National Differences For

UL 62368&NDASH;1

Audio/video, information and communication technology equipment - Part 1: Safety requirements

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Edition: 2

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This new edition of ANSI/UL 62368-1 is being issued to update requirements to those published in IEC 62368-1, second edition. Technical changes to the IEC Standard have been incorporated into the new edition of the UL Standard. National Differences from the First Edition of UL 62368-1 were reviewed and updated in the new edition.

UL 62368-1 is an adoption of IEC 62368-1, Audio/video, information and communication technology equipment – Part 1: Safety requirements (Second Edition, issued February 2014).). Please note that the national difference document incorporates all of the U.S. national differences for UL 62368-1.

This document provides a single listing of the National Differences included in the UL adoption of the corresponding IEC standard.

Preface

This document provides a single listing of the technical National Differences included in the UL adoption of the corresponding IEC standard.

In its IEC-based standards, UL uses the notations indicated below to identify national difference type, and these types are additionally noted in this document. The standard may not use all types of these deviations.

D1 - These are deviations which are based on basic safety principles and requirements, elimination of which would compromise safety for U.S. consumers and users of products.

D2 - These are deviations based on safety practices. These are deviations for IEC requirements that may be acceptable, but adopting the IEC requirements would require considerable retesting or redesign on the manufacturer's part.

DC - These are deviations based on the component standards and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE - These are deviations based on editorial comments or corrections.

DR - These are deviations based on the national regulatory requirements.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

National Differences

1DV.1 DC *Modify Clause 1 by adding the following text after the third paragraph:*

Battery backup systems that are not an integral part of stationary equipment, such as provided in separate cabinets, are subject to the appropriate standard for battery backup systems, such as UL 1973, Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications.

NOTE See Figures 1.1 and 1.2 of UL 1973 for more information on independent electric energy storage systems (EESS) covered by UL 1973, which can consist of both low voltage (class ES or ES2) and high voltage (class ES3) subsystems, battery management, thermal management, and related features and safeguards. When interconnected with AV, IT, and CT Equipment, and typically used in conjunction with an uninterruptible power supply (UPS), such EESS typically serve as a short-term substitution of the mains supply during power outages and similar disturbances.

1DV.2 DE *Modify Clause 1 by replacing the seventh paragraph with the following:*

Additional requirements for information and communication technology equipment intended for outdoor installation are given in CSA/UL 60950-22. Additional requirements for audio/video equipment intended for outdoor installation are given in the relevant requirements in CAN/CSA C22.2 No. 60065 or UL 60065.

1DV.3 DR *Modify Clause 1 by adding the following text:*

1DV.3.1 This standard also is applicable to equipment designed to be installed in accordance with the Canadian Electrical Code, Part I, CSA C22.1-12; Canadian Electrical Code, (CEC) Part II, General Requirements, CAN/CSA C22.2 No. 0-10; the National Electrical Code, NFPA 70-2014; and the National Electrical Safety Code, IEEE C2-2012.

1DV.3.2 The standard is also applicable to equipment, when identified by a marking or instruction [see Annex DVK (Annex DVA, Clause 1 entry)], designed to be installed in accordance with Article 645 of the National Electrical Code, NFPA 70-2014 and the Standard for the Protection of Information Technology Equipment, NFPA 75-2013.

1DV.3.3 See Annex DVA for requirements and references to regulatory requirements that apply to this equipment, as applicable.

1DV.4 D2 *Modify Clause 1 by adding the following text:*

1DV.4.1 This standard includes additional requirements for equipment used for entertainment purposes intended for installation in general patient care areas of health care facilities. See Annex DVB.

1DV.4.2 This standard includes additional requirements for equipment intended for mounting under kitchen cabinets. See Annex DVC.

1DV.4.3 This standard does not apply to equipment having Remote Feeding Telecommunication (RFT) circuits. Equipment having RFT circuits is covered by CSA/UL 60950-21.

1DV.4.4 Additional requirements may apply to large data storage equipment. Refer to CSA/UL 60950-23.

1DV.4.5 This standard does not cover Modular Data Centers (MDCs), only the information and communication technology equipment contained within.

NOTE: In the U.S., Modular Data Centers are covered by UL 2755, Modular Data Centers.

1DV.5 DC *Modify Clause 1 by adding the following text:*

1DV.5.1 Power Distribution Equipment and Sub-Assemblies

1DV.5.1.1 This standard also is applicable to power distribution subassemblies connected to a mains used to distribute power entirely within a system of equipment also covered by this standard, such as power distribution units (PDUs) in the form of cord-connected power strips and shelves with multiple power outlets (receptacles) and intended to be installed in system racks, cabinets, home entertainment centers, etc.

1DV.5.1.2 For equipment covered by this standard that incorporates components and sub-assemblies that perform a power distribution and control function covered by other standards, such as panelboards, load transfer equipment, or uninterruptible power systems utilized in power conditioners and computer power centers, this standard only may be used for investigation of safety for those aspects not covered by the other standards.

1DV.5.1.3 This standard also does not apply to stand-alone equipment used for distribution of mains power that is covered by individual power distribution equipment standards.

1DV.5.1.4 Based on the specific function, the following requirements are applicable to the stand-alone distribution equipment, or apply additionally to power distribution sub-assemblies and components of equipment covered by this standard, as described in 1DV.5.1.2 and 1DV.5.1.3:

- **For Industrial Control Equipment, see CSA C22.2 No. 14 and UL 508.**
- **For Panelboards, see CSA C22.2 No. 29 and UL 67.**
- **For Switchboards, see CSA C22.2 No 244 and UL 891.**
- **For Transfer Switch Equipment, see CSA C22.2 No 178.1 and UL 1008.**
- **For Uninterruptible Power Systems, see CSA C22.2 No. 107.3 and UL 1778.**
- **For Power Distribution Centers for Communications Equipment, see UL 1801.**

– For other forms of power distribution units for general applications, such as,

• Relocatable Power Taps, see CSA C22.2 No. 21, Cord Sets and Power Supply Cords, and UL 1363, Relocatable Power Taps.

• Cord connected Surge Protective Devices, see CSA Technical Information Letter No. A-24, Interim Certification Requirements for AC Line Connected Wiring Devices with Varistors, and UL 1449, Surge Protective Devices.

• Furniture Power Distribution Units, see CSA C22.2 No. 21, Cord Sets and Power Supply Cords, and UL 962A, Furniture Power Distribution Units.

NOTE 1 It is assumed that power distribution equipment covered by the scope of this Standard is interconnected to the ″Outlet″ of a ″Branch Circuit″ as defined in Section 0 of the CEC, Part I, and Article 100 of the NEC. In the case of cord-connected equipment, the Outlet is the Receptacle associated with the building wiring. In the case of permanently connected equipment, the Outlet is the interface between the Branch Circuit conductors associated with the building wiring and the input terminals, pressure connectors, or leads associated with the power distribution equipment covered in whole or part by this standard.

NOTE 2 The following are common definitions of the hardware with related functions that require additional investigation to the appropriate Canadian and U.S. standards.

Industrial Control Panel – An assembly of two or more components consisting of one of the following:

(1) Power circuit components only, such as motor controllers, overload relays, fused disconnect switches, and circuit breakers;

(2) Control circuit components only, such as pushbuttons, pilot lights, selector switches, timers, switches, control relays; or

(3) A combination of power and control circuit components.

These components, with associated wiring and terminals, are mounted on or contained within an enclosure or mounted on a subpanel. The industrial control panel does not include the controlled equipment.

Panelboard – A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition, or other support; and accessible only from the front.

Switchboard – A large single panel, frame, or assembly of panels on which are mounted, on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments. Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets.

Transfer Switch – An automatic or nonautomatic device for transferring one or more load conductor connections from one power source to another.

Uninterruptible Power Supply – A power supply used to provide alternating current power to a load for some period of time in the event of a power failure.

2DV.1 DE *Modify Clause 2 by adding the following NOTE:*

NOTE See also 4.1.1DV.1.

2DV.2 DE *Modify Clause 2 by adding the following references:*

ANSI/ASA S3.25-1989, American National Standard for Occluded Ear Simulator

ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E162, Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source

ASTM F2951, Consumer Safety Specification for Baby Monitors

CSA C22.1, Canadian Electrical Code, Part I

CAN/CSA C22.2 No. 0, Canadian Electrical Code, Part II, General Requirements

CSA C22.2 No. 0.12, Wiring Space and Wire Bending Space in Enclosures for Equipment Rated 750 V or Less

CSA C22.2 No. 14, Industrial Control Equipment

CSA C22.2 No. 21, Cord Sets and Power Supply Cords

CSA C22.2 No. 29, Panelboards and enclosed panelboards

CSA C22.2 No. 31, Switchgear Assemblies

CSA C22.2 No. 42, General use receptacles, attachment plugs, and similar wiring devices

CAN/CSA C22.2 No. 94, Special Purpose Enclosures

CAN/CSA C22.2 No. 94.2, Enclosures for Electrical Equipment, Environmental Considerations

CSA C22.2 No. 107.3, Uninterruptible Power Systems

CSA C22.2 No. 178.1, Requirements for Transfer Switches

CSA C22.2 No. 205, Signal Equipment

CAN/CSA C22.2 No. 226, Protectors in Telecommunication Networks

CSA C22.2 No. 233, Cords and cord sets for communication systems

CSA C22.2 No. 244, Switchboards

CAN/CSA C22.2 No. 60065, Audio, Video and Similar Electronic Apparatus – Safety Requirements

CAN/CSA C22.2 No. 60601-1, Medical Electrical Equipment – Part 1-1: General Requirements for Safety

CAN/CSA C22.2 No. 60950-1, Information Technology Equipment – Safety – Part 1: General Requirements

CAN/CSA C22.2 No. 60950-21, Information Technology Equipment – Safety – Part 21: Remote Power Feeding

CAN/CSA C22.2 No. 60950-22, Information Technology Equipment – Safety – Part 22: Equipment to be Installed Outdoors

CAN/CSA C22.2 No. 60950-23, Information Technology Equipment – Safety – Part 23: Large Data Storage Equipment

CSA CAN-3-C235, Preferred Voltage Levels for AC Systems, 0 to 50 000 V

CAN/CSA-E60825-1, Safety of laser products – Part 1: Equipment classification, requirements and user's guide

CSA Technical Information Letter No. A-24, Interim Certification Requirements for AC Line Connected Wiring Devices with Varistors

C.R.C, c. 1370, Canadian Radiation Emitting Devices Regulations (REDR)

Canada – Hazardous Products Act – Hazardous Products (Toys) Regulations; Canada – Consumer Packaging and Labeling Act

IEC 60318, Electroacoustics – Simulators of human head and ear – Part 1: Ear simulator for the measurement of supra-aural and circumaural earphones

IEC 60651, Sound Level Meters

IEC 61672-1, Electroacoustics – Sound level meters – Part 1: Specifications

IEEE C2, National Electrical Safety Code

IEEE 269, Standard Methods for Measuring Transmission Performance of Analog and Digital Telephone Sets, Handsets, and Headsets

IEEE 487, Recommended Practice for the Protection of Wire-Line Communication Facilities Serving Electric Power Locations

IEEE 1613, Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations

ISO 261, ISO general purpose metric screw threads – General plan

ISO 262, ISO general purpose metric screw threads – Selected sizes for screws, bolts and nuts

NEMA C84.1, American National Standard for Electric Power Systems and Equipment-Voltage Ratings (60 Hz)

NFPA 70, National Electrical Code

NFPA 72, National Fire Alarm and Signaling Code

NFPA 75, Standard for the Protection of Information Technology Equipment

NFPA 99, Health Care Facilities Code

UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 50E Enclosures for Electrical Equipment, Environmental Considerations

UL 67 Panelboards

UL 497 Protectors for Paired Conductor Communications Circuits

UL 497A Secondary Protectors for Communications Circuits

UL 498 Attachment Plugs and Receptacles

UL 508 Industrial Control Equipment

UL 723 Tests for Surface Burning Characteristics of Building Materials

UL 746A Polymeric Materials – Short Term Property Evaluations

UL 891 Switchboards

UL 962A Furniture Power Distribution Units

UL 1008 Transfer Switch Equipment

UL 1059 Terminal Blocks

UL 1069 Hospital Signaling and Nurse-Call Equipment

UL 1363 Relocatable Power Taps

UL 1449 Surge Protective Devices

UL 1778 Uninterruptible Power Systems

UL 1801 Outline for Power Distribution Centers for Communications Equipment

UL 1863 Communications-Circuit Accessories

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

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

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

UL 60950-21 Information Technology Equipment – Safety – Part 21: Remote Power Feeding

UL 60950-22 Information Technology Equipment – Safety – Part 22: Equipment to be Installed Outdoors

UL 60950-23 Information Technology Equipment – Safety – Part 23: Large Data storage Equipment

U.S. Code of Federal Regulations (CFR), Title 21, Chapter I, Subchapter J, Part 1020, Section 1020.10

U.S. Code of Federal Regulations (CFR), Title 21, Chapter I, Subchapter J, Part 1040

U.S. Code of Federal Regulations (CFR), Title 16, Chapter II, Subchapter C, Part 1505

3.2DV DE *Modify 3.2 by replacing the entry for the abbreviation PIS with the following, to correct a typographical error:*

PIS potential ignition source

3.3DV DE *Modify 3.3 by adding the term "telecommunication network" to the above list.*

telecommunication network 3.3.1.3DV.1

3.3.1.2DV D2 *Modify 3.3.1.2 by adding the following Notes:*

Note 1 to entry: For additional information on low voltage d.c. mains (with 48 V and 60 V 'station battery' interface per IEC/TR 62102, or more commonly known as 'centralized d.c. power systems'), refer to Annex DVD.

Note 2 to entry: The requirements in this standard are considered adequate for equipment connected to high voltage d.c. mains up to 600 V d.c. Specific requirements for the d.c. mains interface connector are future work.

3.3.1.3DV D1 *Add new definition of telecommunication network as 3.3.1.3DV.1:*

3.3.1.3DV.1 TELECOMMUNICATION NETWORK – metallically terminated transmission medium intended for communication between equipment that may be located in separate buildings, excluding:

– the mains system for supply, transmission and distribution of electrical power, if used as a telecommunication transmission medium;

– cable distribution systems;

– ES1 circuits connecting units of audio/video, information, and communication technology equipment.

3.3.3.5DV DE *Modify 3.3.3.5 by adding the following NOTE:*

NOTE 1-15, 2-15, 2-20, 5-15 and 5-20 plugs and outlets as specified in IEC/TR 60083 are considered to be non-industrial within the meaning of this standard.

4.1.1DV.1 D2 *Modify 4.1.1 by adding the following text:*

In the U.S. and Canada, components and subassemblies that comply with the standards referenced in Annex DVE are required in addition to or as a replacement for the requirements in this standard. Components complying with these standards are considered acceptable as part of equipment covered by this standard without further evaluation other than to give consideration to the appropriate use of the component or subassembly in the end product.

4.1.1DV.2 DC *Modify 4.1.1 by adding the following text:*

In the U.S. and Canada, components and subassemblies that comply with the standards referenced in Annex DVG are acceptable as an alternative to requirements as part of equipment covered by this standard without further evaluation other than to give consideration to the appropriate use of the component or subassembly in the end product.

4.1.2DV DC *Modify 4.1.2 by adding the following text:*

In the U.S. and Canada, some UL/CSA component standards may be used as alternatives to referenced IEC standards for the purposes of North America certifications or surveillance programs. Components and subassemblies that comply with the standards referenced in Annex DVF are acceptable as part of equipment covered by this standard without further evaluation other than to give consideration to the appropriate use of the component or subassembly in the end product.

4.1.16DV DE *Add Clause 4.1.16DV.1:*

4.1.16DV.1 Mains connections

4.1.16DV.1.1 DE See Clause G.7 for Mains Supply Cords for Pluggable (Cord Connected) Equipment.

4.1.16DV.1.2 DR See Clause G.7ADV for Mains Supply Cords for Pluggable (Cord Connected) Equipment (Canadian and U.S. regulatory-based requirements).

4.1.16DV.1.3 D2 See Annex DVH for requirements for Permanently Connected Equipment.

4.1.16DV.1.4 DR See Annex DVH for requirements for Permanently Connected Equipment (Canadian and U.S. regulatory-based requirements).

4.1.17DV D2 *Add Clause 4.1.17DV.1:*

4.1.17DV.1 External interconnecting cable and wiring

4.1.17DV.1.1 General

External interconnecting cable and wiring are investigated to the requirements of 6.5 and either 4.1.17DV.1.2 or 4.1.17DV.1.3, as appropriate.

External interconnecting cable and wiring 3,05 m or less may be investigated as part of the equipment (system) to the requirements of this standard. See 4.1.17DV.1.2.

External interconnect cable and wiring longer than 3,05 m are regulated by the Canadian Electrical Code, Part I, CSA C22.1, and the National Electrical Code, NFPA 70, and are subject to associated requirements. See 4.1.17DV.1.3.

External interconnect cable longer than 3,05 m designed to carry audio and/or video signals only, and that is not specified by the manufacturer to be routed inside the building structure (e.g., walls, ceilings, etc.), is subject to the applicable requirements of 4.1.17DV.1.2. For purposes of 4.1.17DV.1.2, it is assumed such cables are connected to PS1 circuits.

Alternatively, detachable external interconnecting cable and wiring (with terminations) may be excluded from the equipment evaluation if specified by the manufacturer.

4.1.17DV.1.2 Equipment (system) interconnecting cable and wiring

The following requirements apply to detachable and nondetachable external interconnecting cable and wiring investigated as part of the equipment (system):

– The length of the external interconnecting cable or wiring shall not exceed 3,05 m.

– For external interconnecting cable and wiring connected to PS2 and PS3 circuits, see 6.5 for fire (flammability) considerations.

– There are no fire (flammability) considerations for external interconnecting cable and wiring specified by the manufacturer for connection to circuits that are PS1.

– External interconnecting cable and wiring intended to be connected to an ES3 or PS3 circuit require a jacket for mechanical protection in accordance with Table G.7ADV.2, or equivalent.

– Detachable external interconnecting cable and wiring (with terminations) intended to be connected to a PS2, PS3, ES2, or ES3 circuit and furnished as part of the equipment shall be either marked, or similarly identified in the installation instructions, with the name, trademark, or trade name of the organization that is responsible for the equipment and with the organization's identifying number or equivalent designation for the cable. See Annex DVK.

• The marking may be applied on the cable and wiring at any location.

• This marking is not required to comply with the test for permanence of markings, F.3.9

NOTE This marking is required to allow authorities having jurisdiction to identify external interconnecting cables and wiring that are evaluated as a part of the equipment (system).

Optical fiber interconnecting cables 3,05 m or less are not subject to the above requirements.

4.1.17DV.1.3 External interconnecting cable and wiring considered part of the building installation

External interconnecting cables and wiring longer than 3,05 m are regulated by the Canadian Electrical Code, Part I, CSA C22.1, and the National Electrical Code, NFPA 70. See Annex DVA (Annex Q entry).

4.6.2DV D2 ***Modify 4.6.2 by adding the following text:***

– wire-wrap terminals used for the connection of ES1 and ES2 that are:

• provided on equipment that forms part of the telecommunication network, up to and including the demarcation point, and are located in service access areas only. (This equipment is generally considered Central Office Equipment, although it may be deployed elsewhere in similarly controlled environments.); and

• provided with a guard or cover that prevents unintentional contact during normal operation.

are tested with a steady force of 2,5 N ± 0,25 N.

4.8.3DV D2 ***Modify 4.8.3 by adding the following as a new paragraph following the second dashed paragraph:***

If screws or similar fasteners are used to secure the door/cover providing access to the battery compartment, the fasteners shall be captive to ensure that they remain with the door/cover. This does not apply to side panel doors on larger devices which are necessary for the functioning of the equipment and which are not likely to be discarded or left off the equipment.

4.8.4.5DV D2 ***Modify 4.8.4.5 by deleting the first dashed paragraph.***

4.8.5DV.1 D2 ***Modify 4.8.5 by replacing the value of 30 N in the first paragraph with 45 N.***

4.8.5DV.2 D2 ***Modify 4.8.5 by replacing the first and second dashed paragraphs with the following:***

– the battery compartment door/cover shall not open; and

– the battery shall not become accessible.

Figure 20DV D2 ***Delete Figure 20.***

This Figure does not apply.

5.4.1.8.1DV DE *Modify 5.4.1.8.1 e) by replacing the last sentence with the following to correct a typographical error:*

For DOUBLE INSULATION between transformer windings, the short-circuit is assumed to take place at the point by which the highest WORKING VOLTAGE is produced across the other insulation;

5.4.4.1DV D1 *Modify 5.4.4.1 by replacing the last paragraph with the following:*

For printed boards, see Clause G.13. For antenna terminals, see 5.4.5. For solid insulation on internal and external wiring, see Clause G.6. Additionally, for internal wiring accessible to an ordinary person, see 5.4.6.

5.6.3DV.1 DR *Replace the first paragraph of 5.6.3 with the following:*

Protective earthing conductors shall comply with the minimum conductor sizes in Table G.5, except as required by

- **Table G.7ADV.1 for cord connected equipment; or**
- **Annex DVH for permanently connected equipment.**

5.6.3DV.2 DR *Add two new Notes following the existing Note 2:*

NOTE 1 For cord connected equipment, reference is made to G.7.2 and Table G.7ADV.1 for the size of current-carrying conductors and its associated protective earthing conductor.

