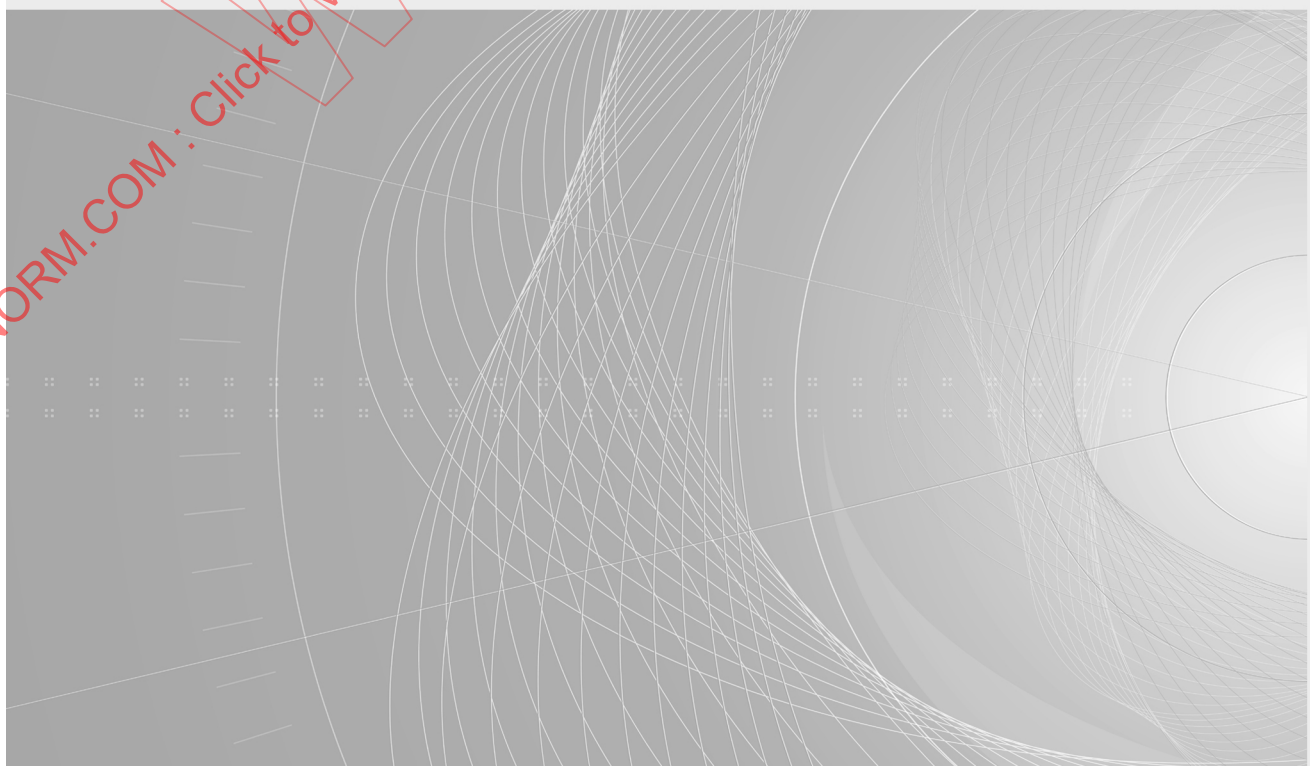
IEC 60335-2-89

Edition 2.2 2015-05
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

colour inside

Household and similar electrical appliances – Safety – Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor



IEC 60335-2-89:2010-02+AMD1:2012-07+AMD2:2015-05 CSV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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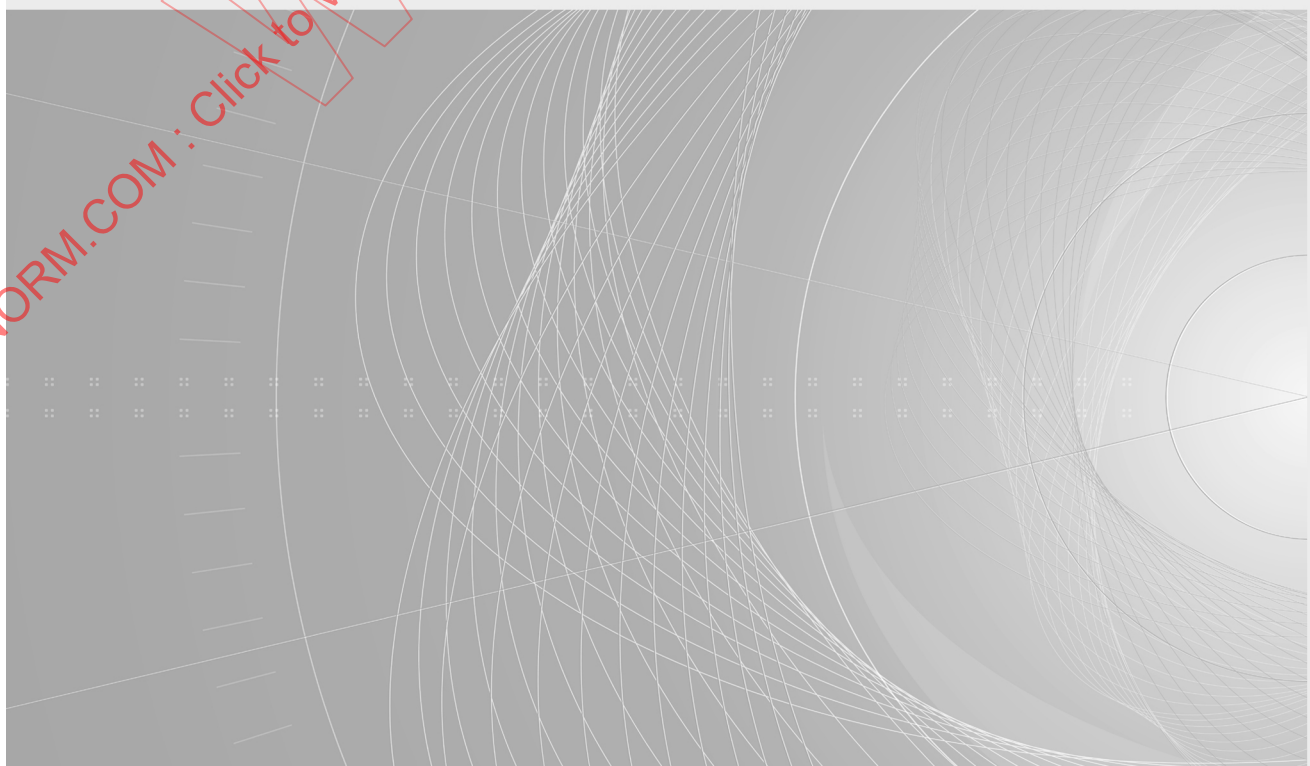

IEC 60335-2-89:2010-02+AMD1:2012-07+AMD2:2015-05 CSV(en)

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by subcommittee 61C: Safety of refrigeration appliances for household and commercial use, of technical committee 61: Safety of household and similar electrical appliances

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
61C/562/ISH	61C/571/RVISH

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

SC 61C interpretation sheet on: Pressure relief devices used in transcritical refrigeration systems

Introduction

Requirements for refrigeration systems that use transcritical refrigerants such as CO_2 (R 744) were introduced into the standard in 2010; however at the time few manufacturers saw transcritical refrigerants as a future progression. It is only recently that commercial refrigerating appliances using such systems are being developed and as a result some clarification of the standard is required due to practicalities of technology being applied.

There is a requirement in 22.103 that appliances employing **a transcritical refrigeration system** shall include a **pressure relief device** in the high pressure side of the refrigeration system. The intent of this device is to prevent the pressure of the system exceeding the **design pressure** should a malfunction occur, such as a failure of the gas cooler fan motor.

A pressure test is carried out on the system with the **pressure relief device** rendered inoperative to ensure that the high side of the system and components can withstand at least 3 times the **design pressure** or as a minimum the high side pressure specified in IEC 60335-2-34, which in the case of R 744 (CO_2) is 420 bar (42 MPa).

The **pressure relief device** is defined in 3.111 as a “pressure sensing device intended to reduce pressure automatically when pressures within the refrigeration system exceed the setting pressure of the device”.

