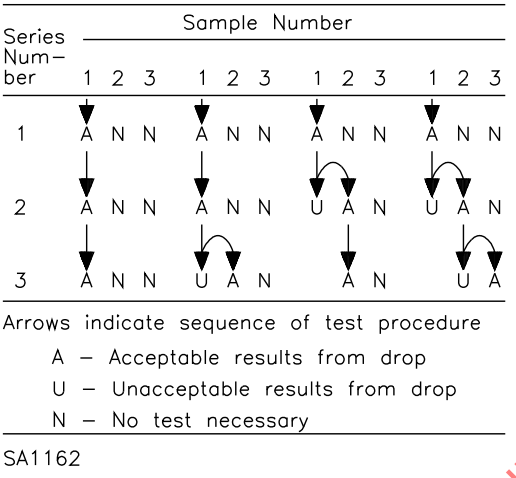
31.2 The samples shall be subjected to a cooling atmosphere for 4 h of 0.0 ±2.0 °C (32.0 ±3.6 °F). Immediately after removal from the chamber the connector shall be subjected to the impact that results from the product being dropped through a distance of 2.44 m (8 ft) onto a hardwood surface. Depending upon intended usage, the product is to be dropped so as to strike the floor in the positions most likely to produce adverse results. After the impact test each connector shall be allowed to stabilize to room temperature. The connector assembly shall be suitable for installation and use after being dropped.

31.3 The hardwood surface is to consist of a layer of nominal 19 mm (3/4 in) thick tongue-and-groove oak flooring mounted on two layers of nominal 19 mm (3/4 in) thick plywood. The hardwood surface assembly is to rest on a concrete floor or the equivalent during the test.

31.4 The test on the connector is to be conducted so that each sample strikes the surface in a position different from those of the other two samples. Three individual samples may be employed for the tests, or if the manufacturer so elects, fewer samples may be used in accordance with Figure 31.1.

Figure 31.1

Procedure for Impact



31.5 The overall performance is acceptable upon acceptable completion of any one of the procedures represented in the table. If any sample is not acceptable on its first drop in any of three positions, the results of the test are unacceptable.

31.6 Test results are acceptable if the samples are not damaged in a manner that would:

a) Allow the release of the low voltage/extra-low voltage equipment from the grid rail; or

b) Affect compliance with Electrical Spacings, Section 17.

32 Field Cutting Test

32.1 A grid rail bus bar and insulator that is intended to be field cut shall be tested in accordance with 32.2. Compliance criteria is described in 32.3.

32.2 The samples shall be subjected to a cooling atmosphere for 4 h to -20.0 ±1 °C (-4.0 ±1.8 °F). Immediately after removal from the chamber the manufacturers recommended method(s) of cutting shall be used to cut the rail through the bus bar and insulator into two pieces. Each piece of cut grid rail shall be allowed to stabilize to room temperature. The grid rail and bus bar assembly shall be suitable for installation and use after being cut. Each piece of grid rail bus bar shall then be subjected to the Dielectric Voltage Withstand Test, Section 36.

32.3 Test results are acceptable if the samples withstand for 1 min, without breakdown, the test potential specified in Section 36.

33 Conductor Secureness Test

33.1 A connector intended for use with an individual conductor or a cable shall be subjected to the test described in 33.2 – 33.4. Compliance criteria is described in 34.5.

33.2 Three samples with the conductor or cable installed shall be placed in a full draft circulating air oven maintained at a uniform temperature at least 10 °C (18 °F) higher than the maximum temperature of the material measured under actual operating conditions, but not less than 70 °C (158 °F). The samples are to

remain in the oven for 7 h. After removal from the oven and returning to room temperature, the samples are to be subjected to the test described in 33.3.

33.3 A pulling force shall be applied for 1 min to the individual conductor or cable in a direction perpendicular to the plane of entrance to the connection. The pulling force shall be 89 N (20 lbf) for an individual conductor and 156 N (35 lbf) for cables.

33.4 Immediately following the tests in 33.3, the connector shall be subjected to and comply with the Dielectric Voltage Withstand Test, Section 36.

33.5 Test results are acceptable if:

a) There is no breaking of the individual conductor or cable or loosening of the conductor or cable connections; and

b) The samples withstand for 1 min, without breakdown, the test potential specified in Dielectric Voltage Withstand Test, Section 36.

