



National Differences For

Household And Similar Electrical Appliances – Safety – Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers

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National Differences For

Household And Similar Electrical Appliances – Safety – Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers

Second Edition

Edition Date: September 15, 2017

This Second edition of UL 60335-2-40 is being adopted as an ANSI standard.

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

1DV.1 DR Modification of the second paragraph of Clause 1 as follows:

Change “250 V” to “300 V” and add the following sentence to the end of the second paragraph “Partial units are within the scope of this Standard.”

1DV.2 D1 Modification of the 2nd paragraph of Clause 1 as follows:

Change “600 V” to “15 000 V”.

1DV.3 DE Add the following note:

Note 102A: Class A2 includes class A2L.

1DV.4 DR Modification of the eighth paragraph of Clause 1 as follows:

Replace “ISO 5149” with ANSI/ASHRAE 15 Safety Standard for Refrigeration Systems (USA) and CSA B52 Mechanical Refrigeration Code (Canada).

2DV DR Modification of Clause 2 to add the following references:

CSA/UL 60335-1

Safety of Household and Similar Appliances – Part 1: General Requirements

ANSI/ASHRAE 15

Safety Standard for Refrigeration Systems

ANSI/NFPA 70

National Electrical Code

ANSI/NFPA 90A

Standard for the Installation of Air-Conditioning and Ventilating Systems

ANSI/NFPA 90B

Standard for the Installation of Warm Air Heating and Air-Conditioning Systems

ASME VIII

Unfired Pressure Vessel Code

ASTM B344

Standard Specification for Drawn or Rolled Nickel-Chromium and Nickel-Chromium-Iron Alloys for Electrical Heating Elements

CAN/ULC-S102

Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

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CSA B52***Mechanical Refrigeration Code*****CSA C22.1*****Canadian Electrical Code, Part I*****CAN/CSA-C22.2 No. 0*****General Requirements – Canadian Electrical Code, Part II*****CSA-C22.2 No. 0.3*****Test methods for electrical wires and cables*****CAN/CSA-C22.2 No. 0.17*****Evaluation of properties of polymeric materials*****CSA-C22.2 No. 100*****Motors and generators*****CSA-C22.2 No. 197*****PVC insulating tape*****CAN/CSA-C22.2 No. 198.1*****Extruded insulating tubing*****CSA-C22.2 No. 253*****Medium-voltage ac contactors, controllers, and control centres*****CSA-C22.2 No. 274*****Adjustable speed drives*****CAN/CSA-C22.2 No. 60335-2-34*****Safety of household and similar electrical appliances – Part 2-34: Particular requirements for motor-compressors*****IEC 60335-2-34,*****Household and similar electrical appliances – Safety – Part 2-34: Particular requirements for motor-compressors*****IEC 60695-11-20,*****Fire hazard testing – Part 11-20: Test flames – 500 W flame test methods*****ISO 4126-1*****Safety devices for protection against excessive pressure – Part 1: Safety valves*****ISO 4126-2*****Safety devices for protection against excessive pressure – Part 2: Bursting disc safety devices*****ISO 4892-2*****Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps***

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UL 94

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

UL 224

Standard for Extruded Insulating Tubing

UL 347

Standard for Medium-Voltage AC Contactors, Controllers, and Control Centers

UL 510

Standard for Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

UL 723

Standard for Test for Surface Burning Characteristics of Building Materials

UL 1004-9

Standard for Form Wound and Medium Voltage Rotating Electrical Machines

UL 1441

Standard for Coated electrical sleeving

UL 1581

Reference Standard for Electrical Wires, Cables, and Flexible Cords

UL 1694

Standard for Tests for Flammability of Small Polymeric Component Materials

UL 60730-2-6

Automatic Electrical Controls – Part 2-6: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements

UL 60730-2-9

Standard for Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls

UL 61800-5-1

Standard for Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy

3.127DV D1 Modification by replacing Clause 3.127 with the following:

FACTORY SEALED APPLIANCE

appliance in which all refrigerating system parts have been sealed tight by welding, brazing or a similar permanent connection during the manufacturing process and does not include service ports.

3.129DV DE Add the following definitions, 3.129DV – 3.136DV to Clause 3 of this Part 2:

3.129DV AFCI (ARC FAULT CIRCUIT INTERRUPTER): a device intended to mitigate the effects of arcing faults by functioning to de-energize the circuit where an arc fault is detected.

