UL 60335-2-89

STANDARD FOR SAFETY

Household and Similar Electrical Appliances – Safety – Part 2-89: Particular Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor

UL Standard for Safety for Household and Similar Electrical Appliances – Safety – Part 2-89: Particular Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor, UL 60335-2-89

Second Edition, Dated October 27, 2021

Summary of Topics

Adoption of IEC 60335-2-89, Household and Similar Electrical Appliances – Safety – Part 2-89: Particular Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor Third edition issued by the IEC June 2019, and includes IEC Corrigendum 1 published September 2019, as a new IEC-based UL standard, UL 60335-2-89. Please note that the National Difference document incorporates all of the U.S. national differences for UL 60335-2-89.

The requirements are substantially in accordance with Proposal(s) on this subject dated December 4, 2020 and April 30, 2021.

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Household and Similar Electrical Appliances – Safety – Part 2-89: Particular Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor

October 27, 2021

This national standard is based on IEC 60335-2-89, third edition (2019), including Corrigendum 1 dated September 2019.

Approved American National Standard

ANSI/UL 60335-2-89-2021

Commitment for Amendments

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PREFACE

This is the harmonized CSA Group and UL Standard for Household and similar electrical appliances – Safety – Part 2-89: Particular requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor. It is the second edition of CSA C22.2 No. 60335-2-89 and the second edition of UL 60335-2-89. This edition of CSA C22.2 No. 60335-2-89 supersedes the previous edition published in 2017 as CAN/CSA-C22.2 No. 60335-2-89 (adopted IEC 60335-2-89:2010+A1:2012).

This harmonized standard is based on IEC Publication 60335-2-89: third edition Household and similar electrical appliances – Safety – Part 2-89: Particular requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor issued June 2019, as revised by corrigendum 1 issued September 2019. IEC 60335-2-89 is copyrighted by the IEC.

This harmonized Standard was prepared by CSA Group and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Committee 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 Household Appliances for Refrigeration, 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 Commercial Refrigerators and Freezers, STP 60335-2-89. This standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

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.

CSA C22.2 No. 60335-2-89 is to be used in conjunction with the second edition of CAN/CSA-C22.2 No. 60335-1. The requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor 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. Where a particular subclause of CAN/CSA-C22.2 No. 60335-1 is not mentioned in CSA C22.2 No. 60335-2-89, the CAN/CSA-C22.2 No. 60335-1 subclause applies.

UL 60335-2-89 is to be used in conjunction with the sixth edition of UL 60335-1. The requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor 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 60335-2-89, 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 Group 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 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:

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;

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

National 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.

IEC Copyright

For CSA Group, the text, figures, and tables of International Electrotechnical Commission Publication 60335-2-89, Household and similar electrical appliances – Safety – Part 2-89: Particular requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor, copyright 2019, are used in this Standard with the consent of the International

Electrotechnical Commission. The IEC Foreword and Introduction are not a part of the requirements of this standard but are included for information purposes only.

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NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60335-2-89, Household and similar electrical appliances – Safety – Part 2-89: Particular requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor, copyright 2019, 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.

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

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY – Part 2-89: Particular requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor

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.

This part of International Standard IEC 60335 has been prepared by subcommittee 61C: Household appliances for refrigeration, of IEC technical committee 61: Safety of household and similar electrical appliances.

This third edition cancels and replaces the second edition published in 2010, Amendment 1:2012 and Amendment 2:2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

– the text has been aligned with Ed 5.2 of Part 1;

– some notes have been deleted or converted to normative text (4, 5.2, 7.6, 22.111, 22.111.1);

– some subclauses have been renumbered (22.103, 22.104, 22.105, 22.106, 22.107, 22.109, 22.110, 22.111, 22.112, 22.113, 22.114, 22.115);

– requirements for commercial ice-makers have been added (5.7, 5.101, 7.1, 11.8, 19.102);

– installation of appliances with a remote refrigerant unit or motor-compressor has been clarified (5.10, 11.2);

– installation instructions for appliances with a remote refrigerant unit employing R-744 refrigerant in a transcritical refrigeration system have been added (7.12.1);

– a pressure test for appliances employing R-744 refrigerant has been added (22.7);

– additional refrigerants have been added to Table 102 and it has been updated to reference only ISO 817 and ISO 5149-1 data;

– additional requirements for appliances with a refrigerant charge exceeding 150 g of flammable refrigerant within each refrigerating circuit have been added (7.1, 21.103, 22.108, 22.110, 22.116, 22.117, 22.118, 22.119, 22.120, 22.121, Annex CC);

– Annex AA has been modified to cover motors that are supplied at a voltage that is different from the rated voltage of the appliance;

– Annex BB has been updated to align with the latest edition of IEC 60079-15.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
61C/792/FDIS	61C/796A/RVD

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

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

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.

