



UL 60335-2-40

STANDARD FOR SAFETY

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

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UL Standard for Safety for Household And Similar Electrical Appliances – Safety – Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers, UL 60335-2-40

Second Edition, Dated September 15, 2017

Summary of Topics

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

The new requirements are substantially in accordance with Proposal(s) on this subject dated September 16, 2016 and May 26, 2017.

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CSA Group
CAN/CSA-C22.2 No. 60335-2-40:17
Second Edition
(IEC 60335-2-40:2013, MOD)



Underwriters Laboratories Inc.
UL 60335-2-40
Second Edition

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

September 15, 2017

This national standard is based on publication IEC 60335-2-40, Fifth Edition (2013).



ANSI/UL 60335-2-40-2017

Approved by



Standards Council of Canada
Conseil canadien des normes



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This ANSI/UL Standard for Safety consists of the Second Edition. The most recent designation of ANSI/UL 60335-2-40 as an American National Standard (ANSI) occurred on September 15, 2017. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

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PREFACE

This is the harmonized CSA Group and UL standard for particular requirements for electrical heat pumps, air-conditioners and dehumidifiers. It is the second edition of CAN/CSA-C22.2 No. 60335-2-40, and the second edition of UL 60335-2-40. This edition of CAN/CSA-C22.2 No. 60335-2-40 supersedes the previous edition published on November 30, 2012, and it also replaces CSA C22.2 No. 117-1970, Room Air Conditioners; CSA C22.2 No. 92-15, Dehumidifiers; and CSA C22.2 No. 236-15, Heating and Cooling Equipment. This edition of UL 60335-2-40 supersedes the previous edition published on November 30, 2012.

The major differences between this edition and the previous edition include the following:

- a) The realignment of the second edition of CSA/UL 60335-2-40 with the current edition of IEC 60335-2-40, and the expanded scope to cover requirements for high voltage, 601 V to 15 000 V.
- b) The addition of requirements for pressure vessels, dehumidifiers, flammable refrigerants, transcritical CO₂, contactor reliability, partial units, all-pole-disconnected electric heaters, nichrome wire, and polymeric materials.

This harmonized standard is based on IEC Publication 60335-2-40: Edition 5.0, *Household and Similar Electrical Appliances -- Safety -- Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers*, issued December 2013. IEC 60335-2-40 is copyrighted by the IEC.

At the time of publication, IEC 60335-2-40:2013 is available from IEC in English only. CSA Group will publish the French version when it becomes available from IEC.

In Canada, for general requirements on the standards of the Canadian Electrical Code, Part II, see CAN/CSA-C22.2 No. 0.

This harmonized standard was prepared by CSA Group and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Subcommittee on Air-Conditioning and Refrigeration (THSC 61D WG10) of the Council on the Harmonization of Electrotechnical Standards of the Nations of the Americas (CANENA) are gratefully acknowledged.

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

This standard was reviewed by the CSA Subcommittee on Appliances for Air-Conditioning for Household and Similar Purposes, under the jurisdiction of the CSA Technical Committee on Consumer and Commercial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee. This Standard was also reviewed and approved by UL's Standards Technical Panel for Heating and Cooling Equipment – Heat Pumps, Air-Conditioners and Dehumidifiers, STP 60335-2-40.

This standard has been approved as a National Standard of Canada by the Standards Council of Canada (SCC).

This standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

Application of Standard

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

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

CAN/CSA-C22.2 No. 60335-2-40 is to be used in conjunction with the second edition of CAN/CSA-C22.2 No. 60335-1:16. The requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers are contained in this Part 2 Standard and CAN/CSA-C22.2 No. 60335-1:16. Requirements of this Part 2 Standard, where stated, amend the requirements of CAN/CSA-C22.2 No. 60335-1:16. Where a particular subclause of CAN/CSA-C22.2 No. 60335-1:16 is not mentioned in CAN/CSA-C22.2 No. 60335-2-40, the CAN/CSA-C22.2 No. 60335-1:16 subclause applies.

UL 60335-2-40 is to be used in conjunction with the sixth edition of UL 60335-1. The requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers are contained in this Part 2 Standard and UL 60335-1. Requirements of this Part 2 Standard, where stated, amend the requirements of UL 60335-1. Where a particular subclause of UL 60335-1 is not mentioned in UL 60335-2-40, the UL 60335-1 subclause applies.

Level of Harmonization

This standard adopts the IEC text with national differences. This standard is published as an equivalent standard for CSA and UL.

