



National Differences For

UL 60730-1

Automatic Electrical Controls - Part 1: General Requirements

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Automatic Electrical Controls - Part 1: General Requirements

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This new fifth edition of ANSI/UL 60730-1 adopts IEC 60730-1 (Edition 5.1, Issued by the IEC December, 2015.)

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

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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

1.1.7DV.1 D2 Modification of 1.1.7 by adding the following text:

This standard applies to discrete THERMISTORS and also to controls using NTC or PTC THERMISTORS, requirements for which are contained in Annex J

1.1.101DV DR Addition to the Scope by adding the following text:

CONTROLS intended to be installed in air handling spaces or in other environmental air space (plenums) are covered under the scope of this standard.

1.2DV D2 Addition of the following to 1.2:

The following UL Standards are referenced in this Standard:

UL 50

Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 50E

Enclosures for Electrical Equipment, Environmental Considerations

UL 62

Flexible Cords and Cables

UL 94

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

UL 157

Gaskets and Seals

UL 248-14

Low-Voltage Fuses – Part 14: Supplemental Fuses

UL 310

Terminals, Electrically Quick-Connect

UL 508

Industrial Control Equipment

UL 514A

Metallic Outlet Boxes

UL 514B

Fittings, Conduit, Tubing and Cable

UL 514C

Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 635***Insulating Bushings*****UL 746C*****Polymeric Materials – Use in Electrical Equipment Evaluations*****UL 796*****Printed-Wiring Boards*****UL 969*****Marking and Labeling Systems*****UL 1059*****Terminal Blocks*****UL 4200A*****Products Incorporating Button or Coin Cell Batteries of Lithium Technologies*****UL 4248*****Fuseholders series*****UL 5085-1*****Low Voltage Transformers – Part 1: General Requirements*****UL 5085-2*****Low Voltage Transformers – Part 2: General Purpose Transformers*****UL 5085-3*****Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers*****2.1.5DV D1 Modification of Note 2 to entry of 2.1.5 by adding the following:**

Replace IEC 61558-2-6 with UL 5085-1 and UL 5085-3. Transformers used in Switch-mode power supplies are evaluated to the applicable requirements of this standard.

2.1.6DV DR Addition of the following note to 2.1.6:

A Class 2 transformer which is considered a safety isolating transformer is defined as a step-down transformer of the low-voltage secondary type in accordance with Article 725 of the National Electrical Code, NFPA 70.

2.4.5DV D2 Modification of 2.4.5 by adding the following text after the word "MICRO-DISCONNECTION":

"that is mechanically secured (see 11.4.16DV)."

2.5.3DV D2 Modification of Note 1 to entry:

A fuse in the plug is regarded to be part of the CONTROL if the cord is non-detachable using attachment methods Y or Z.

2.7.3DV DR Modification of 2.7.3 by adding the following text after the notes:

CLASS 0I is not applicable.

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2.7.8DV D2 Modification of 2.7.8:

Replace "Figure 2" with "Figure DVA.3.2.2."

2.7.10DV DE Relocation of Note 2 to entry:

Relocate Note 2 to entry under 2.7.9.

2.7.15DV DR Modification: Replace the second from last sentence of 2.7.15 with the following:

Requirements for EQUIPOTENTIAL BONDING can be found in the National Electrical Code (NEC), NFPA 70 for the installation of buildings.

2.13.11DV D2 Addition of Note 1 to entry:

A SMART ENABLED CONTROL is not limited solely to SMART GRID applications but also applies to applications where remote connectivity is present.

3DV DR Modification of Clause 3 by adding the following after "the appropriate part 2":

In addition, controls shall be constructed so as to be installable in accordance with the National Electrical Code, NFPA 70.

6.2.3DV DE Modification of 6.2.3 by adding the following text to the end of the note:

"(carry only), make only or break only."

6.2.5DV D2 Modification of 6.2.5 by adding the following text:

An INDEPENDENTLY mounted, in-line, or free standing CONTROL shall be rated in accordance with Annex DVB.