34 Strain Relief Test

34.1 A strain relief device intended for use with individual conductors or cable shall be subjected to the test described in 34.2 – 34.4. Compliance criteria is described in 34.5.

34.2 One complete assembled sample consisting of the conductor or cable, strain relief device, and strain relief device mechanical support system shall be placed in a full draft circulating air oven maintained at a uniform temperature at least 10 °C (18 °F) higher than the maximum temperature of the strain relief device measured under actual operating conditions, but not less than 70 °C (158 °F). The sample is to remain in the oven for 7 h. After removal from the oven and returning to room temperature, the sample is to be subjected to the test described in 34.3.

34.3 A pulling force of 156 N (35 lbf) shall be applied for 1 min to the conductor or cable in a direction perpendicular to the plane of the entrance to the strain relief device.

34.4 Immediately following the strain relief test, the conductor or cable shall be subjected to the Dielectric Voltage Withstand Test, Section 36.

34.5 Test results are acceptable if:

a) There is no damage to the conductor, cable, or strain relief device, no loss of integrity to the strain relief device support mechanism, and no more than 32 mm (1/8 inch) movement of the conductor or cable; and

b) The samples withstand for 1 min, without breakdown, the test potential specified in Dielectric Voltage Withstand Test, Section 36.

35 Push-Back Relief Test for Conductors or Cable

35.1 The conductor or cable shall be tested as described in 35.2. Compliance criteria is described in 35.3.

35.2 The conductor or cable is to be held 25.4 mm (1 in) from the point where the cable emerges from the product and is then to be pushed back into the product. When a removable bushing that extends further than 25.4 mm (1 in) is present, it is to be removed prior to the test. When the bushing is an integral part of the conductor or cable, then the test is to be carried out by holding the bushing. The conductor or

cable is to be pushed back into the product in 25.4 mm (1 in) increments until the conduit or cable buckles or the force to push the conductor or cable into the product exceeds 26.7 N (6 lbf).

35.3 Means shall be provided to prevent the conductor or cable from being pushed into the enclosure of a connector through the enclosure entry hole that results in:

a) Subjecting the conductor or cable to mechanical damage;

b) Exposing the conductor or cable to a temperature higher than that for which it is rated;

c) Affect compliance with Electrical Spacings, Section 17; and

d) Damaging internal connections or components.

36 Dielectric Voltage Withstand Test

36.1 The insulation and spacings of a suspended ceiling grid low voltage/extra-low voltage system shall be subjected to the test potential specified in 36.2. Connectors shall be either assembled to or separated from the bus rail which ever condition is more likely to breakdown.

36.2 A 60-Hz sinusoidal potential is to be applied between live parts conductively connected to the supply circuit and dead metal parts. The applied potential is to be 500 V for components on the load side of an:

a) In Canada:

1) CEC Class 2 power source;

b) In the United States:

1) NEC Class 2 power source;

or 1000 V plus twice the supply voltage for all other components. The supply source is to have capacity to maintain the potential specified, except in case of breakdown. The voltage is to be increased gradually from zero until the specified test potential is reached or until breakdown occurs.

Exception: A direct-current potential of 1.414 times the rms value of the specified alternating-current voltage is permitted to be used.

36.3 Breakdown is usually indicated by the tripping of an overload protector in the test equipment; however, an abrupt decrease or retarded advance of the voltmeter reading also indicates insulation breakdown.

36.4 The test equipment is to include a transformer having a sinusoidal output, a means of indicating the test potential, an audible or visual indicator of electrical breakdown, and either a manually reset device to restore the equipment after electrical breakdown or an automatic feature to reject any product that does not meet the requirement.

36.5 When the output of the test equipment transformer is less than 500 volt-amperes, the equipment is to include the voltmeter in the output circuit to directly indicate the test potential.

36.6 When the output of the test equipment transformer is 500 volt-amperes or more, the test potential is able to be indicated by a voltmeter in the primary circuit or in a tertiary-winding circuit, a selector switch marked to indicate the test potential, or in the case of equipment having a single test-potential output, a marking shall be visible while the equipment is in use to indicate the test potential. When a marking is used