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3.130DV LCDI (LEAKAGE CURRENT DETECTION INTERRUPTER): a device provided in a power supply cord that senses leakage current flowing between or from the integral cord conductors and interrupts the circuit at a predetermined level of leakage current.

3.131DV HYDRONIC FAN COILS: a fan coil unit that uses water which does not exceed 93°C as the heat exchange fluid. The fan coil unit may be used for both heating and/or cooling.

3.132DV ADD ON HEAT PUMP: a heat pump that normally consists of an outdoor section, one or more indoor sections (without circulating fan), and related control devices.

3.133DV EXTRA HARD USAGE CORD: a cord intended for use with heavy equipment, classified as the highest grade in mechanical serviceability.

3.134DV HARD USAGE CORD: a cord intended for use with moderately heavy equipment, classified as the medium grade in mechanical serviceability.

3.135DV TAPPED CONTROL CIRCUIT: a tapped control circuit is one that is tapped within the equipment from the load side of the overcurrent device for the controlled load.

3.136DV IGNITION SOURCE: a current carrying device, or portion of a current carrying device, that can be the source of arcing or hot wire glowing.

3.137DV D2 Add the following definition and Note to Clause 3 of this Part 2:

DIRECT RELEASABLE SYSTEM: system with one degree of separation from a space.

Note 1 to Entry: For the purpose of this standard, direct and indirect systems are defined with respect to the potential to leak refrigerant into a space.

3.138DV D2 Add the following definition to Clause 3 of this Part 2:

DIRECT SYSTEM: a direct releasable system in which a single rupture of the refrigerant circuit results in a refrigerant release to a space, irrespective of the location of the refrigerant circuit.

3.139DV D2 Add the following definition and Note to Clause 3 of this Part 2:

INDIRECT SYSTEM: system with more than one degree of separation from the space.

Note 1 to Entry: For the purpose of this standard, direct and indirect systems are defined with respect to the potential to leak refrigerant into a space.

3.149DV D1 Add the following definition to Clause 3 of this Part 2:

ELECTRICAL CONNECTION: the physical interface between two points in a circuit such as spade terminals, pin terminals, micro switch contacts, relay contacts, timer contacts, crimped connections, and connections that are welded or soldered.

5.2DV D2 Modification of Clause 5.2 in the Part 1 by adding the following:

Tests of Clause 15 may be conducted on a separate sample.

5.3DV D2 Modification of Clause 5.3 in the Part 1 by addition of the following:

The test of Clauses 19.101 through 19.105DV may be run in any sequence within Clause 19.

5.7.1ADV D1 Add Clause 5.7.1ADV.1 to the Part 2:

5.7.1ADV.1 See normative Annex 101.DVA for the minimum test conditions.

5.10DV D2 Modification by replacing the second sentence of Clause 5.10 of this Part 2 with the following:

The line length shall be not less than 5 m but may be greater than 7.5 m.

7.1DV.1 DR Modification of Clause 7.1 to add the following dashed items after the first dashed item after “Addition:”

– Motor ratings (FLA, Horsepower)

For motors controlled by adjustable speed drive, FLA shall be replaced with either the motor's MOC or the rated input current of the power conversion equipment. When there is bypass utilized, it shall be the larger of the motor's MOC, the rated input current to the power conversion equipment or the full load amperes of the motor.

– Total input current (cord connected units)

– Minimum circuit ampacity (MCA) (permanently connected equipment only)

– Motor compressor ratings (RLA and LRA)

For motor-compressors controlled by adjustable speed drive, (RLA and LRA) shall be replaced with the rated input current of the power conversion equipment.

– Rating of over current protective device (permanently connected equipment only)

– Branch circuit selection current (BCSC) (if RLA exceeds 64% of MCC)

– Manufacturing date or date code and location if the product is produced in more than one location

7.1DV.2 DE Modification by adding the following note to Clause 7.1:

Note 1DV In Canada, the equivalent French wording for the warning is as follows:

AVERTISSEMENT

L'appareil doit être installé, utilisé et entreposé dans un endroit dont la superficie du plancher est supérieure à «X» m² (applicable uniquement aux appareils qui ne sont pas fixes)

7.1DV.3 D1 Modification of Clause 7.1 by adding the following to the seventh paragraph, regarding minimum room size X:

The X in the marking shall not be required if the refrigerant charge of the appliance is less than or equal to m_1 according to Annex GG.1.1.