6.2.6DV D2 Modification of 6.2.6 by adding the following text:

An INDEPENDENTLY mounted, in-line, or free standing CONTROL shall be rated in accordance with Annex DVB.

6.4.3.13DV D1 Addition: Add the following to 6.4.3.13:

An action which is prevented from functioning automatically by a positive mechanical means (type 1.AY or type 2.AY)

6.5DV D2 Modification of 6.5 by adding the following text:

According to degrees of protection as indicated in the ENVIRONMENTAL protection enclosure requirements of UL 50 and UL 50E. Additional optional degrees of protection are permitted as shown in 6.5.1 and 6.5.2 or, for integrated or INCORPORATED CONTROLS, as otherwise declared.

6.13DV D2 Replace 6.13 with the following:

6.13DV.1 According to value of comparative tracking index (CTI) for the insulation material used

6.13DV.1.1 – material of material group IIIb with a CTI of 100 through 174 (CTI index 4);

6.13DV.1.2 – material of material group IIIa with a CTI of 175 through 249 (CTI index 3) or CTI of 250 through 399 (CTI index 2);

6.13DV.1.3 – material of material group II with a CTI of 400 through 599 (CTI index 1);

6.13DV.1.4 – material of material group I with a CTI of 600 or greater (CTI index 0).

7.2.9DV.1 D2 Modification of 7.2.9 by adding the following:

Alternating current (single phase).....  "or a.c."

7.2.9DV.2 D2 Modification of 7.2.9 by adding the following:

Direct current.....  "or d.c."

7.2.9DV.3 D2 Modification of 7.2.9 by adding the following:

Symbols for alternating current (single phase), alternating current (three phase), alternating current (three phase with neutral) and ambient temperature limits of SWITCH HEAD are not used in the USA.

7.2.9DV.4 D2 Modification of 7.2.9 by adding the following:

Letter type abbreviations (FLA for full load amperes, HP for horsepower) which clearly convey the assigned rating may be used.

7.2.9DV.5 D2 Modification of 7.2.9 by adding the following:

For independently-mounted, free standing and in-line controls, information regarding the connection of specific loads shall be on a wiring diagram or label attached to the control.

Table 1DV D2 Modification of Table 1 with the following eight national differences:

DV.1 Insert row 4A, with the first column being "4A", the second column being "Class 2 power source or circuit", the third column being "DVC.2", and the fourth column being "C".

DV.2 Modify the third column of row 17 by adding, "DVC.1.21".

DV.3 Modify row 89 by replacing “CISPR 11” with “FCC Part 15 and/or 18”.

DV.4 Replace note (f) with the following, “This note does not apply in the USA. Attachment or replacement of NON-DETACHABLE CORDS is not considered a USER function.”

DV.5 Replace note (b) with the following, “Motor load and PILOT DUTY load ratings are established as indicated in Annex DVB and DVC respectively, and marked accordingly.”

DV.6 Add the following four paragraphs to note (c):

Control enclosures shall be marked Deither using the IP system of marking or in accordance with the environmental enclosure requirements of UL 50E.

A control enclosure which has been evaluated against the ingress of water only by the Rain Test shall be marked RAINTIGHT if so constructed that exposure to beating rain will not result in the entrance of water; RAINPROOF if so constructed, protected, or treated as to prevent beating rain from interfering with successful OPERATION of the control.

Control enclosures are not required to be marked to indicate the degree of protection against the entrance of solid objects.

DV.7 Add the following paragraph to note (d):

A switch having one or more push-in (SCREWLESS) TERMINALS shall be marked:

- a) With instructions for connecting acceptably sized wire where readily visible during installation,
- b) With instructions for disconnecting a wire from the terminal where readily visible during wiring and rewiring,
- c) To specify use with “solid wire only” unless the terminal is intended for both solid and stranded wire, and
- d) With instruction to strip the insulation from conductors a specific length, where readily visible during installation.