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 commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor.

Where a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. Where 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 the associated noun are also in bold.

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

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

The contents of the corrigendum of September 2019 have been included in this copy.

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 ***Modify the 7th paragraph after Item 9) and Note 1 of the Part 2 IEC Foreword by replacing them with the following:***

This Part 2-89 is intended to be used in conjunction with the CSA/UL harmonized standard of the second edition of CAN/CSA-C22.2 No. 60335-1 and the sixth edition of UL 60335-1 dated October 31, 2016. This harmonized standard is an adoption of IEC 60335-1, Household and Similar Electrical Appliances – Safety – Part 1: General Requirements, (Edition 5.1, Issued by the IEC April 2014.) All references in this Standard to IEC 60335-1 shall be replaced by reference to this CSA/UL harmonized standard.

102DV DE ***Modify the paragraph following Note 3 in the Part 2 IEC 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 ***Modification by adding the following text at the end of the Part 2 IEC Foreword:***

The numbering system in the 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.

104DV D2 ***Modify the list in the third paragraph after Item 9) of the Part 2 IEC Foreword by adding the following dashed item:***

– introduces requirements for appliances using Stirling engine systems when ambiguity or system differences require a different approach for equivalent safety.

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 and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

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 which 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.

No Text on This Page

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY – Part 2-89: Particular requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 specifies safety requirements for electrically operated commercial refrigerating appliances and ICE-MAKERS that have an incorporated motor-compressor or that are supplied in two units for assembly as a single appliance in accordance with the instructions (split system).

NOTE 101 Examples of appliances that are within the scope of this standard are

– REFRIGERATED DISPLAY and STORAGE CABINETS;

– refrigerated trolley cabinets;

– service counters and self-service counters;

– blast chillers and blast freezers;

– COMMERCIAL ICE-MAKERS.

As far as is practicable, this standard deals with the common hazards presented by these types of appliances including those that use FLAMMABLE REFRIGERANTS and appliances employing R-744 refrigerant.

This International Standard is not applicable to appliances with a mass of FLAMMABLE REFRIGERANT exceeding the limits specified in 22.110 or to appliances with that use refrigerants with a toxicity classification of B according to ISO 817.

It does not cover those features of construction and operation of refrigerating appliances that are dealt with in ISO standards.

NOTE 102 Attention is drawn to the fact that

– for appliances intended to be used in vehicles or aboard ships or aircraft, additional requirements can be necessary;

– in many countries, additional requirements are specified by national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

NOTE 103 This standard does not apply to

– appliances using FLAMMABLE REFRIGERANT in TRANSCRITICAL REFRIGERATION SYSTEMS;

– domestic refrigerating appliances (IEC 60335-2-24);

– split systems having a REFRIGERANT CHARGE of FLAMMABLE REFRIGERANT exceeding 150 g in any REFRIGERATING CIRCUIT;

– industrial refrigerating systems;

– motor-compressors (IEC 60335-2-34);

– commercial dispensing appliances and vending machines (IEC 60335-2-75);

– commercial ice-cream appliances;

– cold temperature rooms;

– multiple refrigerated chambers with a remote motor-compressor.

1DV.1 D2 ***Modification to replace the second paragraph in Clause 1 of the Part 2 with the following:***

This part of UL/CSA 60335 specifies safety requirements for electrically operated commercial refrigerating appliances that have an incorporated compressor, refrigerating appliances that are supplied in two or more units for assembly as a single appliance in accordance with the manufacturer's instructions (split system), and partial units intended for installation in a field erected system in accordance with:

– CSA C22.1, Canadian Electrical Code (CE Code) Part I, in Canada;

– NFPA 70, National Electrical Code (NEC), in the United States.

1DV.2 D2 ***Modification to add the following after the second paragraph in Clause 1 of the Part 2:***

This standard also contains the requirements for:

– commercial refrigerators and freezers for use in fuel dispensing facilities (Annex 101.DVD);

– factory assembled walk in coolers/freezers (Annex 101.DVE);

– refrigerating units (Annex 101.DVF);

– PARTIAL UNITS (Annex 101.DVG);

– dispensing units (Annex 101.DVH);

– commercial refrigeration products with rated voltage up to 15 000V (Annex 101.DVR);

– Stirling refrigeration systems; and

– laboratory refrigerators and freezers (for US only).