NOTE 2 For permanently connected equipment provided with terminal(s) for connection to mains supply, reference is made to the requirements in DVH.3.4 for the size of the protective earthing conductor.

5.6.3DV.3 DR *In the fifth paragraph, add "or Table G.7ADV.1" after the reference to Table G.5.*

5.6.4.1DV DR *Modify 5.6.4.1 by replacing the first dashed paragraph with the following:*

– the minimum conductor sizes in Table G.5 or Table G.7ADV.1 as applicable; or

5.6.4.4DV DR *Modify 5.6.4.4 by adding "or Table G.7ADV.1" after the reference to Table G.5.*

Table 32DV DR *Modify Table 32 as follows:*

In the first column heading, add "or Table G.7ADV.1" after the reference to Table G.5.

5.6.6.1DV DR *Modify 5.6.6.1 by replacing the second paragraph with the following:*

Protective bonding conductors that meet the minimum conductor sizes in Table G.5 or Table G.7ADV.1 as applicable, throughout their length, and whose terminals all meet the minimum sizes in Table 32 are considered to comply without test.

5.7.6.2DV DE *Modify the title of this clause to read as follows:*

Prospective touch voltage and touch current to external circuits

5.7.7DV.1 D2 *Modify 5.7.7 as follows:*

In the first paragraph, and in the first dashed paragraph of a) 1), add the word "stationary" before "pluggable equipment type A".

5.7.7DV.2 D2 *Modify 5.7.7 as follows:*

In the third paragraph, add the following text at the beginning of the paragraph: "Except as noted in a) 1),"

5.7.7DV.3 D2 *Modify 5.7.7 by replacing a) 2) with the following text:*

2) Such equipment shall comply with 5.7.5. The value of S(I_1) shall be added to the measured protective conductor current to determine compliance with the 5 % input current limit per phase specified in 5.7.5.

5.7.7.1DV D2 *Add Clause 5.7.7.1DV.1, including Figures 5.7.7.1DV.1 and 5.7.7.1DV.2:*

5.7.7.1DV.1 Limitation of touch current due to ringing signals

NOTE 1 This requirement is intended to measure the total touch current of the equipment, including touch current due to ringing signals, and determine that the total touch current of the equipment continues to comply with the relevant limits for ES2 specified in Table 4. This requirement supplements 5.7.7, which considers cumulative touch currents associated with all telecommunication ports in the equipment, but not ringing signals exclusively.

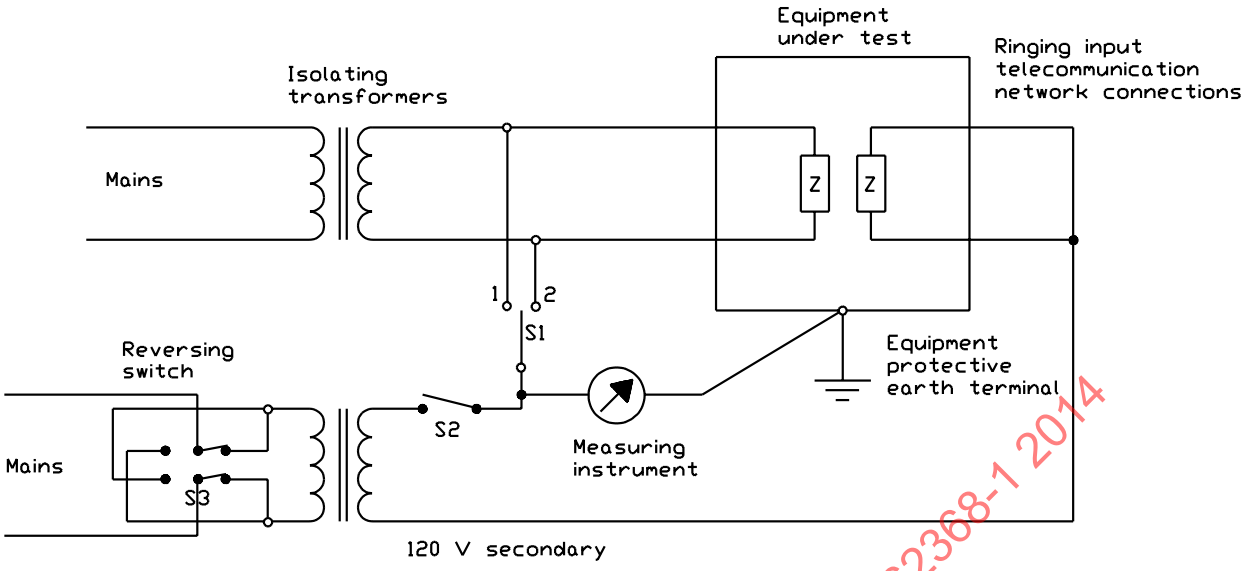
Equipment containing input telecommunication network leads over which ringing voltages are applied to the equipment shall be tested using the circuit of Figure 5.7.7.1DV.1 for mains-connected equipment or Figure 5.7.7.1DV.2 for other equipment. For any position of the selector switches, the total touch current including consideration of 5.7.7 shall not exceed the relevant limits for ES2 specified in Table 4, unless the equipment complies with 5.7.7 a) with the protective conductor current due to ringing signal taken into account.

An EUT that receives ringing voltages on up to three telecommunication network connection ports shall have simulated ringing applied to each network connection.

For four or more ports receiving ringing, simulated ringing shall be applied to three ports and an additional 3 % (rounding down) of the remaining ports.

Compliance is checked by the following tests, which are conducted using the measuring network described in IEC 60990, Figure 4. Simulated ringing at 120 V, 50 to 60 Hz, shall be applied to ringing input telecommunication network leads, either one lead at a time or connected together. Other telecommunication network leads shall be left disconnected. Equipment shall be evaluated in each operating state, including ground start. The general test methods of 5.7 shall apply, checking touch current for all positions of switches S1, S2, and S3 in Figure 5.7.7.1DV.1. In case the total touch current exceeds the ES2 limits, the protective conductor current is measured using the test set up of Figure 5.7.7.1DV.1 or Figure 5.7.7.1DV.2 with the measuring instrument replaced with an ammeter having negligible impedance.

NOTE 2 Conducting the test with the leads connected together generally is a more efficient, though sometimes more onerous, test method. Compliance using either test method is acceptable.



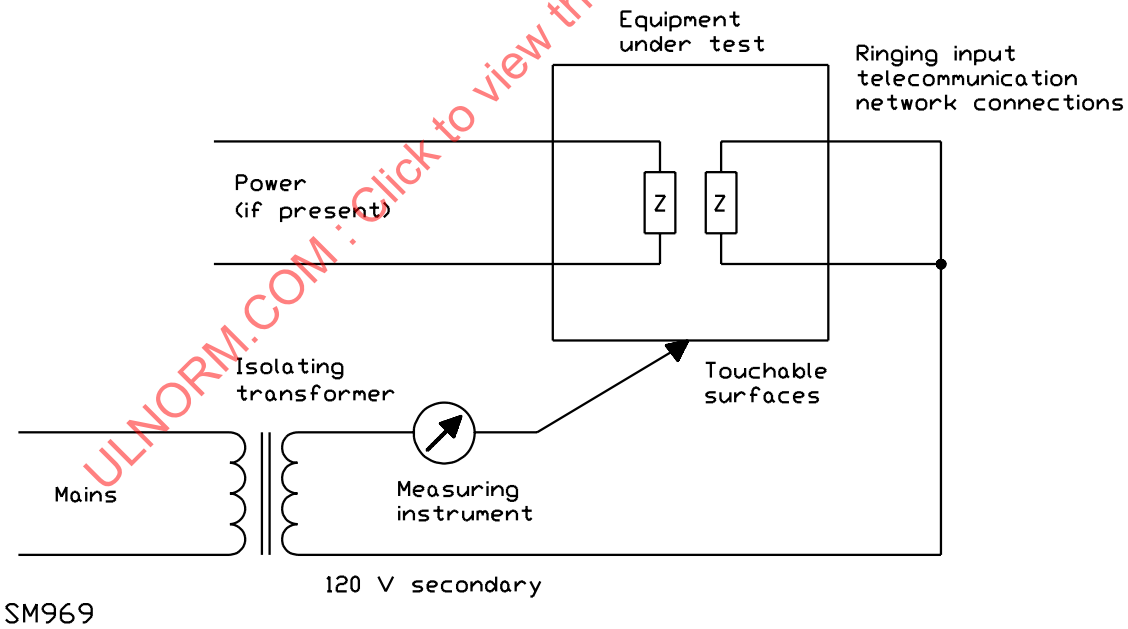


Figure 5.7.7.1DV.2 – Test circuit for earth leakage current on other than mainsconnected equipment

6.5.1DV.1 DC *Modify 6.5.1 by adding the following text to the end of the second, third, and fourth paragraphs:*

or the insulation of the conductor or cable assembly shall be rated VW-1 or FT-1.

6.5.1DV.2 D2 *Modify 6.5.1 by adding the following text and NOTES after the third paragraph:*

PS3 wiring outside a fire enclosure shall comply with single fault testing in Clause B.4. Alternatively, the following constructions are considered to comply:

– conductors provided with overcurrent protection in accordance with Article 240 of the National Electrical Code, NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1, Section 14;

– internal conductors supplied by a power source that is limited to the output voltage and current values specified in Table Q.1 or is limited to the output voltage values and provided with an overcurrent protective device with a rated current value as specified in Table Q.2;

– interconnecting cables supplied by a limited power source (see Clause Q.1); and

– a 20-A protective device used with any size wire in the primary.

NOTE 1 Devices for overload protection of components may also provide protection of associated wiring.

NOTE 2 Internal circuits connected to a mains supply may require individual protection depending on reduced wire size and length of conductors.

6.7DV D1 *Add Clause 6.7DV.1:*

6.7DV.1 Safeguards against electrically-caused fire due to overvoltage from power line crosses

6.7DV.1.1 Equipment with external circuits intended for connection to a telecommunication network that uses outside cable subject to overvoltage from power line failures shall comply with Annex DVI.

10.6.1DV D2 *Modify 10.6.1 by adding the following text:*

For telecommunication-network connected equipment, see Annex DVJ.

F.1DV DR *Modify F.1 by adding the following text:*

F.1DV.1 See Annex DVK for U.S. and Canadian markings and instructions.

F.3.3.9DV DR *Add F.3.3.9DV.1 :*

F.3.3.9DV.1 Equipment with output terminals

Output terminals provided for supply of other equipment except mains supply shall be marked with the nominal output voltage and frequency and, in addition, the maximum output current or power, unless the terminals are marked with the type references of the equipment which are permitted to be connected. When intended to be installed or interconnected in the field by a skilled person, the Class of wiring shall be marked adjacent to the terminals.

Compliance is checked by inspection.

G.4.3DV D2 *Modify G.4.3 as follows:*

Delete the second sentence of the EXAMPLE.

G.5.4.9DV DE *Modify G.5.4.9 by replacing the title with the following to correct a typographical error:*

Test method and compliance criteria for series motors

G.7.2DV DR *Modify G.7.2 as follows:*

In the first paragraph, replace the reference to Table G.5 with a reference to Table G.7ADV.1.

G.7ADV DR *Add Clause G.7ADV, Power supply cords – detachable and nondetachable*

NOTE 1 Applicability of these requirements is dependent on the construction of the equipment and the intended installation and use.

NOTE 2 Related to requirements from the National Electrical Code (NEC), NFPA 70 and the Canadian Electrical Code (CEC), Part I, CSA C22.1, and designated as DR National Differences, this clause is not intended to provide a complete list of all the requirements for power supply cords (detachable and non-detachable) that may be applicable to all equipment covered by this standard – only those that most commonly apply to this type of equipment. For complete requirements, the National Electrical Code (NEC), NFPA 70, the Canadian Electrical Code (CEC), Part I, CSA C22.1, or other referenced documents need to be consulted.

G.7ADV.1 General

Flexible cords and plugs are permitted for movable equipment, hand-held equipment, stationary equipment, and transportable equipment, and for fixed equipment where the fastening means and mechanical connections of the equipment are designed to permit removal for maintenance and repair.

NOTE Equipment such as automated teller machines (ATMs) and similar bank equipment, which are typically installed in banks, financial institutions, supermarkets, etc., are examples of such fixed equipment where flexible cords and plugs are permitted.

G.7ADV.2 Methods of connection

Flexible cords shall be provided with an attachment plug for connection to the branch circuit.

G.7ADV.3 Sizing and ratings

The attachment plug configuration shall be one that is rated not less than 125 % of the current rating of the equipment.

NOTE The maximum rating of equipment that has a NEMA 5-15P plug is 12 A.

Power supply cords shall have conductors with cross-sectional areas sufficient for the rated current of the equipment. Conductors shall be sized based on the requirements in the National Electrical Code (NEC), NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1.

Table G.7ADV.1 provides allowable ampacity for flexible cords and cables based on Table 400.5(a)(1) of the NEC. See Table 400.5(a)(2) of the NEC for ampacity information on portable power cables.

For equipment with a rated current up to and including 2 A, 20 AWG is acceptable provided that the mains plug is provided with a 2 A fuse maximum and the equipment is not provided with a socket outlet.

Table G.7ADV.1 - Power supply cord ampacity

Copper Conductor Size (AWG)	Thermoplastic types	Thermoset types		Types
	TPT, TST	C, E, EO, PD, S, SJ, SJO, SJOW, SJOO, SJOOW, SO, SOW, SOO, SOOW, SP-1, SP-2, SP-3, SRD, SV, SVO, SVOO		HPD, HPN, HSJ, HSJO, HSJOO
		Thermoplastic types		
		ET, ETLB, ETP, ETT, NISPT-1, NISPT-2, SE, SEW, SEO, SEOW, SEOOW, SJE, SJEW, SJEO, SJEOW, SJEOOW, SJT, SJTW, SJTO, SJTOW, SJTOO, SJTOOW, SPE-1, SPE-2, SPE-3, SPT-1, SPT-1W, SPT-2, SPT-2W, SPT-3, ST, SRDE, SRDT, STO, STOW, STOO, STOOW, SVE, SVEO, SVT, SVTO, SVTOO		
		A [a]	B [a]	
27 [b]	0,5	–	–	–
20	–	5[c]	d)	–
18	–	7	10	10
17	–	9	12	13
16	–	10	13	15
15	–	12	16	17
14	–	15	18	20
12	–	20	25	30
10	–	25	30	35
8	–	35	40	–
6	–	45	55	–
4	–	60	70	–
2	–	80	95	–

Table G.7ADV.1 - Power supply cord ampacity Continued on Next Page

Table G.7ADV.1 - Power supply cord ampacity Continued

Copper Conductor Size (AWG)	Thermoplastic types	Thermoset types	Types
	TPT, TST	C, E, EO, PD, S, SJ, SJO, SJOW, SJOO, SJOOW, SO, SOW, SOO, SOOW, SP-1, SP-2, SP-3, SRD, SV, SVO, SVOO	HPD, HPN, HSJ, HSJO, HSJOO

NOTE Derived from the NEC and CEC, Part I. Based on ambient temperature of 30 °C.

[a] The allowable currents under subheading "A" apply to 3-conductor cords and other multi-conductor cords connected to utilization equipment so that only 3 conductors are current-carrying. The allowable currents under subheading "B" apply to 2-conductor cords and other multi-conductor cords connected to utilization equipment so that only 2 conductors are current-carrying.

[b] Tinsel cord.

[c] Elevator cables only.

[d] 7 amperes for elevator cables only; 2 amperes for other types.

G.7ADV.4 Serviceability

Power supply cords and cord sets shall incorporate flexible cords suitable for the particular application or shall be of a type at least as serviceable for the particular application.

Table G.7ADV.2 lists common applications and associated suitable cord types.

Table G.7ADV.2 – Power supply cord serviceability and cord length

Type of equipment	Minimum cord type	Cord length, m
Movable equipment, including desktop, table-top, musical instruments	NISP-2, NISPE-2, NISPT-2, SP-2, SPE-2, SPT-2, SP-3, SPE-3, SPT-3, SV, SVE, SVO, SVOO, SVT, SVTO, SVTOO, SJ, SJE, SJT	1,5 min [a], [b]
Transportable equipment, including hand-held	SV, SVE, SVO, SVOO, SVT, SVTO, SVTOO	1,5 min [a], [b]
Stationary equipment, including floor-standing, rack-mounted, fixed (wall ceiling) mounted	S, SE, SJ, SJE, SJO, SJOO, SJT, SJTO, SJTOO, SO, SOO, ST, STO, STOO, PPE, W	1,5 min [a], [b]
	NISP-2, NISPE-2, NISPT-2, SP-2, SPE-2, SPT-2, SP-3, SPE-3, SPT-3, SV, SVE, SVO, SVOO, SVT, SVTO, SVTOO	1,5 min [a], 2,4 max
Movable, stationary and transportable equipment, including audio and video equipment and musical instruments used in non-household[c] applications	SJ, SJE, SJT	1,5 min, 7,5 max

[a] The minimum length of the power supply cord shall be 1,5 m, unless intended for a special installation, such as dedicated equipment intended to be mounted near a receptacle.

[b] No maximum length specified, except that for equipment intended to allow installation in NFPA 70, Article 645, ITE Rooms [see Annex DVA (Clause 1 entry) and Annex DVK (Annex DVA entry)], the maximum length is 4,5 m.

[c] Non-household applications include commercial and professional equipment installations.

G.7ADV.5 Length

G.7ADV.5.1 Minimum length

The minimum length of a power supply cord shall be 1,5 m unless it is intended for a special installation, such as dedicated equipment intended to be mounted near a mains socket-outlet.

For equipment provided with an external power supply, the minimum length of the power supply cord shall be 0,5 m, provided that the total length of the conductive path from the receptacle to the equipment is 1,5 m or greater.

NOTE The minimum 1,5 m length includes the power supply cord, the axial length of the power supply, and the output conductors, measured from the face of the attachment plug cap to the output connector face. The minimum 0,5 m length of a detachable power supply cord is measured from the face of the attachment plug cap to the cord connector face. The minimum 0,5 m length of a non-detachable power supply cord is measured from the face of the attachment plug cap to the point on the flexible cord where it enters the power supply enclosure, including any strain relief means outside the enclosure.

G.7ADV.5.2 Maximum length

For equipment intended for installation in ITE Rooms, the length of a power supply cord shall not exceed 4,5 m.

For other intended installations, see Table G.7ADV.2.

H.2DV D2 *Modify H.2 by adding the following text after the second dashed paragraph in a):*

Continuous ringing signals shall:

- **be located only in areas where a skilled person has access during servicing;**
- **be so located and guarded that unintentional contact with such parts is unlikely during servicing by a skilled person, or be provided with a marking to warn a skilled person of the presence of continuous ringing signals; and**
- **not become accessible to an ordinary person under single fault conditions.**

H.4DV D2 *Add Clause H.4DV.1:*

H.4DV.1 Other telecommunication signals

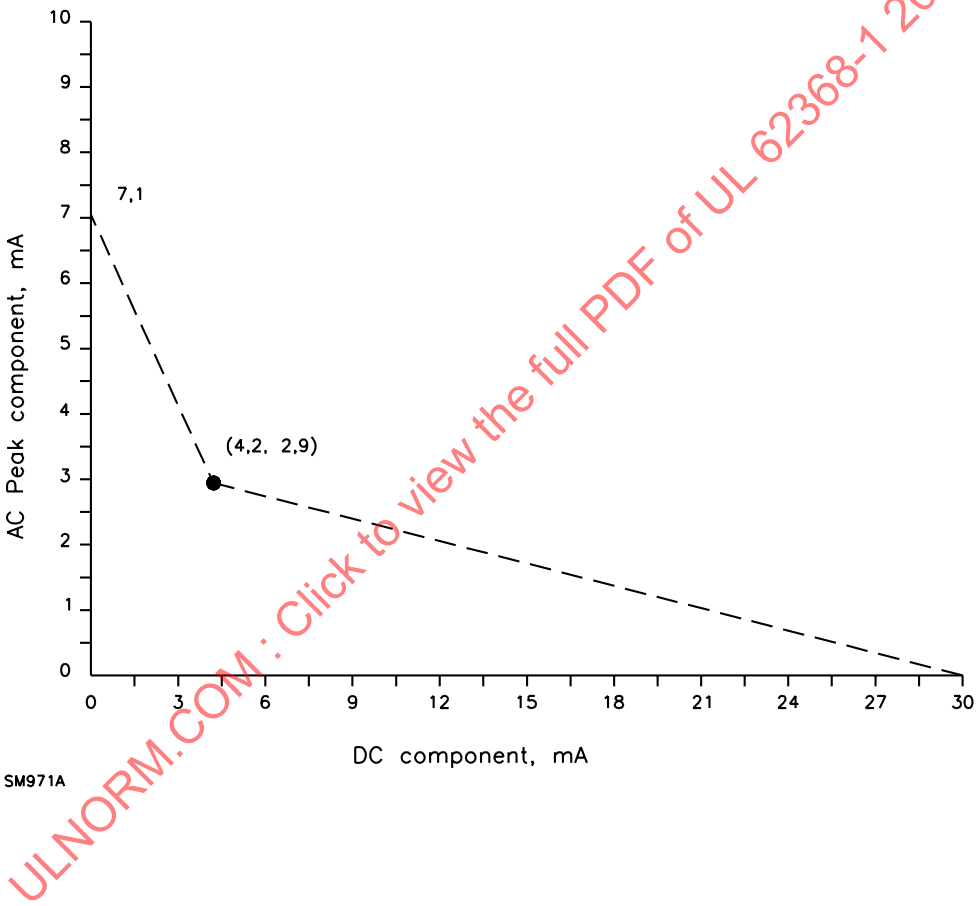
Telecommunication signaling systems (e.g., some message waiting systems) using voltages or current, or both, greater than those specified in 5.2.1.1 and 5.2.1.2 shall be permitted if they comply with the following:

NOTE 1 A part may rely on different requirements for different time intervals.