An equivalent standard is a standard that is substantially the same in technical content, except as follows:

- a) Technical national differences are allowed for national differences resulting from conflicts in codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate.
- b) Presentation is word for word except for editorial changes that do not alter the technical content of the standard. Examples of editorial changes include:
 - 1) different font sizes, figure sizes, and table sizes;
 - 2) minor variations in format, such as indentation and pagination;
 - 3) font appearance (including the use of italic or bold text or uppercase or lowercase letters);
 - 4) the use of a symbol (e.g., A or %) rather than the word (Ampere or percent), or the word rather than the symbol;
 - 5) inclusion of inch-pound units for informational purposes;
 - 6) corrections of misprints or typographical errors;
 - 7) bilingual column headings or figure captions on a common table or figure in a bilingual edition;

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- 8) change from first-angle to third-angle drawing;
- 9) addition of a statement: "This is a first-angle drawing"; and
- 10) substitution of a point (.) for a comma (,) as the decimal marker.

All national differences from the IEC text are included in the CSA Group and UL versions of the standard. While the technical content is the same in each organization's version, the format and presentation may differ.

Reasons for Differences From IEC

Differences from the IEC are being added in order to address safety and regulatory situations present in the US and Canada.

Interpretations

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

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NATIONAL DIFFERENCES

GENERAL

In the CSA Group and UL publications of this standard, National Differences from the text of International Electrotechnical Commission (IEC) Publication 60335-2-40, Household and similar electrical appliances – Safety – Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers, copyright 2013, are indicated by notations (differences) and are presented in bold text. The national difference type is included in the body.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences 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 National Differences based on **editorial comments or corrections**.

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.

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.

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY – Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60335 has been prepared by subcommittee 61D: Appliances for air-conditioning for household and similar purposes, of IEC technical committee 61: Safety of household and similar electrical appliances.

This fifth edition cancels and replaces the fourth edition published in 2002, its Amendment 1 (2005), its Amendment 2 (2005) and its Corrigendum 1 (2006). It constitutes a technical revision.

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The principal changes in this edition as compared with the fourth edition are as follows (minor changes are not listed):

- 3.127 and 3.128 – added new definitions;
- 5.10 – length of refrigerant lines now specified for testing;
- 7.1 – changed marking requirements for FLAMMABLE REFRIGERANTS;
- 8.15 – added requirement to clarify the placement of installation panels during testing;
- 11.2.1 – clarification of test procedure;
- 19 – (whole clause) – replaced in its entirety;
- 21.2 – added new coverage for vibration considerations during transport;
- 22.46 – added clarification for PEC;
- 22.118 – added coverage for use of mechanical connectors indoors when employing FLAMMABLE REFRIGERANTS;
- 32 – made this section of Part 1 applicable;
- Annex FF.2.4 – revised calculation for calculating volume (V);
- Annex FF.2.5 – revision of allowable concentration of flammable refrigerant gas;
- Annex GG.8 – new coverage added;
- Annex HH – added informative annex.

The text of this standard is based on the following documents:

FDIS	Report on voting
61D/213/FDIS	61D/220/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fifth edition (2010) of that standard.

NOTE 1 When “Part 1” is mentioned in this standard, it refers to IEC 60335-1.

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for electrical heat pumps, air-conditioners and dehumidifiers.

When a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. When this standard states "addition", "modification" or "replacement", the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

- subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
- unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;
- additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

- requirements: in roman type;
- *test specifications: in italic type;*
- notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and associated noun are also in bold.

The following differences exist in the countries indicated below:

- 6.1: Class 0I appliances are allowed (Japan).
- 11.8: The temperature of the wooden walls in the test casing is limited to 85 °C (Sweden).

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

101DV D2 *Modification of the of the first sentence of the 7th paragraph after item (9) by replacing it with the following paragraph:*

This Part 2-40 is intended to be used in conjunction with the second edition of CAN/CSA-C22.2 No. 60335-1:16 and the sixth edition of UL 60335-1. All references in this standard to IEC 60335-1 shall be replaced by the second edition of CAN/CSA-C22.2 No. 60335-1:16 and the sixth edition of UL 60335-1.

102DV DE *Modify the paragraph following Note 3 in the Part 2 Foreword by replacing it with the following:*

Words in SMALL ROMAN CAPS in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in SMALL ROMAN CAPS.