As per the text of 22.103 the operating pressure of the pressure relief device shall be no higher than the **design pressure** of the high pressure side. The component test parameters for several different types of **pressure relief device** such as mechanical, electrical and those of the burst disc type are listed in the addition of 24.1.4.

Questions

On the basis that the **pressure relief device** can maintain the **design pressure** by either venting refrigerant from the refrigeration system or by automatically shutting down the pressure generating element (the compressor),

1) How to apply the second paragraph of 22.103 where the pressure is controlled by automatically shutting down the pressure generating element (the compressor).

2) Subclause 24.101 specifies requirements to ensure that the discharge capacity of the pressure relief device is adequate and which can be verified by calculation or by a test. In the case of an electrical pressure relief device that automatically shuts down the compressor instead of externally venting refrigerant is this clause relevant?

Relevant text from IEC 60335-2-89:

The second paragraph of 22.103 states in regard to the mounting of the pressure relief device: "*The **pressure relief device** shall be mounted so that the refrigerant released from the system cannot cause any harm to the user of the appliance. The aperture shall be located so that it is unlikely to be obstructed in normal use.*"

Subclause 24.101 states:

24.101 The discharge capacity of the **pressure relief device** shall be such that it is able to release an adequate amount of refrigerant so that the pressure during the release of the refrigerant does not increase beyond the pressure setting of the **pressure relief device,** even if the compressor is operating.

Compliance is checked by validation of the manufacturer's calculations or by an appropriate test.

ANSWERS

1) The second paragraph of 22.103 is not relevant where the pressure is controlled by automatically shutting down the pressure generating element (the compressor) since the pressure is not controlled by releasing refrigerant from the system.

2) Subclause 24.101 is not relevant to a pressure relief device that senses pressure and shuts down the compressor automatically if the system high side pressure exceeds the high side design pressure since such a device does not have a discharge capacity.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor

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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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 consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

IEC 60335-2-89 edition 2.2 contains the second edition (2010-02) [documents 61C/208/FDIS and 61C/211/RVD], its amendment 1 (2012-07) [documents 61C/507/FDIS and 61C/510/RVD] and its amendment 2 (2015-05) [documents 61C/598/FDIS and 61C/604/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.

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.

The principal changes in this edition as compared with the first edition of IEC 60335-2-89 are as follows (minor changes are not listed):

– aligns the text with IEC 60335-1, and its Amendments 1 and 2;
– introduces requirements for appliances using transcritical refrigerant systems (3.107, 3.108, 3.109, 3.110, 3.111, 7.1, 7.6, 7.12.1, 22.103, 24.1.4, 24.102)
– introduces an enhanced flexing test (23.3)

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 fourth edition (2001) 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.

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.

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 following differences exist in the countries indicated below.

– 22.101: E12 and E17 lamp holders are checked as specified for E14 and B15 lamp holders. E26 lamp holder is checked as specified for E27 and B22 lamp holders (Japan).
– 22.109: For unsealed glass tube heaters, the temperature requirements are different (Japan).

The committee has decided that the contents of the base publication and its amendments 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.

The contents of the interpretation sheet of July 2014 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.

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.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard specifies safety requirements for electrically operated commercial refrigerating appliances that have an incorporated compressor or that are supplied in two units for assembly as a single appliance in accordance with the manufacturer's 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.

As far as is practicable, this standard deals with the common hazards presented by these types of appliances.

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

NOTE 102 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;
– in many countries, additional requirements are specified by national authorities.

NOTE 103 This standard does not apply to

– domestic refrigerating appliances (IEC 60335-2-24)
– industrial refrigerating systems;
– motor-compressors (IEC 60335-2-34);
– commercial dispensing appliances and vending machines (IEC 60335-2-75);
– commercial ice-cream appliances;
– commercial ice makers;
– cold temperature rooms;
– multiple refrigerated chambers with a remote compressor.

NOTE 104 Appliances with a charge of more than 150 g of **flammable refrigerant** in each separate refrigerant circuit are not covered by this standard. For appliances with a charge greater than 150 g of **flammable refrigerant** in each refrigerant circuit and for the installation, ISO 5149-1 may be applied. Consequently, such appliances cannot be assessed for safety using this part 2.