DV.8 Insert row 2A, with the first column being “2A”, the second column being “Date code of manufacturing”, the third column being “DVC.2”, and the fourth column being “C.”

7.4.1DV D2 Addition: Add the following to 7.4.1:

Tests to determine the legibility and durability of markings placed on labels are in the Standard for Marking and Labeling Systems, UL 969. Markings, other than those placed on labels, are tested in accordance with Annex A.

7.4.6ADV D2 Addition: Add the following to 7.4.6:

See Annex DVC.

8.1.3DV D2 Modification of 8.1.3 by adding the following text:

Sealing compounds shall comply with the requirements of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

8.1.9.5DV D2 Modification of 8.1.9.5 by adding the following text:

The requirements of 8.1.9 to 8.1.9.5 inclusive are replaced by the requirements of Annex DVA.

8.3.2.4DV D2 Replacement: Replace 8.3.2.4 with the following:

The voltage between the pins of the plug shall not exceed 30 V.

9.1.1DV.1 D2 Addition:

A splice shall not be employed in a wire used for bonding purposes.

9.1.1DV.2 D2 Addition of 9.1.1DV.2.1 – 9.1.1DV.2.3:

9.1.1DV.2.1 Individually covered or insulated grounding conductors shall have a continuous outer finish that is either green, or green with one or more yellow stripes and no other conductors visible to the INSTALLER in a field wiring compartment shall be so identified.

9.1.1DV.2.2 Additional requirements related to Grounding and Bonding of electrical installations and systems are specified in Article 250 of the National Electrical Code (NEC), NFPA 70.

9.1.1DV.2.3 A PELV circuit supplied from a transformer where the supply system is less than 150 V to ground may be earthed for functional reasons, and are used in applications where SELV is not required. A PELV circuit that is supplied from a transformer where the supply system exceeds 150 V to ground, the PELV circuit shall be grounded.

9.1.2DV D2 Addition: Add the following to 9.1.2:

A grounding connection shall reliably penetrate a nonconductive coating, such as paint or vitreous enamel. Compliance is checked by the test of 9.3.1.

9.3.2DV D2 Modification of 9.3.2 by adding the following text after the notes:

Earthing terminals for the connection of NON-DETACHABLE CORDS using methods X and M shall comply with the requirements of 10.2.

9.3.4DV D2 Modification of 9.3.4 by adding the following text:

A FLYING LEAD for connection to an external earthing conductor shall have a free length of 6 inch (152 mm) and shall have the free end insulated – for example, shall have the end folded back and taped to the lead – unless the lead is located so that it cannot contact LIVE PARTS in the event that the lead is not used in the field. It shall be not smaller than the size specified in Table 9.3.4DV.1.

Table 9.3.4DV.1 D2 Addition:

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Table 9.3.4DV.1

Rating or setting of automatic overcurrent device in circuit ahead of equipment, conduit, etc, Not exceeding amperes	Size of conductor ¹⁾			
	Copper wire AWG	Aluminum wire AWG	Rigid conduit or Pipe, Inch	Electrical metallic tubing, Inches
20 ²⁾	12	10	1/2	1/2
30	10	8	1/2	1/2
40	10	8	1/2	1/2
60	10	8	1/2	1/2
100	8	6	1/2	1/2
200	6	4	1/2	1
¹⁾ Or equivalent cross-sectional area. ²⁾ For a cord-connected device, the grounding wire in the cord may be the same size as the current-carrying conductors.				

9.3.6.1DV D2 Addition: Add 9.3.6.1DV.1 and 9.3.6.1DV.2:

9.3.6.1DV.1 An equipment-grounding terminal or lead grounding point shall be connected to the frame or enclosure by a positive means, such as by a bolted or screwed connection.

9.3.6.1DV.2 A grounding point shall be located so that it is unlikely that the grounding means will be removed during normal servicing.