NOTE 2 These requirements are based on small area contact; parts are not grippable.

– continuous signal: For a signal of duration greater than 5 s, the current through the measuring network described in IEC 60990, Figure 4, shall be not greater than 7.1 mA peak a.c., or 30 mA d.c., or the limit shown in Figure H.4DV.1 for combinations of a.c. and d.c., when measured in accordance with 5.7.

– intermittent signal: For a signal of duration less than 5 s, the current through the measuring network described in IEC 60990, Figure 4, shall be not greater than the limit specified in Figure H.4DV.2. The signal shall be followed by a quiet interval of at least 1 s before the next intermittent signal. During the quiet interval, either the voltage is less than 56,6 V d.c., or the current measured is less than 0,5 mA.



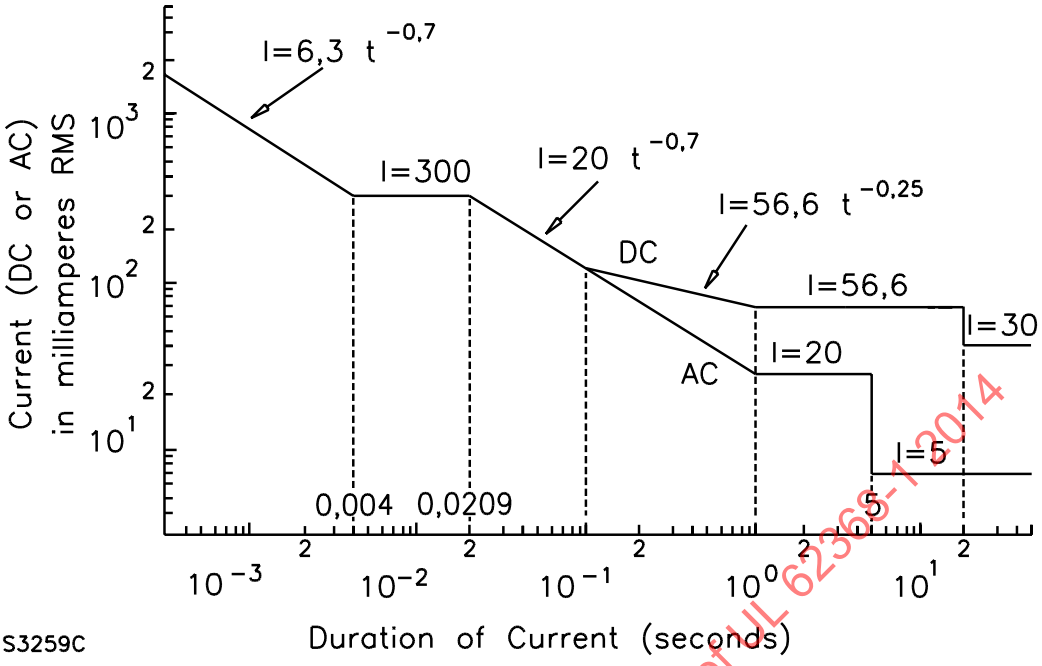


Figure H.4DV.2 - Maximum current as a function of duration

M.1DV DC *Modify Clause M.1 by adding the following text:*

Where a battery standard does not contain requirements for electrical insulation used as a safeguard, appropriate insulation requirements from Clause 5 are applicable based on the working voltage.

M.2.1DV DC *Modify Clause M.2.1 by adding the following text:*

Battery packs with sealed secondary cells and batteries (other than button) containing alkaline or other non-acid electrolyte and used in stationary equipment shall comply with either IEC 62133, UL 2054, or UL 1973.

Additionally, such battery packs that rely on solid-state circuits and software controls as safeguards shall comply with either the requirements in UL 1973 for System Safety Analysis (5.7) and Protective Circuit and Controls (5.8), or similar requirements in an appropriate standard for electronic safety-related controls that are suitable for investigation of such protection of secondary cells and batteries.

P.4.1DV DE *Modify P.4.1 by adding the following text to correct an editing error in the IEC Standard:*

For metalized coatings, clearances and creepage distances for pollution degree 3 shall be maintained instead of the tests of P.4.2DV.1.

P.4.2DV DE ***Add the following text as P.4.2DV.1 to correct an editing error in the IEC Standard:***

P.4.2DV.1 Tests

A sample of the equipment or a subassembly of the equipment containing parts having metalized coating and the parts joined by adhesive is evaluated with the sample placed with the part secured by adhesive on the underside.

Condition the sample in an oven at a temperature T_C for the specified duration (eight weeks, three weeks or one week) as follows:

$$T_C = T_R + (T_A + 10 - T_S)$$

In case the value for $T_A + 10 - T_S$ is negative, the value will be replaced by zero.

where

T_C is the conditioning temperature;

T_R is the rated conditioning temperature value of (82 ± 2) °C for eight weeks; (90 ± 2) °C for three weeks; or (100 ± 2) °C (for one week) as applicable;

***T_A is the temperature of the coating or the part under NORMAL OPERATING CONDITIONS* (see B.2.6.1);**

T_S = 82.

NOTE 1 For example for eight week conditioning, if the actual temperature is 70 °C, then the $T_A + 10 - T_S = 70 + 10 - 82 = -2$, then this -2 is ignored. The minimum conditioning temperature remains 82 °C. Also, for three week conditioning, if the actual temperature is 70 °C, then the $T_A + 10 - T_S = 70 + 10 - 82 = -2$, then this -2 is ignored. The minimum conditioning temperature remains 90 °C. Also, for one week conditioning, if the actual temperature is 70 °C, then the $T_A + 10 - T_S = 70 + 10 - 82 = -2$, then this -2 is ignored. The minimum conditioning temperature remains 100 °C.

NOTE 2 For example for eight week conditioning, if the actual temperature is 75 °C, then the $T_A + 10 - T_S = 75 + 10 - 82 = +3$, the minimum conditioning temperature becomes 82 + 3 = 85 °C. Also, for three week conditioning, if the actual temperature is 75 °C, then the $T_A + 10 - T_S = 75 + 10 - 82 = +3$, then the minimum conditioning temperature remains 90 + 3 = 93 °C. Also, for one week conditioning, if the actual temperature is 75 °C, then the $T_A + 10 - T_S = 75 + 10 - 82 = +3$, then the minimum conditioning temperature remains 100 + 3 = 103 °C.

NOTE 3 The table below gives the summary of the results in NOTE 1 and NOTE 2:

T_A	T_R	T_S	$T_A + 10 - T_S$	$T_C = T_R + (T_A + 10 - T_S)$
70	82 (8 weeks)	82	70 + 10 - 82 = -2	82 + 0 = 82
70	90 (3 weeks)	82	70 + 10 - 82 = -2	90 + 0 = 90
70	100 (1 week)	82	70 + 10 - 82 = -2	100 + 0 = 100
75	82 (8 weeks)	82	75 + 10 - 82 = +3	82 + 3 = 85
75	90 (3 weeks)	82	75 + 10 - 82 = +3	90 + 3 = 93
75	100 (1 week)	82	75 + 10 - 82 = +3	100 + 3 = 103

Upon completion of the temperature conditioning, subject the sample to the following:

– remove the sample from oven and leave it at any convenient temperature between 20 °C and 30 °C for a minimum of 1 h;

– place the sample in a freezer at –40 °C ± 2 °C for a minimum of 4 h;

– remove and allow the sample to come to any convenient temperature between 20 °C and 30 °C for a minimum of 8 h;

– place the sample in a cabinet at 91 % to 95 % relative humidity for 72 h at any convenient temperature between 20 °C and 30 °C;

– remove the sample and leave it at any convenient temperature between 20 °C and 30 °C for a minimum of 1 h;

– place the sample in an oven at the temperature used for the temperature conditioning (T_C) for a minimum of 4 h;

– remove the sample and allow it to reach any convenient temperature between 20 °C; and 30 °C for a minimum of 8 h.

The sample is then immediately subjected to the tests of Annex T according to 4.4.4.

With the concurrence of the manufacturer, the above time durations may be extended.

After the above tests:

– a metalized coating or a part secured by adhesive shall not fall off or partly dislodge;

– a metalized coating shall be subjected to the abrasion resistance test of G.13.6.2. After the abrasion resistance test, the coating shall have not loosened and no particles shall become loose from the coating;

– *ENCLOSURE* parts serving as SAFEGUARDS shall comply with all the applicable requirements for ENCLOSURES.

P.5DV DE *Delete Clause P.5.*

Clause P.5 has been relocated to P.4.1 and P.4.2.

Table T.1DV DE *Modify Table T.1 by replacing the first entry in the first column with the following to correct a typographical error:*

Unless otherwise specified below, any glass used as a SAFEGUARD against class 3 energy sources

U.1DV D1 *Modify U.1 by adding the following text:*

The outer enclosure housing a CRT shall have no opening that exceeds 130 mm^2 unless the minor dimension of the opening is 10 mm or less.

Table W.3DV DE *Modify Table W.3 by replacing the entry for 1.2.8.14 in the first column with the following to correct a typographical error:*

1.2.8.14
TNV-3 CIRCUIT
TNV CIRCUIT
– whose normal operating voltages exceed the limits for an SELV circuit under normal operating conditions and
– on which overvoltages from telecommunication networks and cable distribution systems are possible

Annex DVA D2 *Add Annex DVA:*

This annex provides examples of and references for regulatory requirements that apply to equipment. Although normative, applicability of an individual requirement is dependent on the particular construction of the equipment and its intended installation and use.

This annex is not intended to provide a complete list of all of the applicable requirements, only to serve as a reference for requirements that most commonly apply to this type of equipment.

For complete requirements, the referenced code, standard, or regulation shall be consulted.

Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the edition of that code or standard referenced in Clause 2, Normative References.

"CEC" refers to the Canadian Electrical Code, Part I, CSA C22.1. "NEC" refers to the U.S. National Electrical Code, NFPA 70.

Annex DVA

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
1	Scope Equipment installed on utility facilities and functions up to the service point. Special installation methods are required for equipment associated with supply and communication lines employed by a public or private electric supply, communications, railway, or similar utility in the exercise of its function as a utility. These include street and area lights (supplied by underground or overhead conductors) under the exclusive control of utilities (including their authorized contractors) or other qualified persons (such as those associated with an industrial complex). Note The NEC and CEC cover utilization wiring and equipment installation requirements beyond the service point, i.e., within homes, buildings, etc.	IEEE C2	
	Equipment installed in communication facilities associated with high voltage electric power stations Special installation methods are required for equipment connected to wire-line communication facilities serving high voltage electric power stations operating at greater than 1 kV. These requirements do not cover the equipment used in the design of such installations. Special system design requirements, such as those covered by ANSI/IEEE 487, Recommended Practice for the Protection of Wire-Line Communication Facilities Serving Electric Power Locations, and ANSI/IEEE 1613, Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations, shall be followed to reduce the risks associated with wire-line communication facilities serving such power stations.	NEC: 90.2(B)(5); IEEE 487; IEEE 1613	CEC: Sections 0, 36, and 60
	Equipment intended for installation in Information Technology Equipment Rooms Equipment intended for installation Information Technology Equipment Rooms, commonly also known as Computer Rooms and Data Centers, shall be marked to indicate suitability for use in such locations. This marking is required since Article 645, Information Technology Equipment, of the National Electrical Code, and NFPA 75, Standard for Protection of Information Technology Equipment, contain special requirements for equipment installed in such locations. NOTE The CEC also has requirements for Data Processing Systems in various Sections of the Code, which are referenced in this Annex, as applicable.	NEC: 645; NFPA 75	
	Equipment intended for outdoor installation See Clause 1 and the reference to IEC 60950-22.	NEC: 110.11, 110.28, Table 110.28	CEC: 22-102, 2-400, 2-402, Table 65

Annex DVA Continued on Next Page

Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	Equipment intended for outdoor installation shall be evaluated in accordance with the Standard for Enclosures for Electrical Equipment, Non- Environmental Considerations, UL 50, Enclosures for Electrical Equipment, Environmental Considerations, UL 50E, Special Purpose Enclosures, CAN/CSA C22.2 No. 94, or Enclosures for Electrical Equipment, Environmental Considerations, CSA C22.2 No. 94.2, and shall be marked with a suitable outdoor use enclosure designation compatible with the National Electrical Code, NFPA 70, or the Canadian Electrical Code, Part I, CSA C22.1. The term ″rainproof″ may be used instead of an Enclosure-type number for equipment enclosures meeting the environmental requirements for Enclosure Types 3R and 3RX. The term ″raintight″ may be used instead of an Enclosure-type number for equipment enclosures meeting the environmental requirements for Enclosures Types 3, 3S, 3SX, 3X, 4, 4X, 6 and 6P.		
	<u>Equipment for use in spaces used for environmental air (plenums)</u> Equipment intended for use in spaces used for environmental air, such as the space over a hung ceiling used for environmental air-handling purposes, is required to be provided with a metal enclosure or with a non-metallic enclosure having adequate fire-resistance and low smoke-producing characteristics. Determination of low-smoke-producing characteristics is made in accordance with the Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces, UL 2043. Equipment intended for installations in these locations shall be marked to indicate suitability.	NEC: 300.22(C)	CEC: 12-010
	Equipment shall not be installed in air ducts specifically fabricated for environmental air.	NEC: 300.22(B)	CEC: 12-010
	<u>Automated information storage equipment</u> For equipment identified for ITE (computer) room applications [see Annex DVA (Clause 1 entry), Equipment intended for installation in Information Technology Equipment Rooms], automated information storage equipment intended to contain more than 0,76 m^3 of combustible media shall have provision for either automatic sprinklers or a gaseous agent extinguishing system with an extended discharge. Note – Automated information storage equipment is enclosed storage and retrieval equipment that moves recorded media between storage and electronic computer equipment.	NFPA 75: 8.1.4	
	<u>Commercial audio systems incorporating emergency signaling functionality</u> Commercial audio systems that incorporate emergency signaling functionality, including mass notification and muting/override, shall comply with applicable parts of NFPA 72, National Fire Alarm and Signaling Code, depending upon the specific features.	NFPA 72	CEC: 46-210

Annex DVA Continued on Next Page

Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	Consumer products designed or intended primarily for children 12 years of age or younger Consumer products designed or intended primarily for children 12 years of age or younger are subject to additional requirements in accordance with Canadian and U.S. Regulations.	U.S. Code of Federal Regulations (CFR), Title 16, Chapter II, Subchapter C, Part 1505	Canada – Hazardous Products Act – Hazardous Products (Toys) Regulations; Canada – Consumer Packaging and Labeling Act
	Baby Monitors		
	Baby monitors shall comply with ASTM F2951, Consumer Safety Specification for Baby Monitors.	U.S. CPSC	
2	Normative references		
3	Terms, definitions and abbreviation		
4	General requirements		
5	Electrically-caused injury		
5.6	Protective conductor Provisions for protective earthing The terms ″protective earth,″ ″protective earthing″ and ″earthing″ are not commonly used in Canada or the U.S. For connections to the grounding system, the following terms should be applied as defined in the Canadian Electrical Code (CEC), Part I, CSA C22.1, and/or the National Electrical Code (NEC), NFPA 70. These terms appear in parentheses, where appropriate: Bonding Conductor (CEC) Grounding Conductor (CEC, NEC) Grounded (CEC, NEC) Grounding Conductor, Equipment (NEC) Grounding (CEC) Grounding System (CEC)	NEC: Article 100	CEC: Section 0
	Size of protective bonding conductors For pluggable equipment type A, the current rating of the circuit supplied by the mains shall be taken as 20 A since pluggable equipment type A configurations used Canada and the U.S. are protected by maximum 20 A branch circuit overcurrent protection.	NEC: 210.20, 210.23	CEC: 26-710(b), 26- 720(f)
	Output receptacle circuit earthing (grounding) Equipment having output receptacles for alternating current power connections that are generated from an internally derived source (i.e., provided with transformer isolation internal to the equipment, which provides isolation of the output circuit from the mains supply) shall have the earthed (grounded) circuit conductor bonded to the protective earthing (grounding) terminal via a ″system bonding jumper″ considering the maximum fault current of the circuit. For cord-connected equipment, the size of the bonding jumper shall not be less than the current-carrying conductors of the derived output circuit. For permanently connected equipment, the bonding jumper shall not be less than 8 AWG per NEC Table 250.66 and CEC Table 41.	NEC: 250.30, 250.66, Table 250.66, 645.15 NEC: 250.66, Table 250.66	CEC: 10-614, 10-906, Table 41 CEC: 10-614, Table 41
	Screws for protective bonding	NEC: 250.8	

Annex DVA Continued on Next Page

Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	Sheet metal (spaced thread) screws shall not be used to connect protective earthing (grounding) and bonding conductors or connection devices to enclosures.		
	Earthing (grounding) of equipment connected to d.c. mains Equipment intended to be connected to a nominal 48 V d.c. (or higher) power supply source, or systems rated less than 48 V d.c. that have one point directly earthed (grounded), shall have provision for the earthing (grounding) of all exposed dead metal parts that might become energized from the power supply source or from circuits involving a risk of electric shock. See Annex DVH.	NEC: 480.4, 250	CEC: 10-102, 10-104, 10-202, 10-404, 10-810
6	Electrically-caused fire See Annex DVA (Clause 1 entry), Equipment for use in spaces used for environmental air (plenums), Equipment intended for use in spaces used for environmental air (plenums).		
6.3	Safeguards against fire under normal operating conditions and abnormal operating conditions		
	Air Filters	NFPA 75: 7.2.1	
	For equipment identified for ITE (computer) room applications [see Annex DVA (Clause 1 entry)], air filters for use in the cooling systems of individual units shall comply with UL 900, Air Filter Units. The air filters shall be arranged in such a way that they can be removed, inspected, cleaned or replaced when necessary.		
	Liquids for lubrication, cooling or hydraulic purposes	NFPA 75: 7.2.2	
	For equipment identified for ITE (computer) room applications [see Annex DVA (Clause 1 entry)], if the design of the unit is such that oil or equivalent liquid is required for lubrication, cooling, or hydraulic purposes, it shall have a closed-cup flash point of 149°C (300°F) or higher, and the container shall be of a sealed construction, incorporating automatic pressure relief devices.		
	Maximum quantity of flammable liquid stored in equipment	NFPA 30	
	The maximum quantity of flammable liquid stored in equipment shall comply with Table DVA.1.		
6.4.8	Fire enclosures and fire barriers Flammability requirements for large surfaces For equipment identified for ITE (computer) room applications [see Annex DVA (Clause 1 entry), Equipment intended for installation in Information Technology Equipment Rooms], an external surface of combustible material having an exposed area of greater than 0,9 m^2 (10 sq ft) or a single dimension greater than 1,80 m (6 ft) shall have a flame spread rating of 50 or less when tested in accordance with either: – the Standard for Tests for Surface Burning Characteristics of Building Materials, UL 723, or ASTM E 84; or – the radiant panel furnace method in ASTM E162. The flame spread rating as determined by this method is the average value based on tests of six samples representative of the wall thickness used, with no single sample rating greater than 75. The limits mentioned refer to the exposed surface area of a single unbroken section. If two sides of a single piece are exposed, only the larger side shall be considered in computing the area.	NFPA 75: 7.1.4	

Annex DVA Continued on Next Page

Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	A material with a flame spread rating higher than 50 may be used as the exterior finish or covering on any portion of the enclosure, guard or cabinet if the flame spread rating of the combination of the base material and finish or covering complies with the flame spread requirements. For equipment not identified for ITE (computer) room applications, an external surface of combustible material that is not a fire enclosure but that has an exposed area of greater than 0,9 m^2 (10 sq ft) or a single dimension greater than 1,80 m (6 ft), shall be made of V-1 class material.		
6.5.4	Requirements for interconnection to building wiring See Annex Q.		
6.6	Safeguards against fire due to the connection of secondary equipment See Annex Q		
7	Injury caused by hazardous substances		
8	Mechanically-caused injury		
9	Thermal burn injury		
10	Radiation		
10.3.1	Protection against laser radiation Requirements for equipment incorporating lasers Requirements for lasers are contained in the applicable national codes and regulations. Compliance of laser products with the U.S. Code of Federal Regulations (CFR), Title 21, Part 1040, and the Canadian Radiation Emitting Devices Regulations, REDR c. 1370, shall be determined by: a) determining the Class of laser (as defined in the CFR) from the manufacturer's required documentation, such as the Center for Devices and Radiological Health (CDRH) report, markings and labels, or similar documentation; b) verifying that the manufacturer' s markings and labels having the information specified in the CFR are affixed on the laser product (as defined in the CFR); c) determining that the corresponding construction features, such as protective housing, interlocks, and similar features, are provided in accordance with the CFR; and d) determining that the resulting construction complies with the construction requirements of this standard.	U.S. Code of Federal Regulations (CFR), Title 21, Chapter I, Subchapter J, Part 1040	Canada – Radiation Emitting Devices Regulations, REDR c. 1370; or CAN/CSA-E60825-1, Safety of laser products – Part 1: Equipment classification, requirements and user's guide
10.5.1	Protection against x-radiation		