103DV DE *Modify by adding the following text at the end of the Part 2 Foreword:*

The numbering system in this Standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another part 2 of IEC 60335, the relevant part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

NOTE 2 Horizontal and generic standards covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards. For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 standards.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of electric HEAT PUMPS, including SANITARY HOT WATER HEAT PUMPS, AIR-CONDITIONERS, and DEHUMIDIFIERS incorporating motor-compressors and hydronic room FAN COILS, their maximum RATED VOLTAGES being not more than 250 V for single phase appliances and 600 V for all other appliances.

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”.

Appliances not intended for normal household use but which nevertheless may be a source of danger to the public, such as appliances intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard.

This standard also applies to electric HEAT PUMPS, AIR CONDITIONERS and DEHUMIDIFIERS containing FLAMMABLE REFRIGERANT. FLAMMABLE REFRIGERANTS are defined in 3.121.

The appliances referenced above may consist of one or more factory made assemblies. If provided in more than one assembly, the separate assemblies are to be used together, and the requirements are based on the use of matched assemblies.

NOTE 101 A definition of ‘motor-compressor’ is given in IEC 60335-2-34, which includes the statement that the term motor-compressor is used to designate either a hermetic motor-compressor or semi-hermetic motor-compressor.

NOTE 102 Requirements for refrigeration safety are covered by ISO 5149, and requirements for containers intended for storage of the heated water included in SANITARY HOT WATER HEAT PUMPS are, in addition, covered by IEC 60335-2-21.

This standard does not take into account chemicals other than group A1, A2, or A3 as defined by ANSI/ASHRAE 34 [ISO 817] classification.

1DV.3 DE *Add the following note:*

Note 102A: Class A2 includes class A2L.

This standard specifies particular requirements for the use of FLAMMABLE REFRIGERANTS. Unless specifications are covered by this standard, including the annexes, requirements for refrigerating safety are covered by ISO 5149.

The sections and clauses in ISO 5149 of particular concern to this standard are as follows:

- Section 3: “Design and construction of equipment” applies to all appliances and systems.
- Section 4: “Requirements for utilization” applies to appliances and systems which are for “similar electrical appliances”, i.e. commercial and light industrial.
- Section 5: “Operating procedures” applies to appliances and systems which are for “similar electrical appliances”, i.e. commercial and light industrial.

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).

SUPPLEMENTARY HEATERS, or a provision for their separate installation, are within the scope of this standard, but only heaters which are designed as a part of the appliance package, the controls being incorporated in the appliance.

NOTE 103 Attention is drawn to the fact that

- for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary;
- for appliances subjected to pressure, additional requirements may be necessary;
- in many countries, additional requirements are specified, for example, by the national health authorities responsible for the protection of labour and the national authorities responsible for storage, transportation, building constructions and installations.

NOTE 104 This standard does not apply to

- humidifiers intended for use with heating and cooling equipment (IEC 60335-2-88);
- appliances designed exclusively for industrial processing;
- appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60068-2-52, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium, chloride solution)*

IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*

IEC 60079-15:2010, *Explosive atmospheres – Part 15: Equipment protection by type of protection “n”*

IEC 60335-2-34:2012, *Household and similar electrical appliances – Safety – Part 2-34: Particular requirements for motor-compressors*

IEC 60335-2-51, *Household and similar electrical appliances – Safety – Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations*

ISO 817:2005, *Refrigerants – Designation system*

ISO 5149:1993, *Mechanical refrigerating systems used for cooling and heating – Safety requirements*

ISO 7010: 2011, *Graphic Symbols – Safety colours and safety signs – Registered safety signs*

ISO 14903, *Refrigerating systems and heat pumps – Qualification of tightness of components and joints*

ANSI/ASHRAE 34:2010, *Designation and safety classification of refrigerants*

ASTM D4728-01:2001, *Standard Test Method for Random Vibration Testing of Shipping Containers*

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

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

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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*****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***

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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 Terms and definitions**

This clause of Part 1 is applicable except as follows.

3.1.4

Addition:

Note 101 to entry: If the appliance comprises electrical accessories, including fans, the RATED POWER INPUT is based upon the total maximum ELECTRICAL POWER INPUT with all accessories energized, when operating continuously under the appropriate environmental conditions. If the HEAT PUMP can be operated in the heating or cooling mode, the RATED POWER INPUT is based upon the input in the heating or in the cooling mode, whichever is the greater.