1DV.3 D1 *Modification of the sixth paragraph in Clause 1 of the Part 2 by replacing it with the following:*

This standard does not take into account refrigerants other than refrigerant safety groups as defined by ISO 817 or ANSI/ASHRAE 34 as follows:

a) A1;

b) B1 [for use in appliances installed in machinery rooms as defined in accordance with ANSI/ASHRAE 15 (USA) or CSA B52 (Canada), or outdoors only]; and

c) A2L, A2, and A3, refrigerants.

1DV.4 DR *Modification of Clause 1 of the Part 2 by adding the following paragraph:*

All references to ISO 817 in this Part 2 also apply to ANSI/ASHRAE 34. ANSI/ASHRAE 34 shall take precedence over ISO 817.

1DV.5 D2 *Modification of Note 103 in Clause 1 of the Part 2 by replacing it with the following:*

NOTE 103 This standard does not apply to

– appliances using flammable refrigerant in transcritical refrigeration systems;

– domestic refrigerating appliances (IEC 60335-2-24);

– motor-compressors (IEC 60335-2-34);

– vending machines (IEC 60335-2-75);

– professional ice-cream appliances (IEC 60335-2-118);

– laboratory refrigerators and freezers (for Canada only. In Canada, the applicable standard for laboratory refrigerators and freezers is CSA C22.2 No. 61010-2-011.)

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 60079-7:2015, *Explosive atmospheres – Part 7: Equipment protection by increased safety "e"*
IEC 60079-7:2015/AMD1:2017,[1]

[1] There exists a consolidated edition 5.1 (2017) that includes Edition 5 and its Amendment 1.

IEC 60079-15:2017, *Explosive atmospheres – Part 15: Equipment protection by type of protection "n"*

IEC 60079-29-1, *Explosive atmospheres – Part 29-1: Gas detectors – Performance requirements of detectors for flammable gases*

IEC 60335-2-34:2012, *Household and similar electrical appliances – Safety – Part 2-34: Particular requirements for motor-compressors*
IEC 60335-2-34/AMD1:2015
IEC 60335-2-34/AMD2:2016[2]

[2] There exists a consolidated edition 5.2 (2016) that includes Edition 5 and its Amendment 1 and Amendment 2.

IEC 60730-2-6, *Automatic electrical controls – Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements*

ISO 817:2014, *Refrigerants – Designation and safety classification*
ISO 817:2014/AMD1:2017

ISO 4126-2:2018, *Safety devices for protection against excessive pressure – Bursting disc safety devices*

ISO 5149-1:2014, *Refrigerating systems and heat pumps – Safety and environmental requirements – Part 1: Definitions, classification and selection criteria*
ISO 5149-1:2014/AMD1:2015

ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

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

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

Any reference to International Standards that have been adopted in Canada and/or the USA, or are adopted subsequent to the publication of this Standard, shall be replaced by a reference to the equivalent adopted standard.

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CSA Group

CSA B51, *Boiler, Pressure Vessel, and Pressure Piping Code*

CSA B52, *Mechanical Refrigeration Code*

CSA C22.1, *Canadian Electrical Code, Part I*

CSA C22.2 No. 0, *General requirements – Canadian Electrical Code, Part II*

CAN/CSA-C22.2 No. 0.17, *Evaluation of properties of polymeric materials*

CAN/CSA-C22.2 No. 65, *Wire connectors*

CSA C22.2 No. 94.2, *Enclosures for electrical equipment, environmental considerations*

CSA C22.2 No. 120, *Refrigeration Equipment*

CSA C22.2 No. 140.3, *Refrigerant-containing components for use in electrical equipment*

CSA C22.2 No. 153, ***Electrical quick-connect terminals***

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. 60335-1, ***Household and similar electrical appliances – Safety – Part 1: General requirements***

CAN/CSA-C22.2 No. 60335-2-24, ***Household and similar electrical appliances – Safety – Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers***

CAN/CSA-C22.2 No. 60335-2-34, ***Household and similar electrical appliances – Safety – Part 2-34: Particular requirements for motor compressors***

CSA C22.2 No. 61010-2-011, ***Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-011: Particular requirements for refrigerating equipment***

UL (Underwriters Laboratories Inc.)