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Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	Ionizing radiation In addition to measurement of ionizing radiation during normal operation in accordance with 10.5.3, measurements are made with the equipment operating under the following abnormal operating conditions, as applicable: – a maximum supply voltage of 130 V if the equipment has a nominal voltage rating between 110 V and 120 V; or – a maximum supply voltage of 110 % of the equipment nominal if the nominal is not between 110 V and 120 V; and – under conditions identical to those resulting from component or circuit malfunction that maximize x-radiation while maintaining the equipment operative for normal use.	U.S. Code of Federal Regulations (CFR), Title 21, Chapter I, Subchapter J, Part 1020, Section 1020.10	Canadian Radiation Emitting Devices Regulations, REDR c. 1370
Annexes			
F	Equipment markings, instructions, and instructional safeguards		
F.3.3.3	Rated voltage Rated voltage marking Based on nominal rating conventions, the following marking schemes shall be used: The voltage rating for equipment with more than one phase supply conductor and an earthed neutral supply conductor shall indicate the phase-to-earth rated voltage and the phase-to-phase rated voltage, separated by a solidus (/), and shall give an indication of the number of phases of the supply. In order to differentiate this marking from multiple voltage ratings, the number of supply wires, including the neutral, shall also be provided. For example: 120/240 V, 3-wire means the voltage is supplied by two phase wires and one neutral wire with 120 V between each phase conductor and the neutral and 240 V between the phase conductors. 120/240 V, 3-wire + PE means the voltage is supplied by two phase wires and one neutral wire with 120 V between each phase conductor and the neutral and 240 V between the phase conductors, with additional provision for protective earth. 120/208 V, 3-phase 4-wire means the voltage is supplied by a three-phase power system and one neutral wire with 120 V between each phase conductor and the neutral and 208 V between phases. For cord-connected equipment, the rated voltage specified shall not exceed the rating of the attachment plug.	NEC: Article 100, 110.4, 110.21, 220.5, 645.16 NEMA C84.1	CEC: 2-100 CSA CAN3- C235

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Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	A voltage rating that exceeds the attachment plug cap rating may be acceptable if it does not exceed the extreme operating conditions in Table 2 of Preferred Voltage Levels for AC Systems, 0 to 50,000 V, CSA CAN3-C235, and if it is part of a range that extends into ″Normal Operating Conditions″. The voltage rating shall not be lower than that specified for ″Normal Operating Conditions″ in Table 2 of CSA CAN3-C235 unless it is part of a range that extends into ″Normal Operating Conditions.″ For example, a marking of 100 V would not be allowed, but 100 – 118 V would be acceptable. A marking of 127 V would not be allowed, but 100 – 127 V would be acceptable.		
F.3.3.5	Rated current or power Equipment identified for ITE (computer) room installation shall be marked with the rated current as determined according to B.2.5.	NEC: 645.16	
G	Components		
G.1	Switches Orientation of switches and circuit breakers Vertically mounted disconnect switches and circuit breakers shall be mounted such that the up position of the handle is the ″on″ position.	NEC: 240.81	CEC: 14-300, 14-502
G.3.4	Overcurrent protective devices See Clauses G.1, G.6, G.7 Branch circuit protection for receptacles Standard supply outlets and receptacles shall be protected by an overcurrent device in either the equipment or the branch circuit, rated or set at not more than the rating of the outlet or receptacle. The overcurrent device shall be of a type that is suitable for branch circuit protection in accordance with the National Electrical Code, NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1, unless it is supplied by a secondary circuit. For NEMA 5-15R receptacles located in areas not accessible to Ordinary Persons, and when additional evaluation of the end system shows no hazards in accordance with this standard, a maximum of 20 A branch circuit protection may be used. NOTE Standard supply outlets and receptacles are considered an extension of the branch circuit. Equipment that can plug into these receptacles is evaluated based on the branch circuit protection normally associated with the type of receptacle. For example, to comply with both U.S. and Canadian Electrical Code requirements, a 15 A, 125 V receptacle generally is assumed to have branch circuit protection rated 15 A. Overcurrent protection for panelboards This clause contains additional requirements for equipment provided with panelboards. Multiple panelboards For equipment identified for ITE (computer) room applications [see Annex DVA (Clause 1 entry), Equipment intended for installation in Information Technology Equipment Rooms], power distribution units may have multiple panelboards within a single cabinet/enclosure.	NEC: 210.20, 210.23, 240.10, Article 406 NEC: 408.36 NEC: 645.17	CEC: 14-012, 14-114, 14-600 CEC: 14-606

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Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	Overcurrent protection for appliances This clause contains requirements for sizing branch circuits for appliances (equipment). If special overcurrent devices separate from the equipment are required, data for selection of these devices shall be marked on the equipment. Overcurrent protection for Class 2 limiting Where overcurrent protection is required for Class 2 and Class 3 limiting in accordance with the National Electrical Code, NFPA 70, the overcurrent device shall not be interchangeable with devices of higher ratings. A marking is not sufficient regardless of the location of the device. Where a limited power source per Annex Q is used to provide current limiting to external wiring in accordance with the National Electrical Code, NFPA 70, a fuse, if used, shall not be accessible to Ordinary Persons unless it is not interchangeable.	NEC: 422.11 NEC: 422.11, 422-60 NEC: 725.121, Chapter 9 Tables 11(A) and 11(B)	CEC: 14-104, Table 13 CEC: 16-206
G.3.5	Protective devices not mentioned in Clauses G.2 – G.5 See Clauses G.1, G.5, G.7		
G.4.2	Mains connectors See Clause G.7 and G.4.3. class II equipment provided with 15- or 20-A standard supply outlets, Edison-base lampholders or a single pole disconnect device shall be provided with a polarized-type attachment plug. Isolated Ground Receptacles When incorporated into the equipment, Isolated Ground Receptacles shall be of a type identified for the purpose (orange triangle marked on the face of the receptacle) and shall be installed in accordance with the Grounding and Bonding requirements in Section 250.146(D), Isolated Receptacles, of NFPA 70, NEC. Metal parts of the equipment shall be separately protectively earthed in accordance with 5.6, including use of appropriate identification symbols as required.	NEC: 422.40 NEC: 250.146(D)	CEC: 14-016 CEC: 10- 112, 10-906(8)
G.4.3	Connectors other than mains connectors See Annex Q. GFCI protection Receptacles, rated 125-V, single phase, 15- or 20-A accessible to either ordinary, instructed, or skilled persons shall be provided with GFCI Protection for Personnel if the equipment containing the receptacles is installed outdoors. Wiring terminals for the connection of external conductors Field wiring terminals provided for interconnection of units by conductors not supplied by a limited power source, or a Class 2 circuit defined in the National Electrical Code, NFPA 70, or the Canadian Electrical Code, Part I, CSA C22.1, also shall comply with the applicable requirements in Annex DVH.3.	NEC: 210.8(B) NEC: 300.1, 725	CEC: 24-116, 26-700, 26-710(n) CEC: Section 16

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Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	Interconnection of units by conductors supplied by a limited power source, or a Class 2 circuit defined in the National Electrical Code, NFPA 70, or the Canadian Electrical Code, Part I, CSA C22.1, may have field wiring connections other than specified in DVH.3, such as wire-wrap and crimp-on types, if the limited power source and Class 2 circuits are separated from all other circuits by barriers, routing or fixing.		
G.5.3	Transformers Overcurrent protection for distribution transformers Special overcurrent protection is required for individual transformers that distribute power to other units over branch circuit wiring. Typically, these requirements apply to transformers rated 10 kVA and higher with an output of 100 V and higher.	NEC: 450.3(B), Table 450.3(B)	CEC: 26- 254, 26-256
G.5.4	Motors Motor control devices For equipment with a mains-connected (primary) motor, a motor control device is required, unless a) – d) are true: a) the equipment is cord connected; b) the equipment voltage rating is 125 V or less; c) the equipment current rating is 12 A or less; and d) the motor is rated 1/3 hp or less (250 W or less, or locked rotor current of 43 A or less). Although a motor control device is required, the motor control device need not have a 3 mm contact gap if the equipment is provided with a separate suitable disconnect device (such as the plug on a power supply cord).	NEC: 430.81(B)	CEC: 28-500(3)
G.7	Mains supply cords See G.4.2.		
M	Batteries and fuel cells Backup battery power sources For equipment identified for ITE (computer) room applications [see Annex DVA (Clause 1 entry), Equipment intended for installation in Information Technology Equipment Rooms], batteries integral to equipment shall incorporate a means for battery disconnect and a means for connection to the remote emergency power off circuit that disconnects the battery power source, except for battery circuits for which 1) the product of the open circuit voltage times the rating of the overcurrent protective device does not exceed 750 VA; or 2) any resistive load cannot draw more than 750 VA for more than five minutes after the mains power is disconnected. If connection to the remote emergency power off circuit is required, batteries shall be disconnected within five minutes of activating the remote emergency power off circuit.	NEC: 645.11	
Q	Interconnection with building wiring Building wiring Wire and cables installed as part of building wiring systems (premises wiring, facility wiring, etc.) shall comply with the applicable provisions in the National Electrical Code, NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1. For example:	NEC: 110.8	CEC: 12-3030, 16-012, 16-114, 16-212

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Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	– Conductors for general wiring	NEC: Article 300, 310	CEC: Section 4
	– Cables installed within an ITE (computer) room.	NEC: 645.5	CEC: 12-020
	– Cables extending beyond an ITE (computer) room	NEC: 645.6	
	– Class 1, 2, and 3 circuits	NEC: Article 725	CEC: Section 16
	– Optical fiber cables	NEC: Article 770	CEC: Section 56
	– Communication circuits	NEC: Article 800	CEC: Section 60
	Building wiring and cable used in ducts, plenums and other air-handling space	NEC: 300.22	CEC: 12-010
	Building wiring and cable used in ducts specifically fabricated for environmental air, and other spaces used for environmental air (plenums), are subject to special requirements.		
	General requirements	NEC: 300.22	CEC: Section 12-010
	Class 2 and 3 circuits	NEC: 725	CEC: Section 16
	Optical fiber cables	NEC: 770	CEC: Section 56
	Communication circuits	NEC: 800	CEC: Section 60
	Cables used in ITE (computer) rooms	NEC: 645.5, NFPA 75	CEC: 4-012(2)(i), 12-020, 60-306, 60-316, 60-318
	Type DP or equivalent cable is the base requirement for cabling under raised floors in ITE (computer) rooms. Type DP-1 or DP-1P cable is suitable for use in any external circuit operating at 600 volts or less. Type DP-2 or DP-2P cable is suitable for use in any external circuit operating at 300 volts or less.		
	NEC Table 645.5 summarizes other cable types also permitted under raised floors if they meet the appropriate use requirements outlined in the respective Article covering the circuit/cable type, e.g., Article 725 for CL2.	Table 645.5	
	Generally, for ITE (computer) room applications, it is assumed that any cable over 3,05 m in length, coiled or uncoiled, can be used under raised floors.		
	Cables extending beyond the ITE (computer) room are subject to the applicable requirements in the National Electrical Code, NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1, for building wiring.	NEC: 300, 645.6	CEC: 4-004, 4-012
	Class 1 and 2 Power-Limited Circuits		
	Markings for Class 2 terminals	NEC: 725.124	CEC: 12-020, 16-204
	Wiring terminals intended to supply Class 2 outputs in accordance with Article 725 of the National Electrical Code, NFPA 70, or Section 16 of the Canadian Electrical Code, Part I, CSA C22.1, shall be marked with the voltage rating and ″Class 2″ or the equivalent. The marking shall be located adjacent to the terminals and shall be visible during wiring.		
	For circuits supplied by limited power sources, Article 725 of the National Electrical Code, NFPA 70, permits the use of CL2 or permitted cable substitutions. See Table DVA.2.	NEC: 725.130, 725.136	
	Markings for Class 1, 2, and 3 audio output terminals	NEC: 640.9(C)	

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Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	When intended to be installed in the field by either a skilled person or instructed person, equipment containing an audio power amplifier shall be marked with the required Class of wiring, either Class 1, Class 2, or Class 3, depending on the open-voltage of the audio output signal. The open-circuit voltage measurements are according to Annex E.1 f). The marking shall be located adjacent to the terminals and shall be visible during wiring. See Table DVA.3 for the Classes of wiring corresponding to audio amplifier output.		
	Separation of circuits Interconnecting cables containing more than one type of circuit may be subjected to additional restrictions per the National Electrical Code, NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1. In particular, restrictions are placed on cables that contain both conductors with Class 2, Class 3 (for U.S. only), or limited power source circuits and conductors with power, Class 1 and other circuits specified in the Code. Such constructions may require additional consideration.	NEC: 725.133 – 725.139	CEC: 16-212, 60-316
	Communications Systems Equipment and accessories associated with the communications systems, including telecommunications equipment and equipment connected to a cable distribution system may need to be subjected to applicable parts of Chapter 8 of the NEC and Section 54 and 60 of the CEC.	NEC Chapter 8	CEC: Sections 54 and 60
	Communications Circuits Telephone line cords, extension cords and the like shall comply with the requirements of the Standard for Communications-Circuit Accessories, UL 1863, and Cords and Cord Sets for Communication Systems, CSA C22.2 No. 233.	NEC: 800 NEC: 800.113	CEC: 60 CEC: 60-102
	Radio and Television Equipment Equipment connected to cable distribution systems used for connection to antennas and dishes shall be installed in accordance with the applicable provisions of Article 810. These provisions may include: Grounding Antenna Discharge Units	NEC: 810 NEC: 810.15, 810.21 NEC: 810.20, 810.57	CEC: 54 CEC: 54-300, 54-302 and 54-304
	Community Antenna Television and Radio Distribution Systems Equipment connected to cable distribution systems employed in CATV systems shall be installed in accordance with the applicable provisions of Article 820. These provisions may include: Protection Cable Grounding Cable Grounding, within premises Listing, Marking, and Installation of Coaxial Cables Installation of Cables and Equipment	NEC: 820 NEC: 820.93 NEC: 820.100 (A) – (E) NEC: 820.100, Exception NEC: 820.113 NEC: 820.133	CEC: 54 CEC: 54-202 CEC: 54-200, 54-300 CEC: 54-300 CEC: 54-500, 54-502
	Network-Powered Broadband Communication Systems	NEC: 830	

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Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	Equipment connected to cable distribution systems that are part of a broadband communication system shall be installed in accordance with the applicable provisions of Article 830. These provisions may include:		
	Output Circuits	NEC: 830.3(E)	
	Primary Electrical Protection	NEC: 830.90	
	Cable, Network Interface Unit, and Primary Protector Bonding and Grounding	NEC: 830.100	
	Listing Requirements – Network-Powered Broadband Communication Equipment and Cables	NEC: 830.179	
	Premises-Powered Broadband Communication Systems	NEC: 840	
	Equipment such as Optical Network Terminals (ONTs) connected to premises-powered optical fiber-based broadband communication systems shall be installed in accordance with the applicable provisions of Article 840. These provisions may include:		
	Protective Devices	NEC: 840.90	
	Requirement for ONT and cable grounding-protection (including grounding of coaxial cable shield not completely located inside premises)	NEC: 840.100 (770:100, 800.100, 820.100)	
	Coaxial cable shield grounding where premises cable is completely inside building	NEC: 840.101(A)(1); 820.100, 820.106 (same as coaxial cable entering premises from the outside network) or, NEC: 840.101(A)(2); 250.118 (connection to an NEC defined equipment grounding conductor with a fixed connection) or, NEC: 840.101(A)(3) (connection to a grounding point in the ONT if the ONT grounding point is connected to ground in accordance with 820.100 or 820.106 or via a fixed connection to an NEC defined equipment grounding conductor per 250.118)	

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Annex DVA Continued

Clause No.	Topic/summary	U.S. Regulation	Canadian Regulation
	ONT grounding	NEC: 840.101(C), 840.103 (required by listing unless grounding per 840.101(A)(3) is required)	
	Listing Requirements - Equipment and cables	NEC 840.170	

Table DVA.1
Maximum quantity of combustible/flammable liquid stored in equipment

[see Annex DVA (6.3 entry)]

Liquid			Closed storage container	
NFPA 30 Class	Flash point, °C	Boiling point, °C	Material	Size, liters
Class IA	Below 22,8	below 37,8	shall not be used	
Class IB	Below 22,8	Above 37,9	Glass Metal or polyethylene	1 20
Class IC and II	At or above 22,8 and below 60	–	Glass Metal or polyethylene	5 20
Class III	At or above 60	–	Glass Metal or polyethylene	20 20

1) FLAMMABLE LIQUIDS with flash points below 22,8 °C and boiling points below 37,8 °C may not be used or stored within equipment covered by the scope of this standard.

2) Individual reservoirs in equipment shall not be larger than the corresponding sizes for closed storage containers in this table.

Table DVA.2
Circuit and cable types permitted by the National Electrical Code, NFPA 70

[see Annex DVA (Annex Q entry)]

Circuit type	Cable type[a]
Class 2 or Limited Power	CL2
Class 3	CL3
TNV	CM
Optical	OFC, OFN
CATV	CATV

[a] Substitution tables in the National Electrical Code, NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1, apply.

Table DVA.3
Audio signal NEC wiring class marking

[see Annex DVA (Annex Q entry)]

Audio signal voltage V r.m.s. [a]	NEC Class	NEC Wiring Class Marking
0 up to 71	2	"Class 2 Wiring"
Above 71 and up to 120	2	"Class 2 Wiring"
Above 120	1	"Class 1 Wiring"
[a] Audio signal voltage is determined according to Annex E.1 f).		

Annex DVB D2 *Add Annex DVB:*

DVB.1 General

The requirements of this standard supplemented or replaced by those contained in this annex apply to equipment designed for installation in general patient care areas of health care facilities.

NOTE 1 A signaling and nurse-call feature, when provided, and all pendant controls and pillow speakers (including any associated cord and connector), are covered by the applicable requirements in UL 1069 and CSA C22.2 No. 205.

NOTE 2 Circuits supplying external connections that may supply devices that may extend directly into the patient care area are covered by the oxygen safety characterization requirements of UL 1069 and CAN/CSA C22.2 No. 60601-1.

DVB.2 Terms and definitions

DVB.2.1 health care facility equipment – Equipment intended for entertainment purposes by a patient in a hospital, nursing home, medical-care center, or a similar health-care facility in which installation is limited to nonhazardous areas in accordance with the National Electrical Code, NFPA 70, and the Standard for Health Care Facilities, NFPA 99. This equipment is not intended for use in a critical-care area in which a patient receives treatment with an externalized electrical conductor, such as a probe, a catheter, or other electrode, connected to the heart; however, the equipment may be contacted by a patient during the stay at the health care facility.

DVB.3 Electrically-caused injury

DVB.3.1 Protective conductor – unearthed accessible conductive surfaces

DVB.3.1.1 Requirements

All unearthed accessible conductive surfaces of cord-connected equipment shall have provision for earthing by a separate terminal consisting of either a pressure-wire connector or wire binding screw. The pressure-wire connector or wire binding screw shall be capable of securing a 10 AWG (5,3 mm^2) or smaller conductor.

DVB.3.1.2 Compliance

Compliance is checked by inspection.

DVB.3.2 Unearthed (isolated) parts marking

DVB.3.2.1 Requirements

When equipment includes a combination of unearthed, exposed conductive metal parts and earthed conductive metal parts that are not exposed during normal use, it shall be marked with the word, ″CAUTION″ and the following or equivalent: ″Accessible metal parts of this equipment are electrically isolated from the grounding conductor of the power supply cord. When grounding of the accessible metal parts is required, a separate grounding lead shall be used.″

DVB.3.2.2 Compliance

Compliance is checked by inspection.

DVB.3.3 Prospective touch current

DVB.3.3.1 Test method

Equipment shall be evaluated for prospective touch current according to the test method and touch current limits according to UL 1069.

DVB.3.3.2 Compliance

Compliance is checked by test.

DVB.3.4 Cleaning and disinfecting

DVB.3.4.1 Requirements

The equipment shall be constructed so that it is capable of being cleaned or disinfected in accordance with the manufacturer's instructions without increasing the risk of electric shock hazard to persons. Following cleaning and/or disinfecting, the equipment shall be subjected to the prospective touch current test described in this Annex and the electric strength test of 5.4.9.

DVB.3.4.2 Test Method

Each equipment or portion of equipment that is intended to be cleaned by wiping shall be wiped thoroughly with a folded cheesecloth applicator saturated in the cleaning agent specified by the manufacturer. The complete wiping procedure shall be repeated until a total of five operations have been completed after which the prospective touch current test specified in this Annex and the electric strength test of 5.4.9 shall be repeated.

DVB.3.4.3 Compliance

Compliance is checked by test.

DVB.3.5 Immersion

DVB.3.5.1 General

Equipment or an appendage of equipment that is intended to be taken into the patient's bed shall comply with the prospective touch current test described in this Annex and the electric strength test of 5.4.9 after being subjected to the immersion test described below.