3.1.9

Replacement:

NORMAL OPERATION

conditions that apply when the appliance is mounted as in normal use and is operating under the most severe operating conditions specified by the manufacturer

3.101**HEAT PUMP**

appliance which takes up heat at a certain temperature and releases heat at a higher temperature

Note 1 to entry: When operated to provide heat (e.g., for space heating or water heating), the appliance is said to operate in the heating mode; when operated to remove heat (for example, for space cooling), it is said to operate in the cooling mode.

3.102**SANITARY HOT WATER HEAT PUMP**

heat pump intended to transfer heat to water suitable for human consumption

3.103**AIR CONDITIONER**

encased assembly or assemblies designed as an appliance to provide delivery of conditioned air to an enclosed space, room or zone

Note 1 to entry: It includes an electrically operated refrigeration system for cooling and possibly dehumidifying the air.

Note 2 to entry: It may have means for heating, circulating, cleaning and humidifying the air.

3.104**DEHUMIDIFIER**

encased assembly designed to remove moisture from its surrounding atmosphere

Note 1 to entry: It includes an electrically operated refrigeration system and the means to circulate air. It also includes a drain arrangement for collecting and storing and/or disposing of the condensate.

3.105**DEHUMIDIFICATION — COMFORT**

dehumidification to reduce the humidity within a space to a level to satisfy the requirements of the occupants

3.106**DEHUMIDIFICATION — PROCESS**

dehumidification to reduce the humidity within a space to a level necessary for the process or the storage of goods and/or materials or the drying out of the building fabric

3.107**DEHUMIDIFICATION — HEAT RECOVERY**

dehumidification where the latent and sensitive heat removed from the space together with the compressor heat is reused in another application rather than rejected outside to waste

3.108**WET-BULB TEMPERATURE****WB**

temperature indicated when the temperature-sensitive element in a wetted wick has reached a state of constant temperature (evaporative equilibrium)

3.109

DRY-BULB TEMPERATURE

DB

temperature indicated by a dry, temperature-sensitive element shielded from the effects of radiation

3.110

EVAPORATOR

HEAT EXCHANGER in which refrigerant liquid is vaporized by absorption of heat

3.111

HEAT EXCHANGER

device specifically designed to transfer heat between two physically separated fluids

3.112

INDOOR HEAT EXCHANGER

HEAT EXCHANGER designed to transfer heat to the indoor parts of the building or to the indoor hot water supplies (e.g. sanitary water) or to remove heat therefrom

3.113

OUTDOOR HEAT EXCHANGER

HEAT EXCHANGER designed to remove or release heat from the heat source (for example, ground water, outdoor air, exhaust air, water or brine)

3.114

SUPPLEMENTARY HEATER

electric heater provided as part of the appliance to supplement or replace the output of the refrigerant circuit of the appliance by operation in conjunction with, or instead of, the refrigeration circuit

3.115

PRESSURE-LIMITING DEVICE

mechanism that automatically responds to a predetermined pressure by stopping the operation of the pressure-imposing element

3.116

PRESSURE-RELIEF DEVICE

pressure actuated valve or rupture member which functions to relieve excessive pressure automatically

3.117

SELF-CONTAINED UNIT

complete appliance, in suitable frame(s) or enclosure(s), that is fabricated and shipped in one or more sections, and has no refrigerant containing parts connected in the field other than by companion or block valves

Note 1 to entry: A SELF-CONTAINED UNIT in a single frame or enclosure is called a single package unit.

Note 2 to entry: A SELF-CONTAINED UNIT in more than one frame enclosure is called a split package unit.

3.118

APPLIANCES ACCESSIBLE TO THE GENERAL PUBLIC

appliances intended to be located in residential buildings or in commercial buildings

3.119

APPLIANCES NOT ACCESSIBLE TO THE GENERAL PUBLIC

appliances which are intended to be maintained by qualified service personnel and located either in machine rooms and the like or at a level not less than 2,5 m or in secured rooftop areas

3.120

FAN COIL

AIR HANDLING UNIT

factory-made assembly which provides one or more of the functions of forced circulation of air, heating, cooling, dehumidification and filtering of air, but which does not include the source of cooling or heating

Note 1 to entry: The device is normally designed for free intake of air from a room and delivery of air into the same room, but may be applied with duct work.

Note 2 to entry: This device may be designed for furred-in application or with an enclosure for application within the conditioned space.