UL 50E, ***Enclosures for Electrical Equipment, Environmental Considerations***

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

UL 207, ***Refrigerant-Containing Components and Accessories, Nonelectrical***

UL 471, ***Commercial Refrigerators and Freezers***

UL 486A-486B, ***Wire Connectors***

UL 310, ***Electrical Quick-Connect Terminals***

UL 347, ***Medium-Voltage AC Contactors, Controllers, and Control Centers***

UL 347A, ***Medium Voltage Power Conversion Equipment***

UL 486C, ***Splicing Wire Connectors***

UL 746A, ***Polymeric Materials – Short Term Property Evaluations***

UL 746B, ***Polymeric Materials – Long Term Property Evaluations***

UL 60335-1, ***Household and Similar Electrical Appliances – Safety – Part 1: General Requirements***

UL 60335-2-24, ***Household and similar electrical appliances – Safety – Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers***

UL 60335-2-34, ***Household and Similar Electrical Appliances – Safety – Part 2-34: Particular Requirements for Motor compressors***

UL 61800-5-1, ***Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy***

UL 61800-5-2, ***Adjustable Speed Electrical Power Drive Systems – Part 5-2: Safety Requirements – Functional***

ANSI (American National Standards Institute)

ANSI Z97.1, ***Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test***

ASHRAE

ANSI/ASHRAE 15, ***Safety Standard for Refrigeration Systems***

ANSI/ASHRAE 34, ***Designation and Safety Classification of Refrigerants***

ASME (American Society of Engineers)

Boiler and Pressure Vessel Code, Section VIII – Pressure Vessels

ASTM International

ASTM D6668, ***Standard Test Method for Discrimination Between Flammability Ratings of F = 0 and F = 1***

ASTM D8211, ***Standard Test Method for Hot Surface Ignition Temperature of Gases on Flat Surfaces***

IEC (International Electrotechnical Commission)

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

IEC 60079-1:2014, ***Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"***

IEC 60335-2-75, ***Household and similar electrical appliances – Safety – Part 2-75: Particular requirements for commercial dispensing appliances and vending machines***

IEC 60695-11-20, ***Fire hazard testing – Part 11-20: Test flames – 500 W flame test methods***

ISO (International Organization for Standardization)

ISO 1302, ***Geometrical Product Specifications (GPS) – Indication of surface texture in technical product documentation***

NEMA (National Electrical Manufacturers Association)

NEMA 250, ***Enclosures for Electrical Equipment (1000 Volts Maximum)***

NFPA (National Fire Protection Association)

NFPA 30A, ***Code for Motor Fuel Dispensing Facilities and Repair Garages***

NFPA 70, ***National Electrical Code***

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

3.1.9 *Replacement:*
NORMAL OPERATION
operation of the appliance under the following conditions:

Appliances are operated at an ambient temperature in accordance with 5.7, empty, with doors or lids closed, or roller blinds closed or open, whichever is the more unfavourable. User adjustable temperature control devices are short-circuited or otherwise rendered inoperative.

Devices that are switched, by dew-point controls or clocks, are switched on or off, whichever is the more unfavourable.

For appliances connected to a water supply, the water other than cooling water, is at a temperature of 15 °C ± 2 °C. The cooling water is at the maximum temperature specified in the instructions.

3.1.9DV D2 ***Modify the third paragraph of Clause 3.1.9 in the Part 2 by replacing it with the following:***

3.1.9DV.1 For the test of a refrigerator of the water-cooled type, the condenser water flow is to be maintained at 27 °C (80 °F) inlet and 38 °C (100 °F) outlet temperatures. When the outlet water cannot attain a temperature of 38 °C (100 °F) because of product construction considerations, the refrigerator is to be tested at 27 °C (80 °F) inlet water and 241 kPa (35 psig) nominal pressure.

3.1.9DV.2 For the test of a wet-type beverage cooler, the tank is to be filled to the marked height with water at the ambient temperature for designated climate class. The refrigerator then is to be tested in accordance with Clauses 10 and 11.

3.1.9DV.3 For the test of a batch-type beverage dispenser, the ingredient charge is to be prepared and the container filled in accordance with the manufacturer's instructions. When water is to be added to the ingredients, the temperature of the water is to be 27 °C (80 °F). The refrigerator then is to be tested in accordance with Clauses 10 and 11 under "no-draw" conditions.

3.1.9DV.4 For the test of a beverage cooler or beverage cooler-dispenser that employs make-up water, the ingredient charge is to be prepared and the containers filled in accordance with the manufacturer's instructions. The temperature of the make-up water is to be maintained at 27 °C (80 °F). The refrigerator then is to be tested in accordance with Clauses 10 and 11 under "no-draw" conditions for the period of time recommended by the manufacturer. At the end of this time the test is to be continued at the draw rate recommended by the manufacturer until temperatures and pressures have stabilized.

3.1.9DV.5 For the test of a processing water cooler, the inlet and outlet temperatures or the make-up water shall be as specified by the manufacturer.

3.1.101
DESIGN PRESSURE
gauge pressure that has been assigned to the high-pressure side of a TRANSCRITICAL REFRIGERATION SYSTEM

Note 1 to entry: The DESIGN PRESSURE assigned should take into account pressures that could be expected during transportation of the TRANSCRITICAL REFRIGERATION SYSTEM.