10.1.1DV D2 Addition of 10.1.1DV.1 and 10.1.1DV.2:

10.1.1DV.1 Terminals for fixed wiring shall comply with the requirements contained in the Standard for Terminal Blocks, UL 1059. Methods X and M are not used in the USA. The attachment of a power supply cord may be made by the methods specified for external, internal, or INTEGRATED CONDUCTORS.

10.1.1DV.2 Flat quick connect terminals may be employed for limited energy, safety extra low voltage circuits. Such connections shall:

- a) Have both engagement parts shipped with the control
- b) Have engagement parts provided with a means to permit interlocking
- c) Be accompanied by instructions for proper installation

10.1.4DV DR Replace Table 3 with the following text:

The nominal cross-sectional area of a conductor is related to the current being carried and shall be sized in accordance with Article 310 and Article 400 of the National Electrical Code, NFPA 70.

10.1.4.1DV D2 Deletion of Note 1.**10.1.8.2DV D2 Modification to 10.1.8.2:**

Terminals are fitted with conductors according to the use of the terminal and in accordance with Article 400 of the National Electrical Code, NFPA 70. The wires of **FIXED WIRING** conductors are straightened before inserting into the terminal.

10.1.14DV.1 D2 Addition of 10.1.14DV.1.1:

10.1.14DV.1.1 A terminal plate tapped for a wire binding screw shall have two or more full threads which may be extruded to provide two full threads.

11.1DV D2 Modification of 11.1 by adding the following text:

Requirements for insulating materials and polymeric enclosures are contained in Annex D and/or the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

11.1.3.1DV D2 Modification of 11.1.3.1 by adding the following text:

Individually covered or insulated grounding conductors shall have a continuous outer finish that is either green, or green with one or more yellow stripes.

11.1.3.2DV D2 Modification of 11.1.3.2 by adding the following text:

All individually covered or insulated conductors other than grounding conductors shall not use a continuous outer finish that is either green, or green with one or more yellow stripes.

11.2.3.3DV D2 Addition of 11.2.3.3DV.1 to 11.2.3.3DV.4:

11.2.3.3DV.1 A 18 AWG or 16 AWG (0,82 or 1,3 mm²) rubber-covered wire in other than a low-voltage circuit as described in 2.1.5 shall be at least Type RFH-1 with impregnated braid, for a potential of 300 V or less; and shall be at least Type RFH-2 with impregnated braid and shall be acceptable for the application for a potential of 301 – 600 V.

11.2.3.3DV.2 A 14 AWG (2,1 mm²) or larger conductor shall be Type TW, RH, or RHW wire.

11.2.3.3DV.3 Other types of conductors that have been found to be acceptable may also be employed; Type TF wire may be used wherever Type RFH-1 or RFH-2 wire is acceptable.

11.2.3.3DV.4 Tubing shall not be subjected to sharp bends, tension, compression, or repeated flexing, and shall not contact sharp edges, projections, or corners. Tubing may be used in dry or damp locations but is not acceptable in wet locations.

11.2.4DV D2 Modification of 11.2.4 by adding the following text:

The tests for insulating properties of a cord's sheath shall be in accordance with UL 62.

11.3.5.1DV D2 Modification of 11.3.5.1 by adding the following text after the note:

A component, such as a resistor, capacitor, diode, and the like, shall not be connected across the contacts of a safety CONTROL or a protective device unless it can be validated through a failure assessment that a single component fault will not result in a loss of protective function.

11.4.16DV D2 Addition:

A Type 1.A.Y or 2.A.Y action (OFF POSITION) shall be so designed that it provides a FULL DISCONNECTION that is prevented from reclosing automatically when in the OFF POSITION by positive mechanical means.

11.5DV D2 Addition of 11.5DV.1 to 11.5DV.3:

11.5DV.1 In-line cord, free-standing and INDEPENDENTLY MOUNTED CONTROLS shall meet the applicable requirements of Annex DVA.