3.121

FLAMMABLE REFRIGERANT

refrigerant with a classification of class A2 or A3 in compliance with ANSI/ASHRAE 34 [ISO 817] classification

3.122

REFRIGERATING SYSTEM

combination of interconnected refrigerant containing parts constituting one closed refrigerant circuit in which refrigerant is circulated for the purpose of extracting heat at the low temperature side to reject heat at the high temperature side by changing the state of the refrigerant

3.123

MAXIMUM ALLOWABLE PRESSURE

limit to the refrigerating system operating pressure, generally the maximum pressure for which the equipment is designed, as specified by the manufacturer

Note 1 to entry: Maximum allowable pressure constitutes a limit to the operating pressure whether the equipment is working or not, see Clause 21.

3.124

LOW-PRESSURE SIDE

part(s) of a refrigerating system operating at the evaporator pressure

3.125

HIGH-PRESSURE SIDE

part(s) of a refrigerating system operating at the condenser pressure

3.126

SERVICE PORT

means to access the refrigerant in a refrigerating system for the purpose of charging or servicing the system, typically a valve, tube extension or entry location

3.127

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

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.

3.128

SINGLE PACKAGE UNIT

factory assembly of components of refrigeration system fixed on a common mounting to form a discrete unit

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.

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.

4 General requirement

This clause of Part 1 is applicable.

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5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.2 Addition:

The testing of Clause 21 may be carried out on separate samples. The testing of Clauses 11, 19 and 21 shall require that pressure measurements be made at various points in the REFRIGERATING SYSTEM.

At least one additional specially prepared sample is required for the tests of Annex FF (Leak simulation tests), if that test option is selected.

The temperatures on the refrigerant piping should be measured during the test of Clause 11.

NOTE Due to the potentially hazardous nature of the tests of Clause 21 and Annexes EE and FF, special precautions need to be taken when carrying out the tests.

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.

5.6 Addition:

Any controls which regulate the temperature or humidity of the conditioned space are rendered inoperative during the test.

5.7 Replacement:

The tests and test conditions of Clauses 10 and 11 are carried out under the most severe operating conditions within the operating temperature range specified by the manufacturer. Annex AA provides examples of such temperature conditions.

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.

5.10 Addition:

For split-package units, the refrigerant lines shall be installed in accordance with the installation instructions. The length of pipe shall be between 5 m and 7,5 m. The thermal insulation of the refrigerant lines shall be applied in accordance with the installation instructions.

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.

5.101 *Motor-compressors are also subjected to the relevant test of Clause 19 of IEC 60335-2-34:2012, unless the motor-compressor complies with that standard, in which case it is not necessary to repeat these tests.*

5.102 *Motor compressors that are tested and comply with IEC 60335-2-34 need not be additionally tested for Clause 21.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 Modification:

Appliance shall be of CLASS I, CLASS II or CLASS III.

6.2 Addition:

Appliances shall be classified according to degree of protection against harmful ingress of water in accordance with IEC 60529:

- appliances or parts of appliances intended for outdoor use shall be at least IPX4;
- appliances intended only for indoor use (excluding laundry rooms) may be IPX0;
- appliances intended to be used in laundry rooms shall be at least IPX1.

6.101 Appliances shall be classified according to the accessibility either as APPLIANCE ACCESSIBLE TO THE GENERAL PUBLIC or as APPLIANCE NOT ACCESSIBLE TO THE GENERAL PUBLIC.

Compliance is checked by inspection and the relevant tests.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 Modification:

Replace the second dash by:

- symbol for nature of supply including number of phases, unless for single phase operation;

Addition:

- rated frequency;
- mass of the refrigerant;
- refrigerant number in accordance with ANSI/ASHRAE 34 [ISO 817]
- permissible excessive operating pressure for the storage tank (for SANITARY HOT WATER HEAT pumps);
- maximum operating pressure for the heat exchanger for hydronic fan coil/air handling units;
- maximum operating pressure for the refrigerant circuit; if the permissible excessive operating pressure for the suction and discharge side differ, a separate indication is required;
- IP number according to degree of protection against ingress of water, other than IPX0.

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)**

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

Appliances shall be marked with all of the designations and the rated inputs of the SUPPLEMENTARY HEATERS for which they are intended to be used, and shall have provision for identifying the actual heater that is field installed.

Unless it is evident from the design, the enclosure of the appliance shall be marked, by words or by symbols, with the direction of the fluid flow.

The flame symbol and the instruction manual symbol of 7.6 shall be visible when a FLAMMABLE REFRIGERANT is employed and the following conditions exist:

- accessing parts expected to be subjected to maintenance or repair;
- observing the appliance under sale or installed conditions;
- observing the appliance packaging, if the appliance is charged with refrigerant.