7.1ADV D1 Addition of the following clauses to Clause 7 of this Part 2:

7.1ADV.1 If the refrigerant is flammable the air conditioning equipment shall have red, Pantone® Matching System (PMS) #185 marked service ports, pipes, hoses, and other devices through which the refrigerant is serviced. This colour shall be present at all service ports and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes). The colour mark shall extend at least 25 mm (1 inch) from the refrigerant servicing point and shall be replaced if removed.

7.1ADV.2 If refrigerant is flammable, the markings specified in Clauses 7.1ADV.3 to 7.1ADV.5 in letters at least 6.35 mm (0.25 in) high shall be permanently affixed to the equipment in the location indicated.

7.1ADV.3 The following markings, or the equivalent, shall be located on the outside of the product when flammable refrigerants are employed:

- “DANGER – Risk Of Fire Or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”
- “CAUTION – Risk Of Fire Or Explosion. Dispose Of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”

Note In Canada, the equivalent French wording for the markings is as follows:

- “DANGER – Risque d’incendie ou d’explosion. Contient un frigorigène inflammable. Confier la réparation à une personne qualifiée. Ne pas perforer la tubulure contenant le frigorigène.”
- “ATTENTION – Risque d’incendie ou d’explosion. Mettre au rebut conformément aux règlements fédéraux ou locaux. Contient un frigorigène inflammable.”

7.1ADV.4 The following markings, or the equivalent, shall be located inside of the product near the compressor when flammable refrigerants are employed.

- “CAUTION – Risk Of Fire Or Explosion. Flammable Refrigerant Used. Consult Repair Manual/Owner’s Guide Before Attempting To Service This Product. All Safety Precautions Must Be Followed”

Note In Canada, the equivalent French wording for the marking is as follows:

- “ATTENTION – Risque d’incendie ou d’explosion. Contient un frigorigène inflammable. Consulter la notice de réparation/utilisation avant de tenter de réparer ce produit. Respecter toutes les mesures de sécurité.”

7.1ADV.5 The shipping carton of an air conditioner that employs a flammable refrigerant shall be marked with the following or equivalent:

- “Caution – Risk of Fire or Explosion due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations.”

Note In Canada, the equivalent French wording for the marking is as follows:

- ATTENTION – Risque d’incendie ou d’explosion en raison du frigorigène inflammable. Respecter le mode d’emploi pour assurer la conformité aux règlements nationaux.

7.6DV DE *Modification by adding the following note to Clause 7.6:*

Note 1DV In Canada, the equivalent French wording for warning symbol W021 of ISO 7010 is “Avertissement : risque d’incendie/matériaux inflammables”.

7.103DV DR *Add the following to Clause 7 of the Part 2:*

Cord-connected appliances shall be marked with the following:

- Statement requiring that a damaged cord be replaced with one supplied by the unit manufacture and not repaired.

9DV DR *Modification of Clause 9 of the Part 2 to replace it with the following:*

Clause 9DV of Part 1 is applicable.

11.2.1DV.1 DE *Modification of 11.2.1 to add a Note as follows:*

Note 1 For horizontal ducted products, reference Figure 101b, rotated 90 degrees counter clockwise.

11.2.1DV.2 D2 *Modification of Clause 11.2.1 in this Part 2 by addition of the following:*

For the test of Clause 11 and Clause 19, the distance from the air outlet opening of the appliance to the furthest point on the test duct, perpendicular to the outlet opening, shall be no more than value of:

- *For upflow appliances $(AB)^{1/2}$ as shown in Figure 101a or the minimum distance specified by the manufacturer, whichever is lower.*
- *For downflow appliances $[300 + (AB)^{1/2}]$ as shown in Figure 101b or the minimum distance specified by the manufacturer, whichever is lower.*

Note 2 Appliances, may be specified by the manufacturer for use in applications with limited space for the appliance and connected ducts. Examples:

- For upflow appliances intended for use in manufactured (mobile) homes, the combined height of the appliance and ducts are typically limited to 2.1m (7 ft) minus the specified clearance to combustible material.
- For downflow appliances intended for use in manufactured (mobile) homes, the distance from the air outlet opening to the furthest point on the test duct, perpendicular to the outlet opening is typically reduced to not less than $[25.4 + (AB)^{1/2}]$.