DVB.3.5.2 Test Method

Each of three samples of the equipment or the appendage shall be immersed for a period of 24 hours in a solution containing 1/2 gram of common table salt per liter of distilled water. Immediately thereafter, the samples shall be subjected to the touch current and dielectric voltage withstand tests described above.

DVB.3.5.3 Compliance

Compliance is checked by test.

DVB.4 Mechanically caused injury – wheels and casters

DVB.4.1 Requirements

When provided, wheels and casters used for the purpose of transport shall have a minimum diameter of 10 cm.

DVB.4.2 Compliance

Compliance is checked by inspection and measurement.

DVB.5 Thermal burn injury

DVB.5.1 Normal temperature test

Under any operating condition the maximum external temperature(s) on an equipment appendage that may be used by the patient shall not exceed 48°C.

DVB.5.2 Compliance

Compliance is checked by test.

DVB.6 Operation and installation instructions

DVB.6.1 Requirements

Operation instructions and installation instructions (when applicable) shall be provided. The instructions shall include cleaning and disinfecting instructions, as applicable.

DVB.6.2 Compliance

Compliance is checked by inspection.

DVB.7 Flexible cord

DVB.7.1 Requirements

Flexible power supply cords shall be jacketed, junior hard service including Types SJ, SJO, SJT, and SJTO. An oil-resistant cord shall be provided when the equipment will be subjected to grease or oil.

The length of a mains supply cord shall not be less than 1,5 m unless installation instructions specify installation adjacent to a receptacle.

DVB.7.2 Compliance

Compliance is checked by inspection and measurement.

DVB.8 Hospital grade attachment plug

DVB.8.1 Requirements

Cord connected Class I equipment shall be provided with a grounding type attachment plug designated as ″Hospital Only″ according to the hospital grade devices requirements in UL 498 and CSA C22.2 No. 21 (moulded-on type) or CSA C22.2 No. 42 (assembled-on type).

DVB.8.2 Compliance

Compliance is checked by inspection.

DVB.9 Disconnect devices – all-poles switch

DVB.9.1 Requirements

A primary power-control switch when provided on equipment shall interrupt all primary power conductors, including the neutral conductor.

The on-off positions shall be clearly indicated.

DVB.9.2 Compliance

Compliance is checked by inspection.

Annex DVC D2 *Add Annex DVC:*

DVC.1 General

The requirements of this standard supplemented or replaced by those contained in this annex apply to equipment intended for mounting under kitchen cabinets.

DVC.2 Terms and definitions

DVC.2.1 Undercabinet equipment – Equipment intended to be secured to the bottom surface of a kitchen cabinet.

DVC.3 Electrically-caused injury – insulation materials and requirements

DVC.3.1 Undercabinet increased moisture test

DVC.3.1.1 Test method

With the undercabinet equipment mounted as described in Simulated installation, DVC.5.1, the equipment shall be supplied by its rated supply voltage. The equipment shall not be operating during this test. The prospective touch voltage and touch current shall be monitored during this test between accessible metal and earth. An electric kettle shall be used for this test. The kettle shall have a minimum capacity of 1,5 L and a spout opening of 12 – 17 cm^2. The spout opening shall be located 12 – 14 cm above the simulated countertop surface. The kettle shall be filled with 1,5 L of water and energized from a variable source of supply that is then adjusted (within its electrical rating) to deliver 1 500 W of input power. The kettle spout shall be positioned to direct steam to the bottom-center of the undercabinet equipment. The water in the kettle shall be boiled until the kettle becomes dry. The final prospective touch voltage and touch current values shall be recorded.

DVC.3.1.2 Compliance

Following the conditioning, an undercabinet equipment shall comply with the requirements for touch current and prospective touch voltage as specified in 5.2.2.2 and electric strength as specified in 5.4.9.

DVC.3.2 Protection of mains supply cords – external flexible cord routing

DVC.3.2.1 Requirements

Undercabinet equipment shall be provided with a means for routing the power supply cord and with a means of cord stowage or equivalent means to prevent excess cord from hanging past the bottom surface of the equipment.

DVC.3.2.2 Compliance

Compliance is checked by inspection.

DVC.4 Safeguards against fire under normal operating conditions – operation and installation instructions

DVC.4.1 Requirements

Undercabinet equipment shall be provided with the following instructional safeguard in the operation and installation instructions: ″CAUTION″ and the following or equivalent wording, ″To reduce the risk of fire, do not place any heating or cooking appliance directly beneath this unit.″

DVC.4.2 Compliance

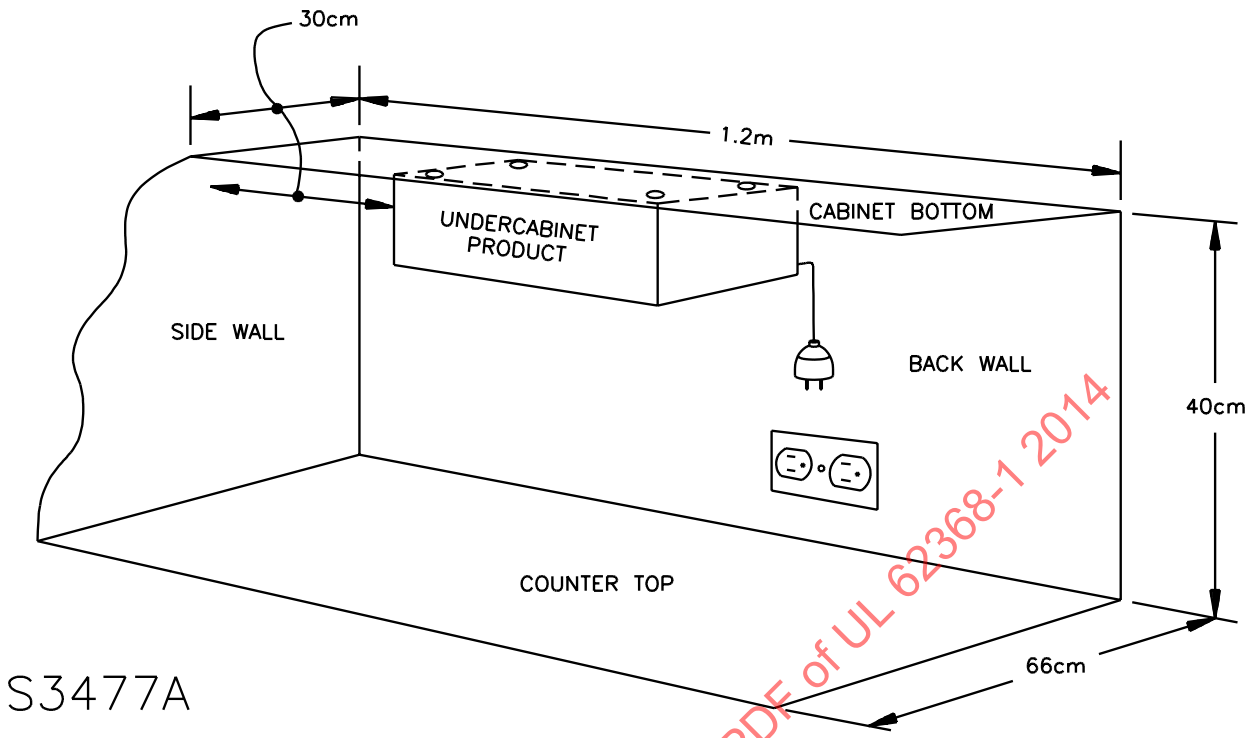
Compliance is checked by inspection.

DVC.5 Normal operating conditions

DVC.5.1 Simulated installation

For the undercabinet increased moisture test, elevated ambient test, and mounting stability test (see 8.7), the equipment shall be mounted in an alcove, as shown in Figure DVC.1, to simulate a typical under cabinet mounting arrangement. The alcove shall be constructed using plywood of any convenient thickness.

The equipment shall be secured to the cabinet bottom surface in accordance with the manufacturer's installation instructions. Adhesive alone shall not be used to secure the equipment to its intended mounting surface. However, the equipment shall be located so that it is 30 cm from the sidewall (measured from the closest edge of the equipment).



DVC.5.2 Undercabinet elevated ambient test

DVC.5.2.1 Test method

Undercabinet equipment shall be mounted as described in Simulated installation, DVC.5.1. When the distance between the bottom surface of the equipment and the simulated countertop surface is less than 250 mm, the countertop surface shall be adjusted downward so that the distance is 250 mm. When the distance is greater than 250 mm, no further adjustment is required.

The equipment shall be connected to its rated supply voltage and operated under normal operating conditions as specified in Clause B.2. An electric frying pan shall be used as an external heat source for this test. The frying pan shall be rated at least 1 200 W; have a cooking surface of 800 – 1 000 cm^2; and have the cooking surface area located 5 – 7 cm above the simulated countertop surface. The thermostatic control of the frying pan shall be bypassed and a thermocouple shall be placed in the center of the cooking area of the frying pan. The frying pan shall be connected to its rated source of supply and adjusted to produce a temperature of 200 ± 5°C. After this temperature has stabilized, the frying pan shall be positioned directly below the undercabinet equipment with the back edge of the fry pan spaced a minimum of 25 mm from the back wall of the alcove. If necessary, the frying pan shall be readjusted to maintain a temperature of 200 ± 5°C. The test shall be continued for 1-1/2 hours.

DVC.5.2.2 Compliance

Compliance is checked by immediately following conditioning with the 5.4.9 electric strength test while the equipment is in a well-heated condition, followed by the tests of Annex V. Selection of the probe will depend upon the application.

Annex DVD D2 *Add Annex DVD:*

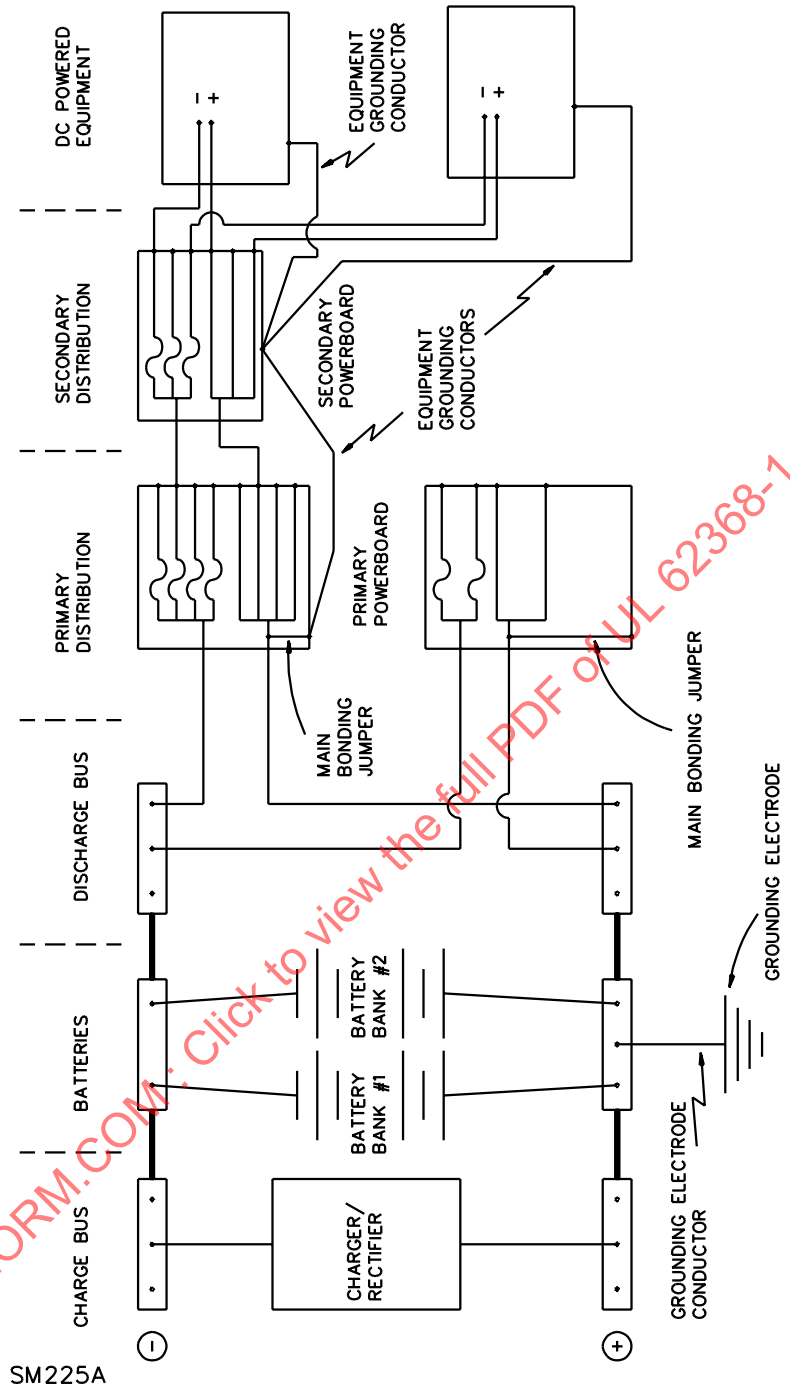
DVD.1 System descriptions

A typical centralized d.c. power distribution system (DC mains) in North America is a power distribution system consisting of open batteries, charger/rectifier circuits, and primary and secondary distribution equipment that is intended to provide power to equipment loads. Systems rated not less than 48 V have one point directly earthed, the exposed conductive parts of the installation being connected to that point by protective earth conductors. Systems rated less than 48 V may have one point directly earthed.

Two types of systems are recognized according to the arrangement of earthed and protective earth (earthing) conductors, as follows:

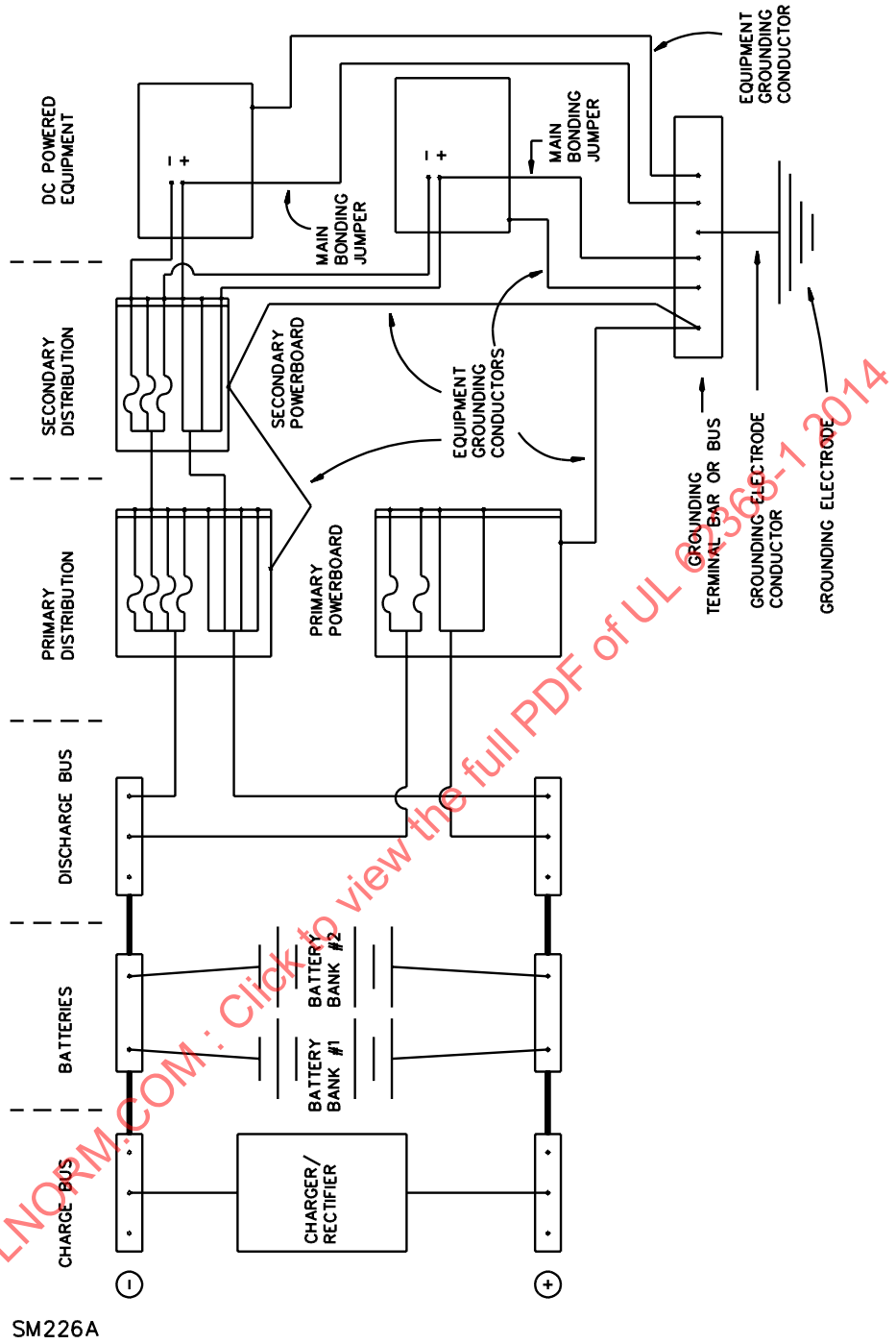
– source earthed d.c. power systems, in which the connection to the earthing electrode is located at the source and separate earthed and protective earth conductors are provided throughout the system. See Figure DVD.1.

– d.c. power system earthed at the equipment location, in which the connection to the earthing electrode is located in the area where the load equipment is to be installed, typically known as the ″earthing window.″ See Figure DVD.2.



NOTE For the purpose of applying this figure, "grounded" and "grounding" are equivalent to "earthed" and "earthing", respectively.

Figure DVD.1 – Typical centralized d.c. power system (dc mains) – plant and distribution source-grounded d.c. power system



NOTE For the purpose of applying this figure, “grounded” and “grounding” are equivalent to “earthed” and “earthing”, respectively.

Figure DVD.2 – Typical centralized d.c. power system (dc mains) – plant and distribution d.c. power system grounded at the equipment location

Annex DVE D2 *Add Annex DVE:*

In the U.S. and Canada, any of the following equipment, components, or subassemblies listed in the table are required to comply with the specified UL or CSA Group standards according to their conditions of use and to the requirements of this standard.

NOTE When additionally considering distribution of end-products outside the U.S. and Canada, compliance with the requirements in IEC 62368-1 or its referenced IEC component standard additionally need to be taken into account.