If a FLAMMABLE REFRIGERANT is used, the symbols for “read operator’s manual”, “operator’s manual; operating instructions” and “service indicator; read technical manual” (symbols ISO 7000-0790 (2004-01), ISO-7000-1641 (2004-01) and ISO 7000-1659 (2004-01)) shall be placed on the appliance in a location visible to the persons required to know the information. The perpendicular height shall be at least 10 mm.

An additional warning symbol (flame symbol: W021 of ISO 7010) shall be placed on the nameplate of the unit near the declaration of the refrigerant type and charge information. The perpendicular height shall be at least 10 mm, and the symbol need not be in colour. When installed, the marking should be visible after removing a DETACHABLE part.

The following warning shall also be applied to the appliance when a FLAMMABLE REFRIGERANT is employed.

WARNING

APPLIANCE shall be installed, operated and stored in a room with a floor area larger than ‘X’ m² (only applies to APPLIANCES that are not FIXED APPLIANCES).

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)

For APPLIANCES, which are not FIXED APPLIANCES, the minimum room size X shall be specified on the appliance. The X in the marking shall be determined in m² by the procedure described in Clause GG.2 for unventilated areas and the X in the marking shall be 4 if the refrigerant charge of the appliance is less than m_1 (see GG.1.1).

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.

The maximum allowable pressure for the low-pressure side and the high-pressure side shall be marked on the product.

NOTE 102 For the REFRIGERATING SYSTEM, if the MAXIMUM ALLOWABLE PRESSURE of the LOW-PRESSURE SIDE and the HIGH-PRESSURE SIDE is the same, a single indication is permitted.

If not already visible when accessing a SERVICE PORT and if a SERVICE PORT is provided, the SERVICE PORT shall be marked to identify the type of refrigerant. If the refrigerant is flammable, symbol W021 of ISO 7010, shall be included, without specifying the colour.

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.

7.6 Addition:

When a FLAMMABLE REFRIGERANT is employed, a warning symbol W021 of ISO 7010, including colour and format, shall be permanently placed on the appliance. The perpendicular height of the triangle containing the “Caution, risk of fire” symbol shall be at least 30 mm.

When a FLAMMABLE REFRIGERANT is employed, a symbol requiring reference to the manual [ISO 7000-0790 (2004-01)], including colour and format, shall be permanently placed on the appliance.

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”.

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Symbol ISO 7010-W021
(2011)

warning; Risk of fire/Flammable materials



Symbol ISO 7000-1641
(2004-01)

operator's manual; operating instructions



Symbol ISO 7000-1659
(2004-01)

service indicator; read technical manual

su2436

7.12 Addition:

For APPLIANCES NOT ACCESSIBLE TO THE GENERAL PUBLIC, the classification according to 6.101 shall be included.

For APPLIANCES using FLAMMABLE REFRIGERANTS, an installation, service and operation manual, either separate or combined manuals, shall be provided and include the information given in Annex DD.

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7.12.1 Addition:

In particular, the following information shall be supplied:

- that the appliance shall be installed in accordance with national wiring regulations;
- the dimensions of the space necessary for correct installation of the appliance including the minimum permissible distances to adjacent structures;
- for appliances with SUPPLEMENTARY HEATERS, the minimum clearance from the appliance to combustible surfaces;
- a wiring diagram with a clear indication of the connections and wiring to external control devices and SUPPLY CORD;
- the range of external static pressures at which the appliance was tested (add-on HEAT PUMPS, and ducted appliances with SUPPLEMENTARY HEATERS, only);
- the method of connection of the appliance to the electrical supply and interconnection of separate components;
- indication of which parts of the appliance are suitable for outdoor use, if applicable;
- details of type and rating of fuses, or rating of circuit breakers;
- details of supplementary heating elements that may be used in conjunction with the appliance, including fitting instructions either with the appliance or with the SUPPLEMENTARY HEATER;
- maximum and minimum water or brine operating temperatures;
- maximum and minimum water or brine operating pressures.

Open storage tanks of HEAT PUMPS for water heating shall be accompanied by an instruction sheet which shall state that the vent shall not be obstructed.

7.15 Addition:

A marking may be located on a panel that can be removed for installation or service, providing that the panel shall be in place for the intended operation of the appliance.

7.101 A marking shall be provided for a replaceable fuse or a replaceable overload PROTECTIVE DEVICE provided as a part of a product or remote control assembly. It shall be visible when the cover or door of the compartment is open. This marking shall specify

- the rating of the fuse in amperes, the type and voltage rating, or
- the manufacturer and model designation of the replaceable overload PROTECTIVE DEVICE.