11.3DV D2 Modification of Note 101 by adding at the end of Note 101 the following:

Larger diameter thermocouples may be used if there is minimum effect on the temperature of the part under test.

11.4DV D2 Modification by deletion of the last sentence of Clause 11.4 of this Part 2.**11.5DV D2 Modification of Clause 11.5 of this Part 2:**

The second paragraph of Clause 11.5 does not apply.

Table 3DV D2 Modification of Table 3 of the Part 2 as follows:

Change maximum temperature for "Material used as insulation, other than that specified for wires and windings: impregnated or varnished textile, paper or press-board" from "95°C" to "90°C"

Change maximum temperature for "– polytetrafluoroethylene" from "290°C" to "205°C"

Replace footnote a) of Table 3 with the following:

^a Not required for motor-compressors that comply with Annex AA of IEC 60335-2-34.

Add the following to Table 3:

Table 3DV – Temperature limits

<i>Parts</i>	<i>Temperature °C</i>
<i>Surfaces of product, discharge plenum, and duct at points of specified zero clearance to test enclosure</i>	92
<i>Surfaces of test enclosure where clearance more than zero to combustible material is specified</i>	92

11.8DV D2 Add the following note to Clause 11.8 of the Part 2 as follows:

Note 103DV A maximum temperature for RTV silicon rubber is 130°C.

13.1DV D2 Modification of Clause 13.1 by addition to the Part 1:

For appliance with supplementary heat or provisions for supplementary heat tested per Clause 19.2, the leakage and dielectric test of Clause 13 of the Part 2 shall be conducted following completion of the tests of Clause 19.

13.2DV D1 Modification of Clause 13.2 of the Part 2 to add the following:

The IEC Part 2 Modification does not apply.

13.2ADV D1 Add the following clause to Clause 13 of this Part 2:

For appliances rated greater than 600 V, leakage currents do not apply. The electrical strength test may be completed after testing as required by Clause 15. Electrical strength tests shall be conducted in accordance with Annex 101.DVH.

16.2DV D1 Modification of Clause 16.2 of the Part 2 to add the following:

The IEC Part 2 Modification does not apply.

16.2ADV D1 Add the following clause to Clause 16 of this Part 2:

For appliances rated greater than 600 V, leakage currents do not apply. Electrical strength tests shall be conducted in accordance with Annex 101.DVH.

19.1DV.1 D1 Modification by replacement of the last paragraph of Clause 19.1 of this Part 2 with the following:

Appliances are additionally subjected to the tests specified in Clauses 19.104 and 19.105DV as applicable.

19.1DV.2 D2 Modification of Clause 19.1 of this Part 2 by addition:

Appliances with supplementary heaters or provision for supplementary heaters shall be configured with inlet and outlet ducts and instrumented in accordance with the applicable clauses of Clause 11.

For appliances with supplementary heaters or provision for supplementary heaters capable of operation with simultaneous supplementary heat and refrigerant heat, the refrigerant heat may be simulated by use of an alternate heating source equal or greater than the heat pump's capacity when operated under the conditions of Clause 11. This capacity shall be maintained throughout the test of Clause 19. If at any condition during the tests of Clause 19, the refrigerant heat would be interrupted by protective control, the alternate heat source shall be interrupted at that point in the test and the test continued.

19.2DV D2 Modification of Clause 19.2 of this Part 2 by replacing with 19.2DV.1 – 19.2DV.4:

19.2DV.1 All ducted appliances provided with SUPPLEMENTARY HEATERS are subjected to the following test under the conditions specified in Clause 11. Appliances are operated at RATED VOLTAGE or at the upper limit of the RATED VOLTAGE RANGE of the SUPPLEMENTARY HEATERS.

19.2DV.2 (Limit Cut-out) After the airflow conditions specified are established, the airflow is then restricted at a rate of 1°K/min outlet air temperature rise until a self-resetting thermal cut-out device operates for the first time as a result of slowly restricting the free area of the inlet.

The restriction shall be halted after any protective device operates until steady state conditions are established. After steady state conditions are reached the restriction is resumed. The test shall continue until the last self-resetting thermal cut-out operates.

The outlet air temperature shall not exceed 93°C.