3.1.101DV DR *Modify Note 1 to entry by replacing it with the following:*

The DESIGN PRESSURE assigned should take into account pressures that could be expected during transportation of the TRANSCRITICAL REFRIGERATION SYSTEM or the Stirling refrigeration system.

3.1.102
REFRIGERANT CHARGE
mass of refrigerant within a REFRIGERATING CIRCUIT

3.5 Definitions relating to types of appliances

3.5.101
REFRIGERATED DISPLAY AND STORAGE CABINET
cabinet which displays or stores beverages or chilled or frozen foodstuff placed therein and which is cooled by a REFRIGERANT UNIT

3.5.101DV DR *Modify Clause 3.5.101 of the Part 2 by adding the following:*

Refrigerated display and storage cabinets include cabinets which are made up of SELF-CONTAINED or PARTIAL SYSTEMS, which display, or store chilled or frozen product placed therein.

3.5.102
ICE-MAKER
appliance in which ice is made by freezing water by a device consuming electrical energy

Note 1 to entry: The appliance may be provided with a compartment for storing the ice.

3.6 Definitions relating to parts of an appliance

3.6.101
ANCILLARY HEATING ELEMENT
heating device which performs an auxiliary function, such as a defrost heater, door heater or anti-condensation heater

3.6.102
FREE SPACE
space with a volume exceeding 60 l in which a child can be entrapped and which is accessible after opening any door, lid or drawer and removing any DETACHABLE INTERNAL PART, including shelves, containers or removable drawers which are themselves only accessible after opening any door or lid

Note 1 to entry: In calculating the volume, a space with any single dimension not exceeding 150 mm or any two orthogonal dimensions each of which do not exceed 200 mm is ignored.

3.6.103
GAS COOLER
heat exchanger in which, after compression, the refrigerant is cooled down, by transferring heat to an external cooling medium, without changing state

Note 1 to entry: A GAS COOLER is normally used in TRANSCRITICAL REFRIGERATION SYSTEMS.

3.6.104
REFRIGERATING CIRCUIT
combination of interconnected refrigerant-containing parts constituting one closed circuit in which the refrigerant is circulated for the purpose of extracting and delivering heat

3.6.105
REFRIGERANT UNIT
factory assembled unit for performing part of the refrigeration cycle (compressing gas, condensation or gas cooling) comprising of one or more refrigerant compressors with motors, condensers or GAS COOLERS, liquid receivers, interconnection pipe work and ancillary equipment, all mounted on a common base

3.6.105DV DE *Modification of Clause 3.6.105 in the Part 2 by replacing it with the following:*

REFRIGERANT UNIT
factory assembled unit for performing part of the refrigeration cycle (compressing gas, condensation or gas cooling) comprising of one or more refrigerant compressors with motors, condensers or gas coolers, liquid receivers, interconnection pipe work, ancillary equipment, Stirling refrigeration systems and thermosyphons, all mounted on a common base.

NOTE 1DV: In North America, the above described refrigerant unit is referred to as a CONDENSING UNIT. (See Annex 101.DVG.)

NOTE 2DV: The term REFRIGERANT UNIT should not be confused with a REFRIGERATING UNIT as described in 3.8.113DV and Annex 101.DVF.

NOTE 3DV: A liquid receiver is optional.

NOTE 4DV: When natural convection is not used, a power-driven fan, or blower to drive air or a pump to circulate the heat transfer fluid through the GAS COOLER may be included. The associated operational controls may be used in addition to the necessary wiring.

3.6.106
TRANSCRITICAL REFRIGERATION SYSTEM
refrigeration system where the pressure in the high-pressure side is above the pressure where the vapour and liquid states of the refrigerant can coexist in thermodynamic equilibrium

3.6.107
HERMETICALLY SEALED SYSTEM
system in which all refrigerant containing parts are sealed by welding, brazing or a similar permanent connection

3.6.108
CRITICAL POINT
point in a REFRIGERATING CIRCUIT were FLAMMABLE REFRIGERANT may leak

Note 1 to entry: The following are considered to be CRITICAL POINTS:

– interconnecting joints between parts of the REFRIGERATING CIRCUIT;

– pipes with a bend radius, measured along the centre line, of less than 2,5 times the external pipe diameter.

Note 2 to entry: The following are not considered to be CRITICAL POINTS:

– pipes with a bend radius, measured along the centre line, equal to or greater than 2,5 times the external pipe diameter;

– welded telescopic joints of the motor-compressor;

– welding of the pipes through the motor-compressor housing;

– welding of hermetic glass to metal seals (fusite).