11.5DV.2 A nonmetallic part such as a reset knob, lever, or button that protrudes through an opening in the enclosure that is not larger than 650 mm² (1 in²) in area shall be made of a material classified as 5VA, 5VB, V-0, V-1, or V-2 in accordance with UL 94.

11.5DV.3 A nonmetallic part that protrudes through an opening in the enclosure that is larger than 650 mm² (1 in²) in area shall be made of a material classified 5VA or 5VB and complies with the requirements for polymeric enclosures in this standard (see also Annex D).

11.6.3.2DV D2 Addition: Add the following to 11.6.3.2:

The special conduit box provided with the control shall comply with the appropriate requirements of the Standard for Enclosures for Electrical Equipment, UL 50 or UL 514 series.

11.6.3.4DV D2 Addition: Add the following to 11.6.3.4:

INDEPENDENTLY MOUNTED CONTROLS for surface mounting used with exposed wiring shall be provided with cable or conduit entries, knock-outs, or glands, which allow connection of the appropriate type of cable or conduit complying with the National Electrical Code (NEC), NFPA 70, and relevant UL standards.

11.7.2.1DV D2 Modification: Replace 11.7.2.1 with 11.7.2.1DV.1:

11.7.2.1DV.1 Polymeric strain relief used in controls other than integrated and incorporated, intended to be connected by means of a NON-DETACHABLE CORD, shall comply with the requirements of the Standard for Insulating Bushings, UL 635 and be suitable for the application with respect to the hole size and shape, maximum use temperature and wire size/type. To ensure that the hole size and shape is suitable for the bushing, the test noted in 11.7.2.11DV shall be conducted.

11.7.2.11DV D2 Modification to replace 11.7.2.11 with the following text:

For mains connected devices, including I/O ports, a strain-relief device shall withstand without damage to the cord or conductors and without displacement a direct pull of 35 pounds (156 N) applied to the cord for 1 minute. Supply connections within the equipment are to be disconnected from terminals or splices during the test. For *SELV* or *PELV* powered devices, including I/O ports employing a flexible output cord, or a multi-conductor cord where the interconnection of outputs does not exceed 30 Vrms or 42.4 V pk, a 89 N (20 pounds-force) is to be applied to the cord and supported by the unit so that the strain relief means is stressed from the most severe angle that the construction of the unit permits. For units employing output wiring consisting of separate leads, a 44 N (10 pounds-force) is to be applied to each lead.

11.7.2.12DV D2 Addition: Add the following to 11.7.2.12:

In the USA, the torque test is not applicable.

11.8.2DV DR Modification of 11.8.2 by adding the following text:

Cord conductors shall comply with the size requirements in the National Electrical Code, ANSI/NFPA 70.

11.9DV D2 Addition of 11.9DV.1:**11.9DV.1 Independently mounted**

11.9DV.1.1 *CONTROLS* intended to be permanently connected to *FIXED WIRING* shall allow the connection of the supply wires after the control has been fixed to its support, and shall be provided with:

- a) A set of terminals allowing the connection of cables for *FIXED WIRING* of the nominal cross-sectional areas specified in Clause 10 or
- b) A set of supply leads accommodated in a suitable compartment and
- c) Cable entries, conduit entries, knockouts or glands which allow the connection of the appropriate types of cable or conduit.
- d) Such a *CONTROL* may be provided with a plug and flexible cord if the following conditions are met:
 - 1) The cord connection of the equipment facilitates frequent interchange,
 - 2) Reduction of the *TRANSMISSION* of noise or vibration is accomplished, or
 - 3) The fastening means or mechanical connections are intended to permit removal for maintenance and repair.

11.9.4DV D2 Addition:

A soft-rubber bushing shall not be less than 3/64 inch (1,2 mm) thick and shall be located so that it will not be exposed to oil, grease, oily vapor, or other substance having a deleterious effect on rubber.