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19.2DV.3 (Heating Op) After the airflow conditions specified are established, the indoor airflow is restricted to such an extent that the temperature of the air in the outlet, measured by means of the thermocouple grid (see Clause 11.3), is 3 K below the temperature obtained after a self-resetting thermal cut-out device operated for the first time as a result of slowly restricting the free area of the inlet.

The appliance shall be operate until steady state conditions are established or for 1 h, whichever is longer. During the test, the temperatures are monitored continuously and shall not exceed the values shown in Table 3.

To facilitate this test, the self-resetting thermal cut-out which has operated in Clause 19.2DV.2 may be short-circuited, if necessary.

19.2DV.4 (Restricted Inlet) After the airflow conditions specified are established, the airflow is restricted at a rate of 1°K/min outlet air temperature rise until a self-resetting thermal cut-out device operates as a result of slowly restricting the free area of the inlet.

The restriction shall be halted after any protective device operates until steady state conditions are established. After steady state conditions are reached the restriction is resumed. The test shall continue until the outlet is fully restricted.

The temperatures are monitored continuously. Temperatures shall not exceed the values shown in (Table 3 + 30°C) during the first hour and Table 3 thereafter.

Note: Tests of Clause 19.2DV.4 may be conducted immediately after the tests of Clause 19.2DV.2.

19.4DV D2 Modification by addition of a note to Clause 19.4 of this Part 2:

Note: For appliances with supplementary heat, the test of Clauses 19.2 (limit cut-out, heating operation and restricted inlet), 19.101 (fan failure), 19.101DV.2 (blocked outlet), 19.104 (curtain drape) and 19.105DV (back up protection) address the fault conditions as indicated in parenthesis. There may be other forms of operation or defects that could result in a hazardous condition that need to be address which may or may not be related to supplementary heat.

19.13DV D2 Modification to add the following to Table 9 in the Part 1:

Parts	Temperature Rise – °K
Surfaces of product, discharge plenum, and duct at points of specified zero clearance to test enclosure	100
Surfaces of test enclosure where clearance more than zero to combustible material is specified	100

19.14DV D1 Modification of Clause 19.14 to add the following:

Contacts tested for 100K cycles are considered to meet the intent of Clause 19.14 and only one set of contacts shall be required.

19.101DV.1 D2 Modification of Clause 19.101 by modification of the first paragraph and addition of a note and compliance statement at the end of the clause:

In appliances in which the compressor is enclosed within an enclosure which may be inadequately ventilated to prevent temperatures of the enclosure or components within the enclosure from becoming a hazard upon loss of refrigerant flow, the refrigerant flow shall be reduced by removal of the refrigerant from the system.

The test shall be conducted under each of the following conditions:

- with 75% of the charge removed
- with the system pressure less than 1.2 atm, but not less than 1.0 atm with the appliance de-energized

The appliance shall be operated under the conditions of Clause 11 at the lower limit of the rated voltage and an ambient temperature of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. The appliance shall be operated until all components and the enclosure temperatures stabilize or are declining, but for not less than 24 hours, or until the operation of the compressor is terminated by a non-self-resetting protective device. Any self-resetting protective devices that actuates during this test shall be allowed to cycle as intended.

Component temperatures shall:

- not exceed the temperature limits in Clause 11
- not exceed the relative thermal index of the material in accordance with UL 746B and CAN/CSA C22.2 No. 0.17 for polymeric materials.

Note There are a number of solutions which can be effective in meeting the test criteria. For example,

- a) thermal based solutions such as electronic devices like HDCI and others and electromechanical devices like bi-metal snap disc and similar thermal based devices, or
- b) refrigerant pressure sensitive devices.

Compliance is checked by inspection, and in case of doubt, the test shall be conducted.

19.101DV.2 D1 Modification by addition to Clause 19.101 of this Part 2:

(Blocked Outlet) The appliance is operated under the conditions in Clause 11 at RATED VOLTAGE or at the upper limit of the RATED VOLTAGE RANGE, at an ambient temperature of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

When steady conditions are attained, the appliance outlet air opening is totally closed off and operation continued until maximum temperatures are determined.

This test with the outlet air opening closed shall not be conducted on any unit without a duct system (free air discharge) with any air discharge openings located more than 1.22 m (4 ft) above the floor level when the unit is installed as intended.