3.6DV DR *Add the following definitions to Clause 3.6 of the Part 2:*

3.6.109DV
MOTOR-COMPRESSOR
an appliance consisting of the mechanical mechanism of the compressor and the motor, both of which are enclosed in the same sealed HOUSING, with no external shaft seals, and with the motor operating in a refrigerant atmosphere with or without oil

For the purposes of this standard, a Stirling engine is considered to be a motor-compressor.

3.6.110DV
STIRLING REFRIGERATION SYSTEM
a hermetic refrigeration system based on the Stirling gas cycle in which the refrigerant is at all times in the gas or vapor phase. The Stirling refrigeration system may include a thermosiphon containing a different refrigerant in a saturated condition

3.7 Definitions relating to safety components

3.7.101
BURSTING DISC
disc or foil which bursts at a predetermined pressure to reduce a pressure in a refrigeration system

3.7.102
PRESSURE RELIEF DEVICE
pressure sensing device, intended to reduce pressure automatically when pressures within the refrigeration system exceed the setting pressure of the device during abnormal operation

3.7.102DV D2 *Modify Clause 3.7.102 by replacing it with the following:*

PRESSURE RELIEF DEVICE
a pressure sensing device, intended to reduce pressure automatically when pressures within the system exceed the setting pressure of the device during abnormal operation

Note to entry: A compressor's or pump's internal pressure-relief device (bypass valve) is not considered a pressure relief device.

3.8 Definitions relating to miscellaneous matters

3.8.101
FLAMMABLE REFRIGERANT
refrigerant with a flammability classification of Class 2L, Class 2 or Class 3 in accordance with ISO 817

Note 1 to entry: For refrigerant blends which have more than one flammability classification, the most unfavourable classification is taken for the purposes of this definition.

3.8.102
QUALIFIED PERSON
person having the appropriate technical training and experience necessary to be aware of hazards to which he or she is exposed in performing a task and of measures necessary to minimize the danger to themselves or other persons

3.8DV DR *Add the following definitions to Clause 3.8 of the Part 2:*

3.8.103DV
PARTIAL UNIT
a remote condensing (or condenser) unit or remote evaporator (or evaporating) unit which is part of a total connected assembly of a refrigeration system where not all assemblies that create the refrigeration system are specified by the manufacturer.

NOTE Partial units are defined and evaluated for safety as stand-alone assemblies (Condensing units, Condenser units, Evaporator units, Evaporating units, and Compressor units) per the requirements of Annex 101.DVG.

3.8.104DV
CASCADE SYSTEM
a refrigeration system that incorporates two or more independent vapor-compressor refrigeration cycles in series. This is done to acquire low temperatures that might not be readily achieved with a single refrigeration cycle.

3.8.105DV
PRESSURE REGULATING RELIEF VALVE
similar to a pressure relief valve, except specifically intended for use with refrigeration systems utilizing carbon dioxide (R744) as the refrigerant in a secondary loop or CASCADE SYSTEM. The pressure relief setting of this valve is always lower than the relief setting of a pressure relief valve. This valve can open and re-close many times during the life of the system.

3.8.106DV
START-TO-DISCHARGE PRESSURE
the pressure at which a relief valve begins to discharge; typically, the pressure where the first bubbles can be seen when a valve is immersed in water.

3.8.107DV
PRESSURE VESSEL
a closed vessel, used for containing, storing, distributing, transferring, distilling, processing, or otherwise handling any gas, vapour, or liquid under pressure and as further defined in CSA B52 and ANSI/ASHRAE 15.

3.8.108DV
MOTOR FUEL DISPENSING FACILITY
that portion of a property where motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles or marine craft or into containers, including all equipment used in connection therewith. The area surrounding a fuel dispenser in an outdoor motor fuel dispensing facility extending up 450 mm (18 in) above grade level and 6

m (20 ft) horizontally in all directions from the dispenser enclosure is considered to be a location where flammable or combustible gas and/or liquids can be present in combustible concentrations as noted in NFPA 30A.

3.8.109DV
FACTORY ASSEMBLED WALK-IN COOLER/FREEZER (WICF)
an enclosed walk-in cabinet that is cooled by a REFRIGERATING UNIT or integral refrigerating system that is completely assembled and shipped from the factory as one assembly.

3.8.110DV
INTEGRAL REFRIGERATING SYSTEM
the necessary equipment for performing the complete refrigeration cycle (compressing gas, condensation or gas cooling, and evaporation) comprising refrigerant compressor(s) with motors, condensers or GAS COOLERS, liquid receivers, interconnecting pipe work, and ancillary equipment. The components needed to perform these functions are incorporated into the design of the system (e.g., walk-in cooler/freezer) and need not be mounted on a single base plate or within a single enclosure.