Compliance is checked by inspection.

7.102 If the product is intended for permanent connection to fixed wiring with aluminium wires, the marking shall so state.

Compliance is checked by inspection.

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.**

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1.5 Addition:

As regards the products which have a dedicated installation panel or cover and which cannot be installed without them, compliance is checked according to 5.10 (after the installation as instructed in the installation manual).

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

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

Clause 9DV of Part 1 is applicable.

10 Power input and current

This clause of Part 1 is applicable.

11 Heating

This clause of Part 1 is replaced by the following.

11.1 Appliances and their surroundings shall not attain excessive temperatures in normal use.

Compliance is checked by determining the temperatures of the various parts under the conditions specified in 11.2 to 11.7. Nevertheless, if the temperature of the motor winding exceeds the value specified in Table 3 or if there is doubt with regard to the classification of the insulation system employed in a motor, compliance is checked by the tests of Annex C.

11.2 Appliances are installed in a test room in accordance with the manufacturer's installation instructions. In particular,

- clearances to adjacent surfaces specified by the manufacturer shall be maintained;
- flow rates for liquid source or sink equipment shall be the minimum specified in the manufacturer's instructions except for FAN COILS where the flow rates and liquid temperatures shall be the maximum specified in the manufacturer's instructions;
- the outlet duct connected to the appliance shall be subjected to the maximum static pressure given in the manufacturer's instructions;
- for appliances provided with means of adjusting the flow, the flow for the tests shall be the minimum obtainable;
- adjustable limit controls are set at the maximum cut-out setting and the minimum differential permitted by the control adjusting means.

For appliances provided with SUPPLEMENTARY HEATERS, an additional test casing as described in 11.9 is used.

11.2.1 For heating tests of ducted appliances with SUPPLEMENTARY HEATERS, an inlet duct is connected to the inlet air opening of the appliance (assuming that the appliance is intended to be so applied). The duct shall be the same size as the flanges, if flanges are provided. If flanges are not provided, the duct is the same size as the inlet opening.

An appliance that includes or has provision for SUPPLEMENTARY HEATER is fitted with a metal outlet duct in accordance with Figure 101a) or Figure 101b), depending on the direction of the airflow.

The inlet duct is provided with an adjustable restricting means by which the airflow can be reduced.

The restriction should be uniform across the duct's cross sectional area, so that the full heating coil surface will be exposed to the airflow except when the restriction is closed.

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 $[25.4 + (AB)^{1/2}]$.

11.2.2 A ducted appliance which does not include SUPPLEMENTARY HEATERS is fitted with an outlet duct sized to fit the casing flanges, or opening without flanges, or locations marked for flanges, and arranged to discharge away from the return air inlet.

The outlet duct is provided with a restricting means to obtain the maximum static pressure given in the manufacturer's instructions.

11.3 Temperatures other than those of windings are determined by means of fine-wire thermocouples so chosen and positioned that they have the minimum effect on the temperature of the part under test.

NOTE 101 Thermocouples having wires with a diameter not exceeding 0,3 mm are considered to be fine-wire thermocouples.

Thermocouples used for determining the temperatures of the surface of walls, ceiling and floor are embedded in the surface or attached to the back of small blackened disks of copper or brass, 15 mm in diameter and 1 mm thick, which are flush with the surface.

So far as is possible, the appliance is positioned so that parts likely to attain the highest temperatures touch the disks.

In determining the temperatures of handles, knobs, grips and the like, consideration is given to all parts which are gripped in normal use and, if of insulating material, to parts in contact with hot metal.

The temperature of electrical insulation, other than that of windings, is determined on the surface of the insulation, at places where failure could cause a short circuit, contact between LIVE PARTS and ACCESSIBLE metal PARTS, bridging of insulation or reduction of CLEARANCES and CREEPAGE DISTANCES below the values specified in Clause 29.

Temperatures of windings are determined by the resistance method unless the windings are non-uniform or severe complications are involved in order to make the necessary connections, in which case the temperatures are determined by means of thermocouples.

The temperatures in the duct are to be measured by means of a thermocouple grid consisting of nine thermocouples of identical length, wired in parallel to form a grid with a thermocouple located centrally in each of nine equal duct areas in a plane perpendicular to the axis of the airflow.

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.