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

Annex DVE

Subclause from this standard	Description	IEC standard	UL standard	CSA Group standard	Application information
4.1.2	Direct plug-in units		UL 1310, Class 2 Power Units	CAN/CSA C22.2 No. 223, Power Supplies With Extra-Low-Voltage Class 2 Outputs	For Direct plug-in units investigated to this standard for use with equipment covered under the scope of this standard, the following additional requirements apply:

Annex DVE Continued on Next Page

Annex DVE Continued

Subclause from this standard	Description	IEC standard	UL standard	CSA Group standard	Application information
					UL 1310: Weight and moment (7.11 – 7.12), mounting tab (7.15), distance from gripping surface to ac mains blades (7.16 – 7.18), integral blade assembly (14.1.1), travelers requirements (14.1.4), backfeed protection (15.4.3), security of ac mains blades tests (43 – 44), mechanical abuse tests (46). CAN/ CSA C22.2 No. 223: Weight and moment (4.1.4, 4.1.5), distance from gripping surface to ac mains blades (4.5.1.4), integral blade assembly (4.5.1.1), security of ac mains blades test (6.10.4 – 6.10.6), mechanical abuse tests (6.9.1 – 6.9.4), mounting tab (4.5.1.2), insertion in duplex receptacle (4.5.1.3)

Annex DVE Continued on Next Page

Annex DVE Continued

Subclause from this standard	Description	IEC standard	UL standard	CSA Group standard	Application information
					For Direct plug-in units with mounting tabs, local regulations in Canada do not permit use of a mounting tab to mount the DPIU to an outlet. Therefore, for such DPIU investigated to CSA/UL 62368-1, the following additional instruction, or similar wording, shall be supplied with the DPIU. "NOTICE – Local Regulations in Canada do not permit use of a mounting tab. In Canada, do not use the mounting tab to attach the unit to an outlet."
4.1.2	Vehicle Battery Adapters		UL 2089, Vehicle battery adapters	CSA TIL I-35 CAN/CSA C22.2 No. 60950-1	UL 2089: Input current rating maximum 12 A) CSA 60950-1: DC to DC converter and its associated wiring

Annex DVE Continued on Next Page

Annex DVE Continued

Subclause from this standard	Description	IEC standard	UL standard	CSA Group standard	Application information
4.5.1	Electrochemical Capacitor Modules		UL 810A, Electrochemical capacitors		Energy storage modules consisting of multiple electrochemical capacitors, also known as ″ultracapacitors″, ″electric double layer capacitors″, ″double layer capacitors″, or ″supercapacitors.″ These requirements do not apply to electrolytic capacitors.
5.4.4.1, G.6	Internal Wiring and Tubing		UL 224 Extruded insulating tubing UL 758, Appliance wiring material UL 1441, Coated electrical sleeving UL 1581, Reference standard for electrical wires, cables, and flexible cords	CSA C22.2 No. 127, Equipment and lead wires CSA C22.2 No. 210, Appliance wiring material products CSA C22.2 No. 198.1, Extruded insulating tubing	Electrical properties of Internal wiring and tubing located in ES2 or ES3 circuits
8.5.4.1	Large Data Storage Equipment	IEC 60950-23, Information technology equipment – Safety – Part 23: Large data storage equipment	UL 60950-23, Information technology equipment – Safety – Part 23: Large data storage equipment	CAN/CSA C22.2 No. 60950-23, Information technology equipment – Safety – Part 23: Large data storage equipment	
G.3.4	Fuses	IEC 60127-1 Miniature fuses – Part 1: definitions for miniature fuses and general requirements for miniature fuselinks	UL 248-1, Low-Voltage Fuses - Part 1: General Requirements UL 248-4, Low-Voltage Fuses – Part 4: Class CC Fuses	CSA C22.2 No. 248 Series Low-Voltage Fuses CSA C22.2 No. 248.1 Low-Voltage Fuses – Part 1: General Requirements	Branch circuit application

Annex DVE Continued on Next Page

Annex DVE Continued

Subclause from this standard	Description	IEC standard	UL standard	CSA Group standard	Application information
			UL 248-5, Low-Voltage Fuses – Part 5: Class G Fuses UL 248-8, Low-Voltage Fuses – Part 8: Class J Fuses UL 248-10, Low-Voltage Fuses – Part 10: Class L Fuses UL 248-12, Low-Voltage Fuses – Part 12: Class R Fuses UL 248-15, Low-Voltage Fuses – Part 15: Class T Fuses	CSA C22.2 No. 248.4 Low-Voltage Fuses – Part 4: Class CC Fuses CSA C22.2 No. 248.5 Low-Voltage Fuses – Part 5: Class G Fuses CSA C22.2 No. 248.8 Low-Voltage Fuses – Part 8: Class J Fuses CSA C22.2 No. 248.10 Low-Voltage Fuses – Part 10: Class L Fuses CSA C22.2 No. 248.12 Low-Voltage Fuses – Part 12: Class R Fuses CSA C22.2 No. 248.15 Low-Voltage Fuses – Part 15: Class T Fuses	
G.3.5	Molded case circuit breakers		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	Branch circuit protection
G.3.5	Ground Fault Circuit Interrupters		UL 943, Ground-Fault Circuit-Interrupters	CAN/CSA C22.2 No.144 Ground Fault Circuit Interrupters	
G.4.2	AC Mains Attachment Plug Configuration		NEMA WD 6, Wiring devices – Dimensional specifications		
G.4.2	Attachment Plugs, Receptacles and Connectors	IEC 60083, Plugs and socket-outlets for domestic and similar general use IEC 60309, Plugs, socket-outlets and couplers for industrial purposes	UL 498, Attachment plugs and receptacles UL 1682, Plugs, receptacles and cable connectors, of the pin and sleeve type	CSA C22.2 No. 42, General use receptacles, attachment plugs, and similar wiring devices CSA C22.2 No. 182.1, Plugs, receptacles and cable cable connectors of the pin and sleeve type	

Annex DVE Continued on Next Page

Annex DVE Continued

Subclause from this standard	Description	IEC standard	UL standard	CSA Group standard	Application information
		IEC 60320-1, Appliance couplers for household and similar general purpose		CSA C22.2 No. 182.2, Industrial locking type, special use attachment plugs, receptacles, and connectors CSA C22.2 No. 182.3, Special use attachment plugs, receptacles and connectors	
G.4.2	Appliance Couplers, household	IEC 60320-1, Appliance couplers for household and similar general purposes - Part 1: General requirements IEC 60320-2-2, Appliance couplers for household and similar general purposes - Part 2-2: Interconnection couplers for household and similar equipment IEC 60906-2, IEC system of plugs and socket-outlets for household and similar purposes – part 2: Plugs and socket outlets 16 A, 250 V AC IEC 60906-2, IEC system of plugs and socket-outlets for household and similar purposes - part 2: Plugs and socket outlets 15 A, 125 V AC	UL 498, Attachment Plugs and Receptacles	CSA C22.2 No. 42 General Use Receptacles, Attachment Plugs, and Similar Wiring Devices	
G.4.2	Appliance Couplers, industrial	IEC 60309-1, Plugs, socket outlets and couplers for industrial purposes - Part 1: General requirements	UL 1682, Plugs, Receptacles, and Cable Connectors, of the Pin and Sleeve Type	CSA C22.2 No. 182.1, Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type	

Annex DVE Continued on Next Page

Annex DVE Continued

Subclause from this standard	Description	IEC standard	UL standard	CSA Group standard	Application information
				CSA C22.2 No. 182.2 Industrial Locking Type, Special Use Attachment Plugs, Receptacles, and Connectors CSA C22.2 No. 182.3 Special Use Attachment Plugs, Receptacles, and Connectors	
G.4.3	Wiring Terminals	IEC 60998-1, Connecting devices for low-voltage circuits for household and similar purposes – Part 1: General requirements IEC 60999-1, Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm^2 up to 35 mm^2 (included) IEC 60999-2, Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 2: Particular requirements for clamping units for conductors above 35 mm^2 up to 300 mm^2 (included)	UL 1059, Terminal blocks UL 486A-486B, Wire connectors	CSA C22.2 No. 158, Terminal blocks	

Annex DVE Continued on Next Page

Annex DVE Continued

Subclause from this standard	Description	IEC standard	UL standard	CSA Group standard	Application information
			UL 486E, Equipment wiring terminals for use with aluminum and/or copper conductors UL 60947-7-1, Low voltage switchgear and controlgear - Part 7-1: Ancillary equipment - Terminal blocks for copper conductors UL 60947-7-2, Low voltage switchgear and controlgear - Part 7-2 - Ancillary equipment - Protective conductor terminal blocks for copper conductors		
G.7	Mains Supply Cords	IEC 60227-1, Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements IEC 60245-1, Rubber insulated cables – Rated voltage up to and including 450/ 750V – Part 1: General requirements	UL 817, Cord sets and power supply cords UL 62, Flexible cords and cable	CSA C22.2 No. 21 Cord Sets and Power Supply Cords	Cord sets and power supply cords may employ a ″solid green″ protective earthing conductor
G.7	Portable power cables		SU 1650, Portable power cable	CSA C22.2 No. 96 Portable power cables	
G.8	Surge Protective Devices, and varistors or MOVs rated below 250 V	IEC 61051-2, Varistors for use in electronic equipment – Part 2: Sectional specification for surge suppression varistors	UL 1449, Surge protective devices	CSA Certification Notice No. 516 for surge protective devices;	CSA Certification Notice No. 516: Where the surge protective device is relied upon to achieve Overvoltage Category 1, UL 1449 requirements apply.

Annex DVE Continued on Next Page

Annex DVE Continued

Subclause from this standard	Description	IEC standard	UL standard	CSA Group standard	Application information
				CSA LTR I-002-2011, CSA Program for Varistors and Gas Discharge Tube for varistors	
G.13	Printed Wiring Boards		UL 796, Printed wiring boards		Printed wiring boards supporting ES2, ES3, PS2 or PS3
Annex Q	Interconnecting Cables		UL 758, Appliance wiring material	CSA C22.2 No. 210, Appliance wiring material products	Non-LPS, 3,05 m or less in length.
Annex DVJ	Communications circuits		UL 497, Protectors for paired-conductor communications circuits UL 497A, Secondary protectors for communications circuits UL 497B, Protectors for data communications and fire alarm circuits UL 497C, Protectors for coaxial communications circuits UL 1863, Communication-circuit accessories	CSA C22.2 No. 182.4, Plugs, receptacles, and connectors for communications systems CSA C22.2 No. 226, Protectors in telecommunications networks CSA C22.2 No. 233, Cords and cord sets for communications systems	

Annex DVF DC *Add Annex DVF:*

In the U.S. and Canada, any of the following equipment, components, or subassemblies that comply with either the specified UL or CSA Group standards are considered as an acceptable alternative to the referenced IEC component standard or requirement of this standard.

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

Annex DVF

Subclause from this standard	Description	IEC publication	UL standard	CSA Group standard	Application information
3.3.4.2	Plastic materials V-0, V-1, V-2, HB40, HB75	IEC 60695-11-10:1999, Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods	UL 94, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances	CAN/CSA C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials	
3.3.4.2	Plastic materials 5VA, 5VB	IEC 60695-11-20:1999, Fire hazard testing – Part 11-20: Test flames – 500 W flame test methods	UL 94, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances	CAN/CSA C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials	
3.3.4.2	Plastic materials HF- 1, HF-2, HBF	ISO 9772, Cellular plastics – Determination of horizontal burning characteristics of small specimens subjected to a small flame	UL 94, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances	CAN/CSA C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials	
3.3.4.2	Plastic materials VTM-0, VTM- 1, VTM-2	ISO 9773, Cellular plastics – Determination of burning behavior of thin flexible vertical specimens in contact with a small-flame ignition source	UL 94, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances	CAN/CSA C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials	
4.1.1	Audio, video and similar electronic apparatus	IEC 60065, Audio, video and similar electronic apparatus – Safety requirements	UL 60065, Audio, Video and Similar Electronic Apparatus – Safety Requirements	CAN/CSA C22.2 No. 60065, Audio, Video and Similar Electronic Apparatus – Safety Requirements	
4.1.1	Information Technology Equipment	IEC 60950-1, Information Technology Equipment – Safety – Part 1: General Requirements	UL 60950-1, Information Technology Equipment – Safety – Part 1: General Requirements	CAN/CSA C22.2 No. 60950-1, Information Technology Equipment – Safety – Part 1: General Requirements	
5.4.1.4.3	Insulation Systems	IEC 60085, Electrical insulation – Thermal evaluation and designation	UL 1446, Systems of Insulating Materials – General		

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Annex DVF Continued

Subclause from this standard	Description	IEC publication	UL standard	CSA Group standard	Application information
5.4.1.10.2	Thermoplastic parts, softening temperature	ISO 306, Plastics - Thermoplastic materials – Determination of Vicat softening temperature	UL 746A, Polymeric materials – Short term property evaluations UL 746B, Polymeric materials – Long term property evaluations		
5.4.3.3	Current Tracking Index (CTI)	IEC 60112, Method for the determination of the proof and the comparative tracking indices of solid insulating materials	UL 746A , Polymeric Materials – Short Term Property Evaluations		
5.6.3	Sheathed Supply Cords	IEC 60227-1, Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements IEC 60245-1, Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 1: General requirements	UL 817, Cord sets and power-supply cords	CSA C22.2 No. 21, Cord sets and power supply cords	Must be a hard service cord: S, SE, SO or ST
5.6.5.1	Wiring Terminals	IEC 60998-1, Connecting devices for low-voltage circuits for household and similar purposes – Part 1: General requirements	UL 1059, Terminal blocks	CSA C22.2 No. 158, Terminal blocks	

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Annex DVF Continued

Subclause from this standard	Description	IEC publication	UL standard	CSA Group standard	Application information
		IEC 60999-1, Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm^2 up to 35 mm^2 (included)	UL 486A-486B, Wire connectors		
		IEC 60999-2, Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 2: Particular requirements for clamping	UL 486E, Equipment wiring terminals for use with aluminum and/or copper conductors		
			UL 60947-7-1, Low voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors		
			UL 60947-7-2, Low voltage switchgear and controlgear - Part 7-2 - Ancillary equipment - Protective conductor terminal blocks for copper conductors		

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Annex DVF Continued

Subclause from this standard	Description	IEC publication	UL standard	CSA Group standard	Application information
6.4.5.2, 6.4.6	Wire Insulation and Tubing	IEC 60332-1-2, Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW premixed flame	UL 224, Extruded insulating tubing	CSA C22.2 No. 127, Equipment and lead wires	Material flammability of wire insulation and tubing in PS2 or PS3 circuits
		IEC 60332-2-2, Tests on electric and optical fibre cables under fire conditions – Part 2-2: Test for vertical flame propagation for a single small insulated wire or cable – Procedure for diffusion flame	UL 758, Appliance wiring material	CSA C22.2 No. 210, Appliance wiring material products	
			UL 1441, Coated electrical sleeving	CSA C22.2 No. 198.1, Extruded insulating tubing	
			UL 1581, Reference standard for electrical wires, cables, and flexible cords		
6.5.1	Internal and External Wiring	IEC/TS 60695-11-21, *Fire hazard testing – Part 11-21: Test flames – 500 W vertical flame test method for tubular polymeric materials*	UL 2556, Wire and Cable Test Methods	CSA C22.2 No. 2556, Wire and Cable Test Methods	The burning characteristic tests for the FV-1 and VW-1 in CSA/UL 2556 ratings are essentially the same as contained in IEC/TS 60695-11-21.
G.1	Switches	IEC 61058-1, Switches for appliances – Part 1: General requirements	UL 61058-1, Switches for appliances – Part 1: General requirements	CAN/CSA C22.2 No. 61058-1, Switches for appliances- Part 1: General requirements	
			UL 1054, Special-use switches	CSA C22.2 No. 55, Special use switches	

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Annex DVF Continued

Subclause from this standard	Description	IEC publication	UL standard	CSA Group standard	Application information
G.2	Relays	IEC 61810-1, Electromechanical elementary relays-Part 1, General requirements	UL 508, Industrial control equipment SU 508B, Relays used in information technology equipment	CSA C22.2 No. 14, Industrial control equipment	
G.3.1	Thermal Cut-offs	IEC 60730 (all parts), Automatic electrical controls for household and similar use	UL 60730-2-9, Automatic electrical controls for household and similar use, Particular requirements for temperature sensing controls UL 873, Temperature regulating and indicating equipment	CSA C22.2 No. 209 Thermal Cut-Offs CAN/CSA E-60730-2-9, Particular requirements for temperature sensing controls	
G.3.2	Thermal Links	IEC 60691, Thermal-links – Requirements and application guide	UL 60691, Thermal-links – Requirements and application guide	CSA C22.2 No. 24, Temperature-indicating and regulating equipment	
G.3.3	PTC Thermistor Devices	IEC 60730 (all parts), Automatic electrical controls for household and similar use IEC 60738-1, Thermistors – Directly heated positive temperature coefficient – Part 1: Generic Specification	UL 1434, Thermistor-Type Devices UL 60730-1A, Automatic electrical controls for household and similar use – Part 1: General requirements	Component Acceptance Service No. 53; or CSA TIL No. CA-03A, Component Acceptance Program for Positive Temperature Coefficient (PTC) Thermistors Used as Overcurrent Protectors in Electrical and Electronic Equipment	
G.3.4	Overcurrent Protective Devices – Fuses for supplementary overcurrent protection	IEC 60127-1 Miniature fuses – Part 1: definitions for miniature fuses and general requirements for miniature fuselinks	UL 248-14, Low-Voltage Fuses – Part 14: Supplemental Fuses	CSA C22.2 No. 248.14, Low Voltage Fuses – Part 14: Supplemental Fuses	

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Annex DVF Continued

Subclause from this standard	Description	IEC publication	UL standard	CSA Group standard	Application information
G.3.5	Other Protective Devices	IEC 60730-1 Automatic electrical controls for household and similar use. Part 1: general requirements	UL 1412, Fusing Resistors and Temperature-Limited Resistors for Radio and Television-Type Appliances UL 60730-1A Automatic Electrical Controls for Household and Similar Use; Part 1: General Requirements		
G.5.1	Magnet Wire	IEC 60317, Specifications for particular types of winding wires (Grade 2)	ANSI/NEMA MW 1000, Magnet wire (Heavy build)	ANSI/NEMA MW 1000, Magnet wire (Heavy build)	
G.8	Varistors and MOVs rated 250 V and above	IEC 61051-2, Varistors for use in electronic equipment – Part 2: Sectional specification for surge suppression varistors	UL 1449, Surge protective devices	CSA LTR I-002-2011 CSA Program for Varistors and Gas Discharge Tubes	
G.11	Capacitors	IEC 60384-14:1993 Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains	UL 60384-14, Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection in the supply mains	CAN/CSA EE60384-14 Fixed Capacitors for Use in Electronic Equipment – Part 14: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains	
G.12	Optical Isolators	IEC 60747-5-5:2007, Semiconductor devices – Discrete devices – Part 5-5: Optoelectronic devices – Photocouplers	UL 1577, Optical Isolators	CSA Component Acceptance Service Notice 5A	

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Annex DVF Continued

Subclause from this standard	Description	IEC publication	UL standard	CSA Group standard	Application information
G.13.6	Conformal Coatings	IEC 60664-3, Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution	UL 746C, Polymeric materials – Use in electrical equipment evaluations	CSA Electrical Bulletin 1402C	
Annex J	Insulated Winding Wire	IEC 60851- 3:2009, Winding wires – Test methods, All parts	UL 2353, Single- and multi-layer insulated winding wire		
Annex M	Battery Cells	IEC 60086-4, Primary batteries – Part 4: Safety of lithium batteries IEC 61960, Secondary cells and batteries containing alkaline or other non-acid electrolytes - Secondary lithium cells and batteries for portable applications	UL 1642, Lithium batteries UL 2054, Household and commercial batteries		
Annex M	Secondary Battery Packs used with transportable equipment	IEC 62133, Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications	UL 2054, Household and commercial batteries		
Annex M	Stationary Lead Acid Batteries	IEC 60896-11, Stationary lead-acid batteries – Part 11: Vented types – General requirements and methods of tests	UL 1989, Standby Batteries		

Annex DVF Continued on Next Page

Annex DVF Continued

Subclause from this standard	Description	IEC publication	UL standard	CSA Group standard	Application information
		IEC 60896-21, Stationary lead-acid batteries – Part 21: Valve regulated types – methods of tests IEC 60896-22, Stationary lead-acid batteries – Part 21: Valve regulated types – Requirements			
Annex M	Fuel cells	IEC 62282-2, Fuel cell technologies – Part 2: Fuel cell modules	SU 2265A, Outline of investigation for hand-held or hand-transportable fuel cell power units with disposable methanol fuel cartridges SU 2265C, Outline of investigation for hand-held or hand-transportable alkaline (Direct Borohydride) fuel cell power units and Borohydride fuel cartridges		
Annex S	Fire Hazard Testing	IEC 60695-11-5:2004, Fire hazard testing - Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance	UL 1694, Tests for Flammability of Small Polymeric Component Materials	CAN/CSA C22.2 No. 0.17,, Evaluation of Properties of Polymeric Materials, Appendix C	
Annex U.1	Intrinsically protected CRT's	IEC 61965:2003, Mechanical safety of cathode ray tubes	UL 61965, Mechanical Safety for Cathode Ray Tubes	CSA-E61965, Mechanical Safety of Cathode Ray Tubes	

Annex DVG DC *Add Annex DVG:*

In the U.S. and Canada, any of the following equipment, components, or subassemblies that comply with either the specified UL or CSA Group standards are considered as an acceptable alternative to the requirements of IEC 62368-1.

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

Annex DVG

Subclause from this standard	Description	UL standard	CSA Group standard	Application information
1	External power supply units	UL 60065, Audio, Video and Similar Electronic Apparatus – Safety Requirements	CAN/CSA C22.2 No. 60065, Audio, Video and Similar Electronic Apparatus – Safety Requirements	
		UL 60950-1, Information Technology Equipment – Safety – Part 1: General Requirements	CAN/CSA C22.2 No. 60950-1, Information Technology Equipment – Safety – Part 1: General Requirements	
		UL 1310, Class 2 Power Units	CAN/CSA C22.2 No. 223 Power Supplies With Extra-Low-Voltage Class 2 Outputs	Direct Plug-In Units with a mounting tab are not permitted in CAN/CSA C22.2 No. 223.
4.1.1	Audio, video and similar electronic apparatus	UL 60065, Audio, Video and Similar Electronic Apparatus – Safety Requirements	CAN/CSA C22.2 No. 60065, Audio, Video and Similar Electronic Apparatus – Safety Requirements	
4.1.1	Information Technology Equipment	UL 60950-1, Information Technology Equipment – Safety – Part 1: General Requirements	CAN/CSA C22.2 No. 60950-1, Information Technology Equipment – Safety – Part 1: General Requirements	
4.4.1	Audio/Video, Information and Communication Technology Equipment Cabinet, Enclosure and Rack Systems	UL 2416 Outline of Investigation for Audio/Video, Information and Communication Technology Equipment Cabinet, Enclosure and Rack Systems		
5.4.6, 6.4, 6.5	Wire and insulating tape	UL 224, Extruded insulating tubing	CSA C22.2 No. 127, Equipment and lead wires	CSA C22.2 No. 197: For other than PVC, use UL 510
		UL 510, Polyvinyl chloride, polyethylene, and rubber insulating tape	CSA C22.2 No. 210, Appliance wiring material products	
		UL 758, Appliance wiring material	CSA C22.2 No. 198.1, Extruded insulating tubing	

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Annex DVG Continued

Subclause from this standard	Description	UL standard	CSA Group standard	Application information
		UL 1441, Coated electrical sleeving	CSA C22.2 No. 197, PVC insulating tape	
6.4	Air filter units	UL 900, Air filter units		
8.10	Carts, stands, wall-mounts and similar carriers	UL 1678, Household, commercial, and professional-use carts and stands for use with audio/video equipment UL 2442, Wall- and ceiling-mounts and accessories		
10.4.3	Materials subjected to UV radiation	UL 746C, Polymeric materials – Use in electrical equipment evaluations	CSA C22.2 No. 0.17, Evaluation of properties of polymeric materials	UL 746C: Section 25 (UV exposure) and Section 57 (UV light exposure test)
F.3.9	Permanence of markings	UL 969 Marking and Labeling Systems	CSA C22.2 No. 0.15, Adhesive Labels	
G.3.4	Fuseholders	UL 4248 Series, Fuseholders	CSA C22.2 No. 39, Fuseholder assemblies CSA C22.2 No. 4248 Series, Fuseholders	
G.3.4	Overcurrent Protective Devices – Supplementary protectors	UL 1077, Supplementary protectors for use in electrical equipment		
G.3.5	Fusing Resistors	UL 1412, Fusing resistors and temperature-limited resistors for radio- and television-type appliances		
G.4.3	Connectors, other than mains	UL 1977, Component Connectors for Use in Data, Signal, Control and Power Applications	CSA C22.2 No. 182.3, Special Use Attachment Plugs, Receptacles and Connectors	UL 1977: Current interruption requirements
G.5.4	Motors	UL 1004-1, Rotating electrical machines UL 1004-2, Impedance protected motors UL 1004-3, Thermally protected motors UL 1004-6, Servo and stepper motors UL 1004-7, Electronically protected motors UL 507 Electric Fans	CSA C22.2 No. 100, Motors and Generators CSA C22.2 No. 113, Fans and Ventilators	
G.5.4	Motor Protection	UL 2111, Overheating Protection for Motors	CSA C22.2 No. 77, Motors with Inherent Overheating Protection or	

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Annex DVG Continued

Subclause from this standard	Description	UL standard	CSA Group standard	Application information
			CSA C22.2 No. 100, Motors and Generators	
G.9	IC Current Limiters	UL 2367, Solid-state overcurrent protectors		
G.11	EMI Filters	UL 1283, Electromagnetic interference filters	CSA C22.2 No. 8, Electromagnetic Interference (EMI) Filters	
G.13	Printed Wiring Boards	UL 796, Printed Wiring Boards		
P.4	Metalized Coatings	UL 746C, Polymeric materials – Use in electrical equipment evaluations		
P.4	Adhesives	UL 746C, Polymeric materials – Use in electrical equipment evaluations	CSA C22.2 No. 0.17, Evaluation of properties of polymeric materials	
Annex Q	Interconnecting cables	UL 758, Appliance wiring material	CSA C22.2 No. 210, Appliance wiring material products	LPS, 3,05 m or less in length
Annex S	Flammability of plastic materials	UL 94, Tests for flammability of plastic materials for parts in devices and appliances	CSA C22.2 No. 0.17, Evaluation of properties of polymeric materials	

Annex DVH D2 *Add Annex DVH:*

This annex provides requirements for permanently connected equipment.