3.8.111DV
BEVERAGE DISPENSERS
equipment comprising means for performing one or more of the functions of cooling, mixing, carbonating, and dispensing of beverages, and intended to be used in commercial establishments.

3.8.112DV
SELF-CONTAINED
equipment consisting of a completely factory assembled, factory charged and factory tested refrigerating system in which all of the refrigerant-containing parts are permanently connected at the factory.

3.8.113DV
PACKAGED REFRIGERATING UNIT
a factory assembled unit for performing the complete refrigeration cycle (compressing gas, condensation or gas cooling, and evaporation) comprising power-driven refrigerant compressor(s) with motors, condensers or GAS COOLERS, liquid receivers, interconnection pipe work, and ancillary equipment, all mounted on a common base. A REFRIGERATING UNIT is a packaged system that is mounted on the enclosure to be cooled, for example, a walk in cooler/freezer, display case with a cassette.

NOTE The term REFRIGERANT UNIT (3.6.105DV) should not be confused with a REFRIGERATING UNIT as described in this clause and Annex 101.DVF.

3.8.114DV
REFRIGERATION SYSTEM
an assembled system for performing the complete refrigeration cycle (compressing gas, condensation or gas cooling, and evaporation) comprising power-driven refrigerant compressor(s), condensers or GAS COOLERS, liquid receivers, interconnection pipe work, and ancillary equipment.

NOTE The terms REFRIGERATING SYSTEM and REFRIGERATION SYSTEM are used interchangeably.

3.8.115DV
COMPLETE SYSTEM
includes PARTIAL UNIT or REFRIGERATING UNIT, and the mechanical and electrical components evaluated in the standard for the equipment in which the units are installed.

3.8.116DV
CORRIDOR
an enclosed exit access component that defines and provides a path of egress to an exit

3.8.117DV
LOBBY
a space serving as a waiting room

3.8.118DV
REFRIGERANT DETECTION SYSTEMS
a sensing system which responds to a pre-set concentration of refrigerant in the environment

Note 1 to entry: A REFRIGERANT DETECTION SYSTEM may have multiple SENSING ELEMENTS.

3.8.119DV
SENSING ELEMENT
part of the refrigerant sensor which is sensitive to the gas/vapor to be measured

3.8.120DV
REFRIGERANT SENSOR
assembly in which the sensing element is housed and that can also contain associated circuit components

3.8.121DV
HOT SURFACE IGNITION TEMPERATURE
the highest temperature at which a refrigerant does not ignite when tested in accordance with Annex 101.DVO or ASTM D8211.

3.8.122DV
RELEASABLE CHARGE (m_{rel})
the maximum quantity of refrigerant that can be released into a space

3.8.123DV
APPLIANCES ACCESSIBLE TO THE GENERAL PUBLIC
appliances intended to be located in residential buildings or in commercial buildings

3.8.124DV
APPLIANCES NOT ACCESSIBLE TO THE GENERAL PUBLIC
appliances which are located either in a secured location with restricted access (e.g. machine rooms, rooftop and the like) or at a level not less than 2,5 m or in secured rooftop areas

4 General requirement

This clause of Part 1 is applicable except as follows.

Addition:

NOTE 101 The use of FLAMMABLE REFRIGERANTS involves some additional hazards that are not associated with appliances which use non-FLAMMABLE REFRIGERANTS.

This standard addresses the hazard due to ignition of leaked FLAMMABLE REFRIGERANT by potential ignition sources associated with the appliance.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.2 *Addition:*

At least one additional specially prepared sample is required for the tests of 22.112.

Unless the motor-compressor complies with IEC 60335-2-34, at least one additional specially prepared sample is required for the tests of 22.109.

Unless the motor-compressor complies with IEC 60335-2-34, at least one additional specially prepared sample is required for the test of 19.1.

At least one additional sample of the fan motor, thermal motor protector combination may be required for the test of 19.1.

The tests of 22.7 and 22.108 may be performed on separate samples.

Due to the potentially hazardous nature of the tests of 22.111, 22.112, 22.113, 22.114 and 22.116, special precautions may need to be taken when performing the tests.

5.2DV D2 *Modify Clause 5.2 in the Part 2 by adding the following:*

If the tests of Annex 101.DVP are carried out, at least two additional sensors are needed.

If the test of Annex 101.DVM has to be carried out, an additional appliance may be used.

The tests of Clauses 15 and 16 may be conducted on a separate sample.

The tests shall be carried out in the order of the clauses. However, the tests of Clauses 15 and 16 may be carried out at any time.