11.9.5DV.1 DE Modification of 11.9.5:

Replace "cable or cord" to "or EXTERNAL CONDUCTOR".

11.9.5DV.2 D2 Modification of 11.9.5 by adding the following text:

A terminal box or compartment on equipment that is to be permanently connected electrically shall be located so that wire connections therein will be accessible for inspection, without disturbing either line-voltage or safety-circuit wiring after the equipment is installed in the intended manner. However, wire connections to equipment intended to be mounted on an outlet box may be accessible upon removal of the equipment from the box. A device which is acceptable for use with a fitting for only one type of wiring system shall be supplied with such a fitting.

11.10.3DV D2 Addition of the following text:

CONTROLS designed for fixed socket-outlets as shown in Figure 31DV shall have a weight of 0,79 kg or less and the design shall be suitable for the application. The maximum acceptable moment, center of gravity and dimensions of the CONTROL shall be within the limits given in Figure 31DV for plug-in TIME SWITCHES featuring two or three integral blades or pins.

11.11.1.2DV D2 Modification of 11.11.1.2 by adding 11.11.1.2DV.1 and 11.11.1.2DV.2 after the notes:

11.11.1.2DV.1 A polymeric COVER attached by screws shall comply with the requirements of 11.11.1 with the screws loosened one full turn.

11.11.1.2DV.2 Devices that allow user removal or replacement of button/coin cells shall comply with the requirements of 5.2 – 5.6 of UL 4200A. Devices with button/coin cells that are not intended to allow user removal/replacement of the cells shall comply with 5.7 of UL 4200A.

11.11.1.3DV D2 Addition: Add 11.11.1.3DV.1 – 11.11.1.3DV.4 to 11.11.1.3:

11.11.1.3DV.1 An enclosure COVER shall be hinged if it gives access to fuses, thermal cutouts, or any other overload-protective device, the functioning of which requires renewal, or if it is necessary to open the COVER in connection with normal OPERATION of the device.

11.11.1.3DV.2 A COVER hinged to comply with 11.11.1.3DV.3 and 11.11.1.3DV.4, shall not depend solely upon screws or other similar means requiring the use of a TOOL to hold it closed, but shall be provided with a spring latch or catch.

11.11.1.3DV.3 A door or cover giving access to a fuse or thermal cutout in other than a low-voltage circuit shall:

- a) Shut closely against a 1/4 inch rabbet or the equivalent,
- b) Have turned flanges for the full length of four edges, or
- c) Have angle strips fastened to it.

11.11.1.3DV.4 A strip used to provide a rabbet and an angle strip fastened to the edges of a door shall be secured at not less than two points, not more than 1-1/2 inch (38,1 mm) from each end of each strip and at points between these end fastenings not more than 6 inch (152,4 mm) apart.

11.11.1.4DV D2 Addition: *Add 11.11.1.4DV.1 – 11.11.1.4DV.3:*

11.11.1.4DV.1 Glass covering an observation opening shall be reliably secured in place so that it cannot be readily displaced in service and shall provide mechanical protection for the enclosed parts.

11.11.1.4DV.2 Glass for an opening not more than 4 inches (102 mm) in any dimension shall not be less than 1/16 inch (1.6 mm) thick, and glass for a larger opening, but not more than 144 inches² (929 cm²) in area and having no dimension greater than 12 inches (305 mm), shall not be less than 1/8 inch (3.2 mm) thick. Glass that covers a larger area shall not be less than 1/8 inch thick and shall conform to one of the following:

- a) The glass shall be of a nonshattering or tempered type that, when broken, shall conform to the performance specifications in the Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings, ANSI Z97.1-1984; or
- b) Shall withstand a 2-1/2 foot-pound (2.41 J) impact from a 2-inch (50.8-mm) diameter, 1.18 pound (535 g) steel sphere without cracking or breaking to the extent that a piece is released or dropped from its intended position.