Applicability of these requirements is dependent on the particular construction of the equipment and its intended installation and use.

With respect to requirements from the National Electrical Code (NEC), NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1, which are designated as DR National Differences, this annex is not intended to provide a complete list of all the requirements that may be applicable to all equipment covered by this standard, only those that most commonly apply to this type of equipment. For complete requirements, including valid exceptions, the National Electrical Code (NEC), NFPA 70, the Canadian Electrical Code, Part I, CSA C22.1, or other referenced documents should be consulted.

Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to that code or standard referenced in Clause 2, Normative References.

DVH.1 General

DVH.2 Connection of wiring systems

DVH.2.1 Mains – General

DVH.5.6.2 Restricted access area

Note – Code (NEC/CEC) references provided in (parenthesis) are considered covered by the requirements in the D1 National Difference.

Annex DVH

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
DVH.1 General		Wiring methods used for the connection of the equipment to the mains supply shall be in accordance with the National Electrical Code, NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1.	110.8	Sections 2, 4, 10, 12, and 14	DR
		NOTE Equipment covered under the scope of this standard is considered a Continuous Load (Duty) for purposes of application of NEC and CEC requirements that consider the nature of the electrical load, such as conductor sizing and overcurrent protection.	Article 100	Section 0	DR
DVH.2 Connection of wiring systems	DVH.2.1 Mains – General	For safe and reliable connection to a mains, permanently connected equipment shall be provided with one of the following: – terminals for permanent connection to the mains supply; or – wires (free conductors)	(110.14)	Rule 12-116 and CAN/CSA C22.2 No. 0	D1
		Equipment shall have provision for connecting and securing a field wiring system. *Compliance is checked by inspection.*	Article 300	Section 12	DR
	DVH.2.2 D.C. mains – Additional considerations	See Annex DVD for additional informative information on d.c. powered equipment and centralized d.c. power systems (d.c. mains).			
		For certain locations, such as some restricted access areas, using low-voltage d.c. systems, open wiring systems are permitted. Equipment intended solely for installation in such locations need not be provided with a provision for connecting and securing a field wiring system, nor a field-wiring compartment. However, a method of securing wiring, supplemented by instructions, as needed, shall be provided to ensure that the installed wiring is adequately protected from abuse and accidental contact. See Annex DVH.5.5.2.	110.26(F), 110.27	12-200	D2

Annex DVH Continued on Next Page

Annex DVH Continued

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
		For equipment intended to be installed in a restricted access area, one pole of the d.c. power distribution system (d.c. MAINS) may be connected both to an equipment mains input terminal and to the main protective earthing terminal of the equipment, if any, provided all of the following conditions are met: a) the equipment is intended to connect directly to the point of earthing of the d.c. system; b) bus bars, bonding jumpers and terminals are provided for the connection of the equipment earthing conductors and the earthing electrode conductor, by permanent wiring methods, to one of the d.c. supply conductors. Such hardware shall be constructed and sized in accordance with the Standard for Switchboards, UL 891, and Switchgear Assemblies, CSA C22.2 No. 31; c) the d.c. supply conductor may be earthed in more than one piece of equipment if all the equipment is located in the same immediate area as the point of earthing of the d.c. system (that is, within the ″earthing window″); d) means are provided for connection of the equipment to the d.c. source by permanent wiring methods, and no disconnecting device is located in the earthed d.c. circuit conductor between the point of connection to the supply and the point of connection to the earthing electrode and equipment earthing conductors; e) the equipment is marked with instructions or a reference to instructions in accordance with DVH.5.5, that address • provisions to connect the earthed conductor of a d.c. supply circuit to the earthing conductor at the equipment, or • installation of equipment that has the earthed conductor of a d.c. supply circuit connected to the earthing conductor at the equipment; and			D2

Annex DVH Continued on Next Page

Annex DVH Continued

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
		f) installation instructions are provided for field assembly of earthing and bonding conductors where the connections are not conventional. *Compliance is checked by inspection.*			
DVH.3 Methods of connection, including size of wiring, cables and conduits	DVH.3.1 General	Permanently connected equipment shall: – permit the connection of the supply wires after the equipment has been fixed to its support; and – be provided with cable entries, conduit entries, knock-outs or glands which allow connection of the appropriate types of cables or conduits.		CAN/CSA C22.2 No. 0	D1
		Branch circuit (current carrying) conductors supplying the equipment are required to be sized minimum 125 % of the equipment rating. This requirement serves as the basis for associated terminal, wiring space and related requirements. Refer to the appropriate article in the National Electrical Code, NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1, for ampacity Tables.	210.19(A), 210.20, Article 300 Ampacity Tables	4-004, Tables 1, 2, 3, 4, 5A, and 5C	DR
		Trade sizes of different size conduits and the number type and ampacity of cables allowed to be used with different sized conduits are covered in the national codes. Table DVH.1 is provided for reference.	300.1I, Chapter 9, Table 4, Annex C	Section 4, Section 12, Tables 6 – 12	DR
		Conduit and cable entries and knock-outs for supply connections shall be so designed or located that the introduction of the conduit and cable does not affect the protection against electric shock, or reduce clearances and creepage distances below the values specified in 5.4.			D2
		The enclosure of an in-wall mounted equipment that is located within the wall cavity shall not be provided with unused openings.			D1

Annex DVH Continued on Next Page

Annex DVH Continued

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
		The thickness of a sheet-metal enclosure at points to which a wiring system is to be connected shall have a thickness not less than 0,81 mm thick when constructed of uncoated sheet steel, and not less than 1,14 mm thick when constructed of nonferrous metal. (UL 508, 6.3.1)			D2
		A metal enclosure for in-wall mounted equipment shall have a minimum thickness of 1,35 mm uncoated. *Compliance is checked by inspection and by measurement.*	312.10(B)		DR
	DVH.3.2 Wire terminals				
	DVH.3.2.1 Wire terminal sizes	Terminals shall be suitable for the wire gauges commonly used in the U.S. and Canada. A MAINS wiring terminal shall be sized to accept branch circuit conductors having an ampacity no less than 125 % of the electrical rating of the equipment.	210.19(A), 422.10(A), 645.5(A)	4-004	DR
		For purposes of application of the ampacity tables in the NEC and CEC, no Correction Factors shall be used for terminal sizing considerations, unless requested by the manufacturer and documented.			DR
		A wiring terminal that will not receive a conductor size one size larger than the minimum determined per NEC Table 310.15(B)(16) shall be marked to restrict its use to the smaller conductor size.			
		A 14 AWG (2,1 mm^2) conductor is the smallest that is capable of being used for branch-circuit wiring and thus is the smallest conductor that is to be anticipated at a terminal for connection of a branch-circuit conductor. *Compliance is checked by inspection, by measurement and by fitting conductors of the smallest and largest cross-sectional areas of the appropriate range.*	210.24, Table 210.24	4-002	DR
	DVH.3.2.2 Wire terminal design	Terminals shall be so fixed that, when the means of clamping the conductor is tightened or loosened, all of the following apply: – the terminal itself does not work loose;			D1

Annex DVH Continued on Next Page

Annex DVH Continued

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
		– internal wiring is not subjected to stress; and – clearances and creepage distances are not reduced below the values specified in Table DVH.2.			
		The spacing between field wiring terminals of opposite polarity, and the spacing between a wiring terminal and any other uninsulated metal part not of the same polarity, shall not be less than that specified in Table DVH.2.	(312.11(A)(3))		DC
		Note – These spacing requirements based on requirements common in North American safety standards (e.g., UL 1059) for field wiring terminals (and containing larger safety margins versus controlled factory wiring spacings) allow for ease of use and are considered to meet the intent of NEC 312.11(A)(3).			
		Screws and nuts that clamp external mains conductors shall have a thread conforming to ISO 261 or ISO 262, or a thread comparable in pitch and mechanical strength (for example, unified threads). The screws and nuts shall not serve to fix any other component, except that they are permitted also to clamp internal conductors provided that the internal conductors are so arranged that they are unlikely to be displaced when fitting the supply conductors.			D1
		The terminals of a component (for example, a switch) built into the equipment are permitted for use as terminals for external mains conductors, provided that they comply with the requirements of Table DVH.2.			DC
		For protective earthing conductor terminals, see annex DVH (DVH.3.4).			
	DVH.3.2.3 Screw terminals	Connection by means of wire-binding screws, or studs and nuts that have upturned lugs is permitted only for terminals intended for 10 AWG (5,3 mm^2) or smaller conductors.	110.14(A)	12-116	DR
		A terminal plate for a wire-binding screw shall be of metal and shall have no less than two full threads in the metal.	250.8(A)	CAN/CSA C22.2 No. 0	DR

Annex DVH Continued on Next Page

Annex DVH Continued

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
		A terminal plate formed from stock having the minimum required thickness as given above is capable of having the metal extruded at the tapped hole for the binding screw so as to provide two full threads. *Compliance is checked by inspection.*	250.8(A)	CAN/CSA C22.2 No. 0	DR
	DVH.3.2.4 Grouping of terminals	All associated mains supply terminals shall be located in proximity to each other and to the main protective earthing terminal, if any. *Compliance is checked by inspection.*			D1
	DVH.3.2.5 Stranded wire	Terminals shall be located, guarded or insulated so that, should a strand of a conductor escape when the conductor is fitted, there is no likelihood of accidental contact between such a strand and – accessible conductive parts; or – unearthed conductive parts separated from accessible conductive parts by supplementary insulation only. *Compliance is checked by inspection and by the performance criteria in G.7.6.2.2 (Stranded wire – Compliance and test method).*			
	DVH.3.3 Connections via wires (free conductors)	When field connection to an external circuit is via wires (example, free conductors), the wires shall not be smaller than 18 AWG (0,82 mm^2) and the free length of the wire inside an outlet box or wiring compartment shall be 150 mm or more. Such wires shall not be more than two wire sizes smaller than the mains supply conductor to which it will be connected. (UL 508, 25.5D.1) NOTE For example, when 14 AWG (2,1 mm^2) mains supply conductors are used, the wires for interconnection provided shall not be smaller than 18 AWG (0,82 mm^2). *Compliance is checked by inspection and by measurement.*	110.14, 300.14	Rules 12-3000(6), 30-404, and CAN/CSA C22.2 No. 0	DR DR

Annex DVH Continued on Next Page

Annex DVH Continued

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
	DVH.3.4 Size of protective earthing conductors and terminals	The sizing of the equipment protective earthing conductor terminal shall be no smaller than the size of the circuit mains conductor terminal(s). See the respective Code references for permissible exceptions. Note – per Table 250.122, a 14 AWG (2,1 mm^2) copper conductor is the smallest that is acceptable of being used for equipment earthing (grounding) conductors for equipment.	250.122(A), Table 250.122	10-814, Table 16	DR
DVH.4 Mains supply wiring space		See G.7.6. No electrical component shall be mounted on a part, such as the cover of a wiring terminal compartment, which must be removed for the connection or inspection of field wiring.	300.15	12-3014	DR
	DVH.4.1 Wire bending space	There shall be adequate wire bending space in a wiring compartment to properly make the field connections. Note – This requirement is not applicable to wiring compartments for non-detachable power supply cords. *Compliance is checked by inspection.*	312.6(B)	12-110	DR
	DVH.4.2 Volume of compartments	There shall be adequate room in a wiring compartment to properly make the field connections. Wiring compartments shall be of sufficient size to provide free space for all conductors enclosed in the box. Note – This requirement is not applicable to wiring compartments for non-detachable power supply cords. *Compliance is checked by inspection.*	(312.6) 314.16(B), Table 314.16(B)	 12-3032, Table 22, 12-3034, Table 23, and CSA C22.2 No. 0.12	D1 DR
	DVH.4.3 Separation of circuits	Field installation of conductors of any circuit shall be separated from Class 2 and Class 3 circuits by barriers (equipment safeguard). *Compliance is checked by inspection.*	725.133, 725.136	12-904, 12-3030, 14-414, 16-212	DR

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Annex DVH Continued

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
DVH.5 Equipment markings and instructional safeguards		See F.3.1.			
	DVH.5.1 Identification of protective earthing terminal	See 5.6.2.2 and F.3.6.1.1. The terminal for the connection of the equipment protective earthing conductor (grounding conductor or bonding conductor) shall be identified by 1) a green-colored, not readily removable terminal screw with a hexagonal head; 2) a green-colored, hexagonal, not readily removable terminal nut; or 3) a green-colored pressure wire connector. If the terminal is not visible, the conductor entrance hole shall be marked with the word ″green″ or ″ground,″ the letters ″G″ or ″GR″ or the grounding symbol (IEC 60417, No. 5019) or otherwise identified by a distinctive green color. Note - The term ″Protective Earth″ or its abbreviation ″PE″ are not commonly used in Canada or the U.S. Therefore, ″G,″ ″GND,″ ″GROUND,″ or the grounding symbol should be used in conjunction with these terms. *Compliance is checked by inspection.*	250.119, 250.126	4-036	DR
	DVH.5.2 Identification of terminal for earthed conductor (neutral)	See F.3.6.1.2. Permanently connected equipment rated at 125 or 125/250 V (3-wire) or less shall have one terminal or lead identified for the connection of the grounded circuit conductor (neutral) of the power supply circuit.	200.9		DR

Annex DVH Continued on Next Page

Annex DVH Continued

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
		A field-wiring terminal intended for the connection of a grounded circuit conductor (neutral) shall be identified by means of a metallic coating that is substantially white in color and be easily distinguishable from the other terminal; or proper identification of the terminal for the connection of the grounded terminal shall be clearly shown in some other manner, such as an attached wiring diagram. When wire leads are provided instead of terminals, the identified lead shall have a white or gray color and shall be easily distinguishable from the other leads. *Compliance is checked by inspection.*	200.9	Section 0, 2-100(j), 4- 030(1)	DR
	DVH.5.3 Identification of terminals for aluminum conductors	Equipment with supply field-wiring terminals intended to be connected to aluminum conductors shall be so identified for the connection of aluminum conductors. This marking shall be independent of all other markings on the terminal connectors and shall be visible after installation. The terminal for the connection of an equipment protective earthing (grounding) conductor shall not be identified for the connection of an aluminum conductor. *Compliance is checked by inspection.*	110.14	12-118	DR
	DVH.5.4 Wire temperature ratings	Equipment for which during the temperature test (e.g., 5.4.1.5) the wire insulation within a terminal box or mains wiring compartment attains a temperature higher than 60 °C shall be marked to indicate the minimum wire temperature rating to be used. *Compliance is checked by inspection.*	110.14(C)(1), 310.15(A)(3)	4-004, 12-100 (App B), 12-1604	DR
	DVH.5.5 D.C. mains – Additional considerations				
	DVH.5.5.1 Polarity	For permanently connected equipment, terminals intended exclusively for connection to a d.c. power distribution (mains) circuit shall be marked to indicate polarity.			D2

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Annex DVH Continued

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
		If a single terminal is provided, both as a main protective earthing terminal in the equipment and for the connection to one pole of the d.c. power distribution circuit, it shall be marked as specified in DVH.2.2, in addition to polarity marking. These indications shall not be located on screws or other parts which might be removed when conductors are being connected.			
	DVH.5.5.2 Equipment with the earthed conductor connected to the protective earthing conductor at the equipment	Equipment that has the earthed conductor of a d.c. power distribution system (mains) connected to the earthing conductor at the equipment shall be provided with a permanent marking located near and in plain view of the field wiring terminals indicating the need for a special installation and to see the installation instructions. See Annex DVK (DVH.5.5.2). *Compliance is checked by inspection.*			D2
	DVH.5.5.3 Equipment with provision to connect the earthed conductor to protective earthing conductor at the equipment	Equipment that has provision to connect the earthed conductor of a d.c. power distribution system (mains) to the earthing conductor at the equipment shall be provided with a permanent marking located near and in plain view of the field wiring terminals indicating the need for a special installation and to see the installation instructions See Annex DVK (DVH.5.5.3). *Compliance is checked by inspection.*			D2
	DVH.5.6 Installation instructions				
	DVH.5.6.1 General	Equipment shall be provided with field wiring instructions for the installer. The instructions provided shall not conflict with any requirement in this standard or in the National Electrical Code, NFPA 70, or the Canadian Electrical Code, Part I, CSA C22.1. *Compliance is checked by inspection.*	110.3(B)		D1

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Annex DVH Continued

Topic	Sub-topic	Requirement	NEC Reference, as applicable	CEC Reference, as applicable	ND Type
	DVH.5.6.2 Restricted access areas	When a physical means is not provided, equipment intended for installation within a restricted access area shall be provided with instructions to ensure that the installed wiring is protected from abuse and accidental contact. *Compliance is checked by inspection.*			D1

Table DVH.1 – Knockout and Throat Diameter Sizes

(see DVH.3.1)

Trade size of conduit	Knockout diameter, mm (inches)						Throat diameter of hole, mm (inches)			
(metric designator)	Minimum		Nominal		Maximum		Minimum		Maximum	
3/8 (12)							11.28	(0.444)	12.52	(0.493)
1/2 (16)	21.82	(0.859)	22.23	(0.875)	23.01	(.906)	14.22	(0.560)	15.80	(0.622)
3/4 (21)	27.79	(1.094)	28.17	(1.109)	28.98	(1.141)	18.85	(0.742)	20.93	(0.824)
1 (27)	34.52	(1.359)	34.93	(1.375)	35.71	(1.406)	23.98	(0.944)	26.64	(1.049)
1-1/4 (35)	43.66	(1.719)	44.04	(1.734)	44.86	(1.766)	31.55	(1.242)	35.05	(1.380)
1-1/2 (41)	49.73	(1.958)	50.39	(1.984)	51.21	(2.016)	36.80	(1.449)	40.89	(1.610)
2 (53)	61.80	(2.433)	62.71	(2.469)	63.50	(2.500)	47.24	(1.860)	52.50	(2.067)
2-1/2 (63)	74.12	(2.918)	75.41	(2.969)	76.20	(3.00)	56.44	(2.222)	62.71	(2.469)
3 (78)	90.50	(3.563)	91.29	(3.594)	93	(3.661)	70.13	(2.761)	77.92	(3.068)
3-1/2 (91)	103.20	(4.063)	104.78	(4.125)	106	(4.173)	81.10	(3.193)	90.12	(3.548)
4 (103)	115.90	(4.563)	117.88	(4.641)	119	(4.685)	92.02	(3.623)	102.26	(4.026)
5 (129)	142.88	(5.625)	145.26	(5.719)	147	(5.787)	115.37	(4.542)	128.19	(5.047)
6 (155)	170.18	(6.700)	173.05	(6.813)	175	(6.890)	138.63	(5.458)		

Table DVH.2 – Clearances and Creepage Distances at wiring terminals

(see DVH.3.3.2)

Potential involved	Minimum spacings		
	Between wiring terminals, through air or over surface	Between terminals and other uninsulated metal parts not always of the same polarity[a]	
		Creepage distance	Clearance
volts	mm	mm	mm
250 or less	6,5	6,5	6,5
more than 250	13	13	10

[a] Applies to the sum of the spacings involved where an isolated dead metal part is interposed.