5.3 *Addition:*

Before starting the tests, the appliance shall be operated at RATED VOLTAGE for at least 24 h, then switched off and left to stand for at least 12 h.

5.7 *Addition:*

For ICE-MAKERS, the tests in accordance with Clauses 10, 11 and 13 are performed at an ambient temperature of 32 °C ± 2 °C

For other appliances, tests in accordance with Clauses 10, 11 and 13 are performed at an ambient temperature of

– 32 °C ± 2 °C on appliances of test room climatic class 0, 1, 2, 3, 4, 6 or 8;

– 43 °C ± 2 °C on appliances of test room climatic class 5 or 7.

Before starting the tests specified in 10, 11 and 13, the appliance, with the doors or lids open, is brought to the ambient specified temperature ± 2 K.

Other tests are performed at an ambient temperature of 20 °C ± 5 °C.

Appliances classified for several climatic classes are tested at the ambient temperature relevant to the highest test room climatic class.

NOTE 101 Steady conditions are considered to be established when three successive readings of the temperature, taken at approximately 60 min intervals, at the same point of any operating cycle, do not differ by more than 1 K.

5.7DV D2 *Modify Clause 5.7 by adding the following:*

A laboratory refrigerator or freezer may be tested in an ambient temperature of 27 °C (80.6 °F).

5.10 *Addition:*

For appliances with a remote REFRIGERANT UNIT, the REFRIGERANT UNIT is connected to the cabinet in accordance with the instructions provided with the appliance before testing.

For the tests of 22.111, 22.112 and 22.113, the appliance is empty with doors or lids closed, or roller blinds closed or open, whichever is the more unfavourable, and is installed as follows.

Appliances, other than BUILT-IN APPLIANCES, are placed in a test enclosure, the walls of which enclose the appliance as closely as possible to all its sides and top surface, unless the manufacturer indicates in the instructions that a free distance shall be observed from the walls or the ceiling, in which case this distance is observed during the test. If the appliance has a REMOTE REFRIGERANT UNIT or motor-compressor, then only the REFRIGERATED DISPLAY AND STORAGE CABINET is installed in the test enclosure, the remote REFRIGERANT UNIT or motor- compressor is placed on the floor of the test corner away from walls.

For appliances incorporating remote REFRIGERANT UNITS or remote motor-compressors, the refrigerant line between the REFRIGERANT UNIT or motor-compressor and the REFRIGERATED DISPLAY AND STORAGE CABINET shall have a length of 5 m to 7,5 m. The refrigerant line shall be installed with thermal insulation applied in accordance with the instructions. If the appliance employs R-744 refrigerant in a TRANSCRITICAL REFRIGERATION SYSTEM, a PRESSURE RELIEF DEVICE shall be installed on the high-pressure side between the motor-compressor and the GAS COOLER unless it is pre-fitted to the motor-compressor.

5.101 *Appliances that use FLAMMABLE REFRIGERANTS and that, according to the instructions, may be used with other electrical appliances inside a food/ice storage compartment are tested with such recommended appliances incorporated and in operation as they would be in normal use.*

NOTE An example of such electrical appliances are deodorizers.

ICE-MAKERS that use FLAMMABLE REFRIGERANTS and that, according to the instructions, may be used in conjunction with accessories such as ice-bins are tested with such recommended accessories installed and in operation as they would be in normal use.

6 Classification

This clause of Part 1 is applicable except as follows.

6.101 REFRIGERATED DISPLAY AND STORAGE CABINETS shall be classified for at least one of the following test room climatic classes:

– test room climate class 0;

– test room climate class 1;

– test room climate class 2;

– test room climate class 3;

– test room climate class 4;

– test room climate class 5;

– test room climate class 6;

– test room climate class 7;

– test room climate class 8.

Compliance is checked by inspection.

NOTE The test room climate classes are specified in ISO 23953-2.

6.2DV D1 *Modification by adding the following to Clause 6.2 of the Part 1:*

Appliances or parts of appliances intended for outdoor use shall be at least IPX4 or equivalent UL 50E Type ratings in accordance with NEMA 250, Table A1.

NOTE For example, UL 50E Type 3, 3X, 3S, 3SX, 3R, 3RX, 4, 4X, 5, 6, 6P, 12, 12K, and 13 meet the requirements of IPX4. Types 1, 2, and 5 do not meet the requirements of IPX4.

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.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Modification:*

Replace the third dash by:

– RATED CURRENT, in amperes;

Addition:

– power input, in watts, of heating systems, if greater than 100 W;

– defrosting power input, in watts, if the current corresponding to the defrosting power input is greater than the RATED CURRENT of the appliance;