11.11.1.4DV.3 A transparent material other than glass employed as a covering over an opening in an enclosure shall be investigated to determine if it has adequate mechanical strength and is otherwise acceptable for the purpose. Compliance is checked by the applicable requirements and tests of Annex D.

11.13.1DV D2 Addition: *Add the following:*

11.13.1DV.1 If an electronic circuit/component is relied upon to prevent a hazard under normal or abnormal operation of the product, that electronic circuit/component is considered to be providing a protective function. Such components/circuits shall comply with the relevant requirements for PROTECTIVE CONTROLS unless it can be shown through a FAULT assessment and tests of Clause 27 that FAILURE or malfunction of the protective circuit/component will not lead to a hazardous condition of the CONTROL i.e., loss of the protective function.

NOTE Examples of such circuits could be zero cross circuits, power regulation circuits, overcurrent protection etc.

12.1.1DV D2 Modification of 12.1.1 by adding the following text:

Alternatively, CONTROLS classified as having protection against ingress of water and dust shall be evaluated to the applicable environmental enclosure requirements of UL 50.

12.1.6DV D2 Modification of 12.1.6 by adding the following text after the note:

Gaskets and seals that are relied upon to prevent ingress of water and dust shall comply with the requirements of Standard for Gaskets and Seals, UL 157.

12.1.6.3DV D2 Addition of the following paragraphs:

12.1.6.3DV.1 The gasket and seals material shall have physical properties as specified in Table 12.1DV.1 before and after aging under the conditions specified in Table 12.1DV.2.

Table 12.1DV.1
Physical properties for gaskets

	Neoprene or rubber compound		Polyvinyl chloride materials	
	Before test	After test	Before test	After test
Recovery – Maximum set when 1-inch (25.4-mm) gage marks are stretched to 2-1/2 inches (63.5 mm) held for 2 minutes and measured 2 minutes after release	1/4 inch (6.4 mm)	–	Not specified	
Elongation – Minimum increase in distance between 1-inch gage marks at break	250 percent, 1 – 3-1/2 inches (25.4 – 88.9 mm)	65 percent of original	250 percent, 1 – 3-1/2 inches	75 percent of original
Tensile Strength – Minimum force at breaking point	850 psi (5.9 MPa)	75 percent of original	1200 psi (8.3 MPa)	90 percent of original

Table 12.1DV.2
Aging conditions

Measured temperature rise		Material	Test program
°C	°F		
35	63	Rubber or neoprene	Air oven aging for 70 hours at 100.0°C ± 2.0°C (212.0°C ± 3.6°F)
35	63	Thermoplastic	Aged in full-draft, air-circulating oven for 168 hours at 87.0 ± 1.0°C (188.6 ± 1.8°F)
50	90	Rubber or neoprene	Air oven aging for 168 hours at 100.0°C ± 2.0°C (212.0°F ± 3.6°F)
50	90	Thermoplastic	Aged in full-draft, air-circulating oven for 240 hours at 100.0 ± 1.0°C (212.0 ± 1.0°F)
55	99	Rubber, neoprene or thermoplastic	Aged in full-draft, air-circulating oven for 168 hours at 113.0 ± 1.0°C (235.4 ± 1.8°F)
65	117	Rubber or neoprene	Aged in full-draft, air-circulating oven for 240 hours at 121.0 ± 1.0°C (249.8 ± 1.8°F)
65	117	Thermoplastic	Aged in full-draft, air-circulating oven for 168 hours at 121.0 ± 1.0°C (249.8 ± 1.8°F) for 1440 hours at 97.0 ± 1.0°C (206.6 ± 1.8°F)
80	144	Rubber, neoprene or thermoplastic	Aged in full-draft, air-circulating oven for 168 hours at 136.0 ± 1.0°C (276.8 ± 1.8°F)

12.1.6.3DV.2 Compliance is checked by INSPECTION. The material shall show no signs of deformation, melt or deterioration to a degree that will affect its sealing properties.