11.4 Appliances are operated under NORMAL OPERATION at a supply voltage between 0,94 times the lowest RATED VOLTAGE and 1,06 times the highest RATED VOLTAGE, the voltage chosen being that which gives the most unfavourable result. Heating elements shall be energized at a voltage which gives an electrical input of 1,15 times the maximum RATED POWER INPUT.

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

11.5 *Where an appliance can be operated in the cooling mode as well as the heating mode, a test is conducted in each mode.*

For appliances with SUPPLEMENTARY HEATERS or provision for SUPPLEMENTARY HEATERS, an additional test is conducted with all the heating elements operative by short circuiting THERMOSTATS or by reducing, if necessary, the air temperature to a value which causes all the elements to switch on.

11.5DV D2 Modification of Clause 11.5 of this Part 2:

The second paragraph of Clause 11.5 does not apply.

11.6 *Appliances with defrost facilities are additionally submitted for a defrost test in the most unfavourable conditions.*

11.7 *All appliances are operated continuously until steady conditions are achieved except for defrost tests.*

11.8 *During the test, the temperatures are monitored continuously and shall not exceed the values shown in Table 3, PROTECTIVE DEVICES shall not operate and sealing compound shall not flow out.*

The temperature of the air in the outlet duct shall not exceed 90 °C.

The value of the temperature of a winding shall be calculated from the formula:

$$T = (R_2 / R_1) (k + T_1) - k$$

where:

T is the temperature of the copper winding at the end of the test;

R_1 is the resistance at the beginning of the test;

R_2 is the resistance at the end of the test;

T_1 is the ambient temperature at the beginning of the test;

k is equal to 234,5 for copper windings and 225 for aluminium windings.

At the beginning of the test, the windings shall be at ambient temperature.

It is recommended that the resistance of windings at the end of the test be determined by taking resistance measurements as soon as possible after switching off, and then at short intervals so that a curve of resistance against time can be plotted for ascertaining the resistance at the instant of switching off.

Table 3 – Temperature limits

Parts	Temperature °C
<i>Windings of sealed motor-compressors ^a</i>	
– with synthetic insulation	140
– with other insulation	130
<i>External enclosure of appliances with or without SUPPLEMENTARY HEATERS</i>	85
<i>Windings ^b if the winding insulation is (other than motor-compressors):</i>	
– of class 105 (A) material ^c	100 (90)
– of class 120 (E) material ^c	115 (105)
– of class 130 (B) material ^c	120 (110)
– of class 155 (F) material ^c	140
– of class 180 (H) material ^c	165
– of class 200 material ^c	185
– of class 220 material ^c	205
– of class 250 material ^c	235
<i>Terminals, including earthing terminals, for external conductors of STATIONARY APPLIANCES, unless they are provided with a SUPPLY CORD</i>	85
<i>Ambient of switches, and THERMOSTATS and TEMPERATURE LIMITERS ^d</i>	
– without T marking	55
– with T marking	T
<i>Rubber or polyvinyl chloride insulation of internal and external wiring, including SUPPLY CORD:</i>	
– without temperature rating ^e	75
– with temperature rating (T)	T
<i>Cord sheaths used as SUPPLEMENTARY INSULATION</i>	60
<i>Rubber, other than synthetic, used for gaskets or other parts, the deterioration of which could affect safety:</i>	
– when used as SUPPLEMENTARY INSULATION or REINFORCED INSULATION	65
– in other cases	75
<i>Lampholders with T-marking ^j</i>	

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Table 3 – Temperature limits Continued on Next Page



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Table 3 – Temperature limits Continued

Parts	Temperature °C
– B15 and B22 marked T1	165
– B15 and B22 marked T2	210
– other lampholders	T
Lampholders without T-marking ⁱ	
– E14 and B15	135
– B22, E26 NS E27	165
– other lampholders and starter holders for fluorescent lamps	80
Material used as insulation other than that specified for wires and windings:	
– impregnated or varnished textile, paper or press board	95
– laminated bonded with:	
• melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins	110
• urea-formaldehyde resin	90
– printed circuit boards bonded with epoxy resin	145
– moulding of:	
• phenol-formaldehyde with cellulose fillers	110
• phenol-formaldehyde with mineral fillers	90
• melamine-formaldehyde	110
• urea-formaldehyde	90
– polyester with glass-fibre reinforcement	135
– silicone rubber	170
– polytetrafluoroethylene	290
– pure mica and tightly sintered ceramic material, when such materials are used as SUPPLEMENTARY INSULATION or REINFORCED INSULATION	425
– thermoplastic material ^f	–
Wood, in general ^g	90
Wooden walls of the test casing	90

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