Annex DVI D1 *Add Annex DVI:*

DVI.1 General

Equipment intended for connection to a telecommunication network that uses outside cable subject to overvoltage from power line failures shall comply with the construction requirements, performance (test) conditions, or combination thereof as shown in Figure DVI.1.

NOTE 1 In Figure DVI.1, ″Pass 1, 2, 3, 4 or 5″ means compliance with Test Condition 1, 2, 3, 4 or 5, respectively, of DVI.4.3.

NOTE 2 It is assumed that the following overvoltage conditions can be encountered on telecommunication networks that connect to outside cable. The overvoltage is the result of:

a) contact with a multi-earthed neutral distribution power line (4 kV to approximately 50 kV);

b) induction from a distribution power line fault to earth;

c) earth potential rise from a distribution power line fault current flowing to earth; and

d) contact with 120 V power line.

Maximum longitudinal voltage of 600 V can occur on inside wiring that is protected with 3-mil carbon blocks. Asymmetrical operation of the carbon blocks can result in a metallic voltage of up to 600 V when the longitudinal voltage is high enough to operate one carbon block but not the other (minimum 285 V peak).

Maximum induced current of 2,2 A, steady state, can result from a high impedance power line fault to earth.

Maximum 7 A for 5 s can result from induction or from earth potential rise after a power line contact with a multi-earthed neutral conductor.

An I^2t of 2 400 can result from power line contact with a telephone shielded cable. A combination of 40 A, 1,5 s is considered the worst case. I^2t is used for current limits in adiabatic heating processes.

A 120 V power line crossed with a telephone line can deliver up to 25 A to the telephone wiring, limited by the wiring impedance.

Compliance with the construction requirements is checked by inspection. Compliance with the performance (test) conditions is checked by the requirements in DVI.2.

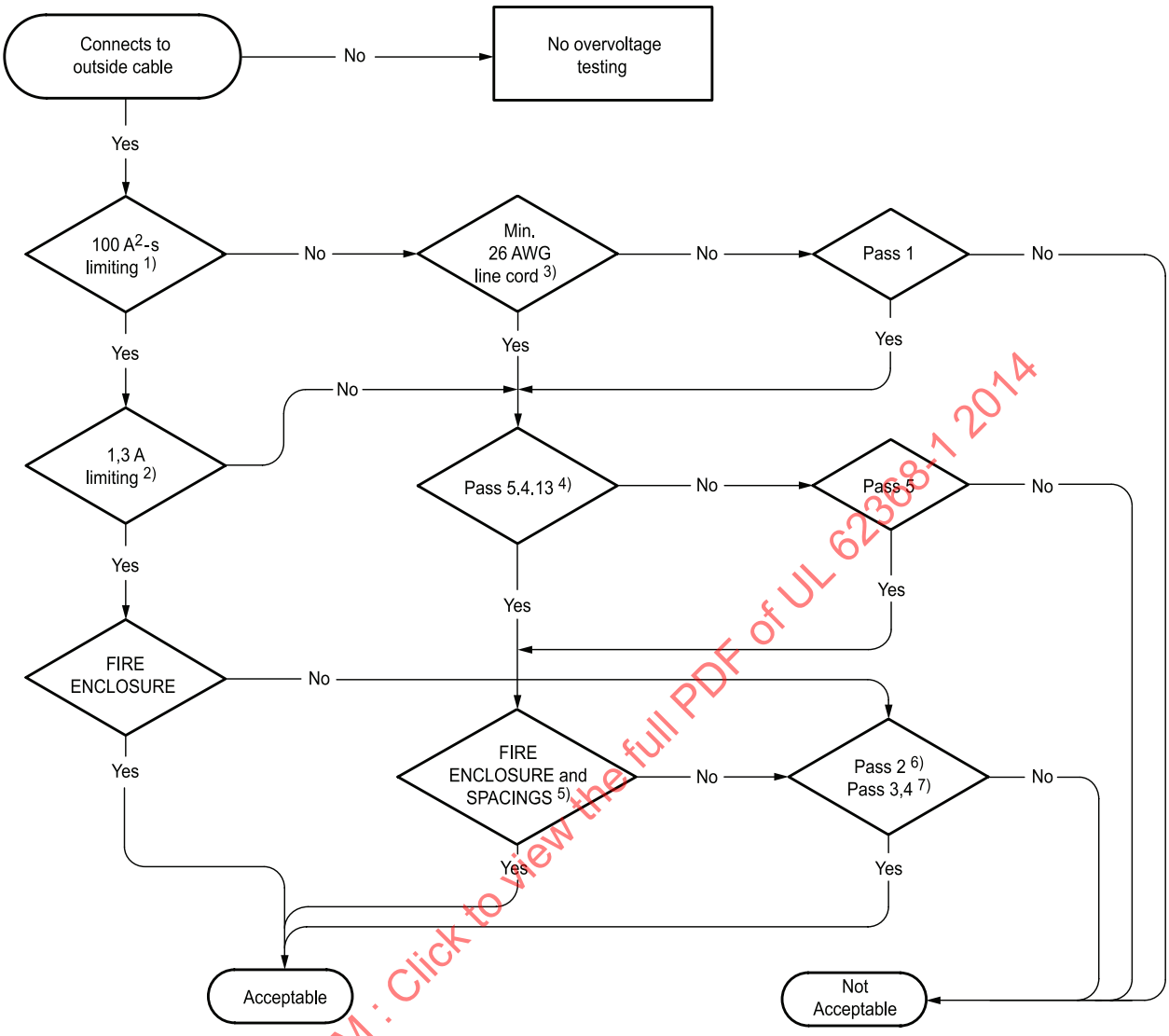

Figure DVI.1 - Overvoltage flowchart

The following conditions are applicable during the application of Figure DVI.1.

1) Equipment contains a method for limiting current energy to 100 A^2-s max. for Test Condition 1. A circuit or component that complies with the Standard for Secondary Protectors for Communications Circuits, UL 497A, or CSA C22.2 No. 226, Protectors in Telecommunication Networks, shall be considered to comply with this requirement.

2) Equipment contains a method for limiting current to 1,3 A max. steady state (e.g0,. a fuse rated 1,0 A maximum) that also complies with the Standard for Secondary Protectors for Communications Circuits, UL 497A, or CSA C22.2 No. 226, Protectors in Telecommunication Networks.

3) Minimum 26 AWG telecommunication line cord, either supplied with the equipment or described in the safety instructions. See Annex DVK.

4) The telephone line is adequately isolated from earth for the operating mode being considered at a voltage of 120 V. This may be determined by complying with the test of 5.4.11, using a minimum voltage of 120 V, or an electric strength test of 120 V. The test is applicable to pluggable equipment type A, pluggable equipment type B and permanently connected equipment.

5) In addition to the requirements for a fire enclosure, the following requirements apply to equipment with external circuits intended for connection to a telecommunication network that might ignite under overvoltage conditions:

a) Plastic materials of a fire enclosure located less than 13 mm through air from non-arcing parts which, under any condition of normal or abnormal operation, could attain a temperature sufficient to ignite the material, shall be capable of passing the test of UL 746A. The average time to ignition of the samples shall be not less than 15 s. If a sample melts through without igniting, the time at which this occurs is not considered to be the time to ignition.

b) The parts shall be separated from internal materials of flammability class V-2 or lower by at least 25 mm of air or a barrier of flammability class V-1 or better, except for the following:

– electrical components that do not present a fire hazard under abnormal operating conditions when tested according to Clause B.4;

– materials and components within an enclosure of 0,06 m^3 or less, consisting totally of metal and having no ventilation openings, or within a sealed unit containing an inert gas;

– one or more layers of thin insulating material, such as adhesive tape, used directly on any surface within a fire enclosure, including the surface of current-carrying parts, provided that the combination of the thin insulating material and the surface of application complies with the requirements of V-2 class material, or HF2 class foamed material;

– meter cases (if otherwise determined to be suitable for mounting of parts at hazardous voltage), meter faces and indicator lamps or their jewels;

– electronic components, such as integrated circuit packages, optocoupler packages, capacitors and other small parts that are mounted on V-1 class material;

– wiring, cables and connectors insulated with PVC, TFE, PTFE, FEP, polychloroprene, or polyimide;

– individual clamps (not including helical wraps or other continuous forms), lacing tape, twine and cable ties used with wiring harnesses;

– wire that complies with the requirements for ″VW-1″ or ″FT-1″ or better, and that is so marked; and

– the following parts, provided that they are separated from electrical parts (other than insulated wires and cables) which under fault conditions are likely to produce a temperature that could cause ignition, by at least 25 mm of air or by a solid barrier of V-1 class material:

• gears, cams, belts, bearings, and other small parts that would contribute negligible fuel to a fire, including labels, mounting feet, key caps, knobs, and the like;

• supplies, consumable materials, media, and recording materials;

• parts that are required to have particular properties in order to perform intended functions, such as rubber rollers for paper pick-up and delivery and ink tubes;

• tubing for air or any fluid systems, containers for powders or liquids and foamed plastic parts, provided that they are of HB75 class material if the thinnest significant thickness of the material is < 3 mm, or HB40 class material if the thinnest significant thickness of the material is ≥ 3 mm, or HBF class foamed material.

c) The parts shall be separated from openings in the top or sides of the enclosure by at least 25 mm of air or a barrier of flammability class V-1 or better unless the openings comply with one of the following:

– not exceed 5 mm in any direction; or

– not exceed 1 mm in width regardless of length.

6) Test Condition 2 is not required for equipment containing a method for limiting current to 1,3 A max steady state (e.g., a fuse rated 1,0 A maximum).

7) Test Conditions 3 and 4 are not required for equipment whose application (because of system function, design limitations, etc.) is limited to connections to outside cable not exceeding 1 000 m (for example, equipment that connects to ISDN S/T reference points and certain proprietary telephone sets).

DVI.2 Equipment evaluation – performance

Equipment required by Figure DVI.1 to be subjected to a performance evaluation shall be evaluated while in each operating state that affects compliance (usually, on-hook and off-hook).

Equipment that functions as either terminal or series equipment shall be evaluated for both functions.

DVI.3 Test set-up

DVI.3.1 Equipment

Equipment shall be mounted as intended for its use. Tests may be conducted on either the equipment as an assembly, on individual subassemblies, or on a partial assembly containing those components that can be exposed to an overvoltage condition. Two single plies of cheesecloth shall be wrapped tightly around the assembly, subassembly, or partial assembly.

NOTE 1 Bleached cotton cheesecloth, running 28 – 30 m/kg and having what is known as a ″count of 32 × 28 inch″ – that is, for any square inch, 32 threads in one direction and 28 threads in the other direction (for any square centimeter, 13 threads by 11 threads) – is considered suitable for this purpose.

NOTE 2 Cheesecloth meeting the requirements of CAN/CSA C22.2 No. 0 is considered suitable for this purpose.

Functional circuitry shall be used for each test. Circuitry that is damaged during testing may be either repaired or replaced for subsequent tests. After any of the specified tests, equipment may be returned to ambient temperature before performing any additional tests. Alternatively, separate samples may be used for each test.

DVI.3.2 Wiring connections

The following requirements apply:

a) Except where a wiring simulator is required, equipment that has a removable telecommunication line cord shall be connected to the test circuit with a line cord having 0,4 mm (26 AWG) or larger copper wire conductors and not more than 1 Ω total resistance. However, equipment supplied with a line cord having 0,4 mm (26 AWG) copper conductors, and having installation instructions for equivalent replacement cords, shall be evaluated with the line cord provided.

b) Equipment that has a permanently attached telecommunication line cord (one that requires use of a tool to remove) or a permanently attached handset cord that can be subjected to overvoltage conditions, and for which these cords have not been approved as component parts, shall have the cord or cords prepared for testing as described in the Standard for Communications-Circuit Accessories, UL 1863, and CSA C22.2 No. 233, Cords and Cord Sets for Communication Systems.

c) For equipment intended to be field-wired to the telecommunications network, a 300 mm length of 0,4 mm (26 AWG) solid copper wire shall be used to connect the equipment to the test circuit.

DVI.3.3 Wiring simulator

A wiring simulator shall be used in test conditions 1 and 5 where:

– a minimum 26 AWG telecommunications line cord is not provided; or

– minimum 26 AWG wiring is not specified for field-wired telecommunications equipment.

The wiring simulator shall be:

– a 50 mm length of 0,2 mm (32 AWG) bare or enameled solid copper wire;

– a fuse having a time-current characteristic comparable to a 0,2 mm wire [Bussman Mfg. Co. Type MDL-2 A fuse or equivalent]; or

– for test condition 1 only, a current probe consisting of a 300 mm length of at least 0,5 mm (24 AWG) copper wire to determine the I^2t imposed on the connecting wiring.

Compliance is determined by the 50 mm length of wire or the fuse not interrupting current during the test, or by the current probe measurement indicating an I^2t less than $100A^2$-s.

DVI.4 Test conditions

DVI.4.1 General conditions

Test voltages shall be applied to a representative pair or pairs of the equipment's leads that connect to outside cable as indicated (M indicates differential mode, L indicates common mode and F indicates 4-wire test mode):

– Terminal equipment with an earthing connection shall be subjected to common mode (longitudinal) L-type overvoltage test conditions using the test circuit described in Figure DVI.2.

– Terminal equipment shall be subjected to differential mode (metallic) M-type overvoltage test conditions using the test circuit described in Figure DVI.3; if the equipment also has an earthing connection, either tip shall be earthed or ring shall be earthed during testing, whichever is more severe.

– Terminal equipment which connects to a 2-pair (4-wire) telecommunication network shall be subjected to pair-to-pair F-type overvoltage test conditions using the test circuit described in Figure DVI.4. Four-wire testing is not required provided any of the following conditions are satisfied:

• the equipment circuitry limits the current in each line to an I^2t less than $100A^2$-s and analysis indicates that the test voltages would not cause excessive power dissipation in the affected components;

• analysis indicates that all circuit elements that would be stressed by the 4-wire test voltages are evaluated in the differential mode or common mode test; or

• a dielectric barrier at the test voltage is provided between the wire pairs.

– Series equipment shall be subjected to:

• all common mode, differential mode and 4-wire tests without terminal equipment being connected; and

• differential mode tests M-2, M-3 and M-4 with terminal equipment connections short-circuited.

Pluggable equipment type A that is not installed by a skilled person shall be evaluated with and without the power-supply cord earthing lead connected to earth if that earthing can affect compliance.

The open circuit voltage at 50 or 60 Hz, and short-circuit current (set before the test voltage is applied) available from the voltage source, are given in the following test requirements.

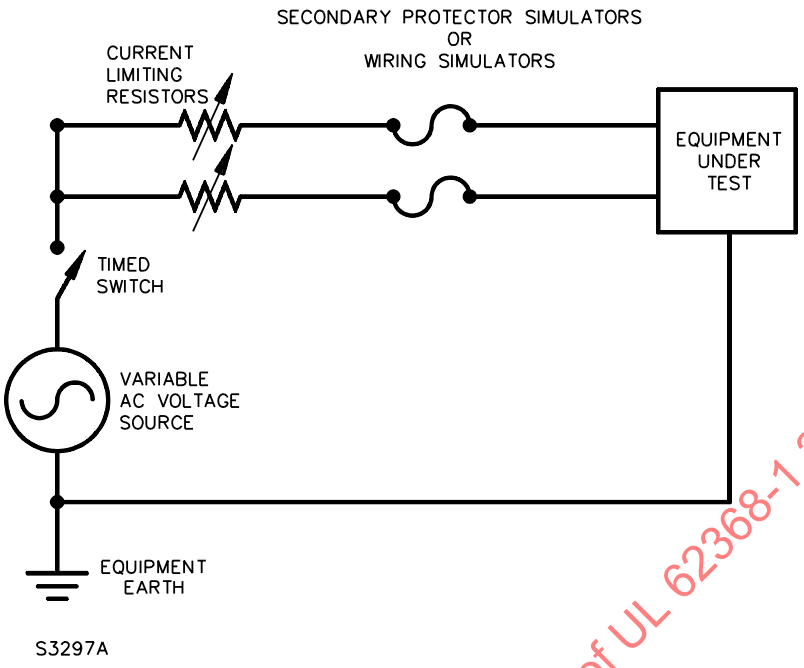

Figure DVI.2 - Circuit for common mode (longitudinal) overvoltage tests

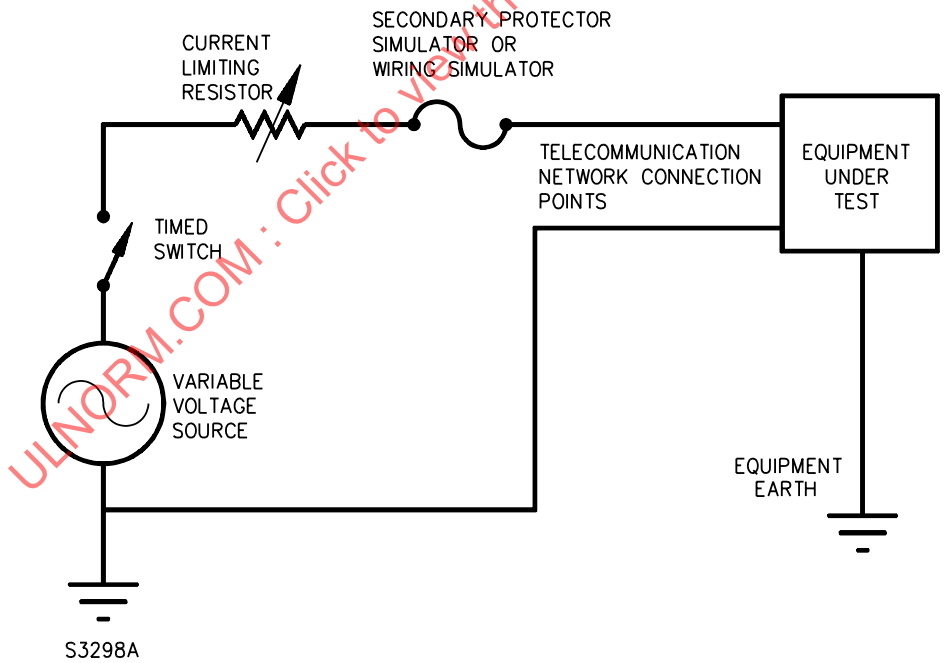

Figure DVI.3 - Circuit for differential mode (metallic) overvoltage tests

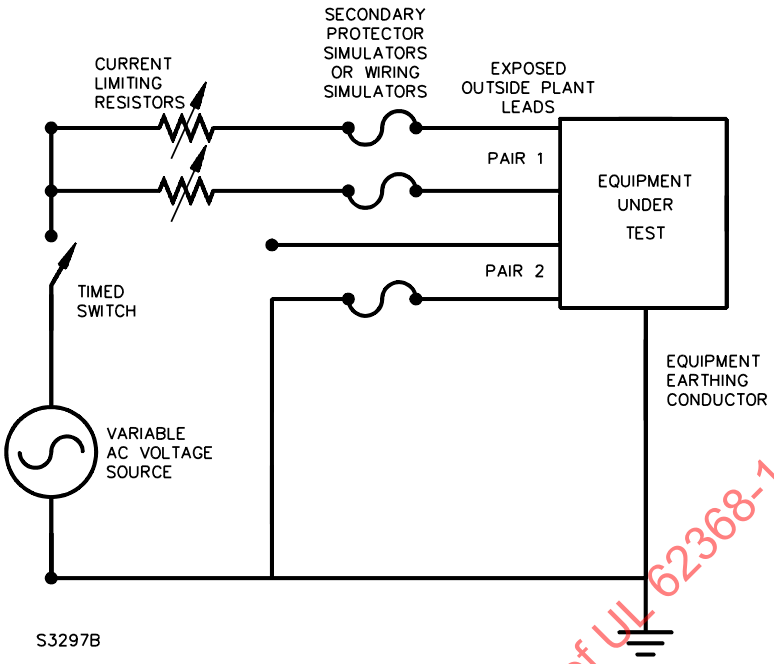

Figure DVI.4 - Circuit for 4-wire overvoltage tests

DVI.4.2 Special conditions

Telecommunication equipment often is used with a primary or secondary protector. A primary protector is a voltage limiting device. A secondary protector is a current limiting device. A secondary protector may, but is not required to, provide voltage limiting acceptable for protecting telephone equipment.

DVI.4.2.1 Primary protectors

On equipment installed by a skilled person and intended for use only with a specified primary protector that complies with the Standard for Protectors for Paired Conductor Communications Circuits, UL 497, and CSA C22.2 No. 226, Protectors in Telecommunication Networks, the voltage may be adjusted based on the 3-sigma breakdown voltage over life for the protector. Since the test voltage is based on the maximum voltage that will not break down the protector, these tests are performed without the actual protector in place.

NOTE Primary protectors are generally under the exclusive control of the service providers, not the equipment manufacturer. Therefore, unless the equipment is intended to be installed by a service provider and it can be ensured that the manufacturer's recommendation for a specific primary protector will be followed, or the primary protector is provided as part of the equipment construction, equipment should be evaluated without a primary protector in the test circuit.