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 60079-4, *Electrical apparatus for explosive gas atmospheres – Part 4: Method of test for ignition temperature*

~~IEC 60079-4A, *Electrical apparatus for explosive gas atmospheres – Part 4: Method of test for ignition temperatures – First supplement*~~

~~IEC 60079-15:2005, *Electrical apparatus for explosive gas atmospheres – Part 15: Construction, test and marking of type of protection "n" electrical apparatus*~~

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

~~IEC/TR 60079-20, *Electrical apparatus for explosive gas atmospheres – Part 20: Data for flammable gases and vapours, relating to the use of electrical apparatus*~~

IEC 60079-20-1, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

IEC 60335-2-5, *Household and similar electrical appliances – Safety – Part 2-5: Particular requirements for dishwashers*

IEC 60335-2-34:2002, *Household and similar electrical appliances – Safety – Part 2-34: Particular requirements for motor-compressors*
Amendment 1 (2004)
Amendment 2 (2008)[1)]

ISO 817, *Refrigerants – Designation ~~system~~ and safety classification*

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs in workplaces and public areas*

ISO 4126-2:2003, *Safety devices for protection against excessive pressure – Bursting disc safety devices*

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

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

ISO 7010:2011, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.9 *Replacement:*

normal operation
operation of the appliance under the following conditions:

Refrigerating 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

1) There exists a consolidated edition 4.2 (2009) that includes Edition 4 and its Amendment 1 and Amendment 2.

rendered inoperative. Devices which 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 instruction.

For appliances with a separate **refrigerant unit,** the **refrigerant unit** is connected to the cabinet in accordance with the manufacturer's instructions.

3.101
refrigerated display and storage cabinet
~~enclosed~~ cabinet which displays or stores beverages or chilled or frozen foodstuff placed therein and which is cooled by a **refrigerant unit**

3.102
ancillary heating element
heating device which performs an auxiliary function, such as a defrost heater, door heater or anti-condensation heater

3.103
skilled 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 his or herself or other persons

3.104
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

3.105
flammable refrigerant
refrigerant with a flammability classification of group 2 or 3 in accordance with ISO 5149-1

NOTE For refrigerant blends which have more than one flammability classification, the most unfavourable classification is taken for the purposes of this definition.

3.106
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. 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

3.107
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

3.108
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 A gas cooler is normally used in **transcritical refrigeration systems**.

3.109
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**.

3.110
bursting disc
disc or foil which bursts at a predetermined pressure to reduce a pressure in a refrigeration system

3.111
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

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 which 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.

The hazard due to ignition of leaked **flammable refrigerant** by an external potential ignition source associated with the environment in which the appliance is installed is compensated for by the low probability of ignition.

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 22.107.

Unless the motor-compressor complies with IEC 60335-2-34, at least one additional specially prepared sample is required for the tests of 22.103.

NOTE 101 Unless the motor-compressor complies with IEC 60335-2-34, at least one additional specially prepared sample may be required for the test of 19.1.

NOTE 102 At least one additional sample of the fan motor, thermal motor protector combination may be required for the test of 19.1.

NOTE 103 The test of 22.7 may be performed on separate samples.

NOTE 104 Due to the potentially hazardous nature of the tests of 22.107, 22.108 and 22.109, special precautions may need to be taken when performing the tests.

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:*

Tests in accordance with Clauses 10, 11 and 13 are performed at an ambient temperature of

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

– *43 °C ± 2 °C on appliances of 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 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.

5.10 *Addition:*

For the tests of 22.107, 22.108 and 22.109, the appliance is empty and installed as follows.

~~***Built-in appliances*** *are installed in accordance with the instructions for installation.*~~

~~*Other*~~ *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 for installation that a free distance shall be observed from the walls or the ceiling, in which case this distance is observed during the test.*

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 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 which use* ***flammable refrigerants*** *and which, according to the instructions, may be used with other electrical appliances inside a food storage compartment, are tested with such recommended appliances incorporated and in operation as they would be in normal use.*

NOTE Examples of such electrical appliances are ice-cream makers and deodorizers.

6 Classification

This clause of Part 1 is applicable except as follows.

6.101 Refrigerated display and storage cabinets shall be at least one of the following climatic classes:

– appliance of class 0;

– appliance of class 1;

– appliance of class 2;

– appliance of class 3;

– appliance of class 4;
– appliance of class 5;
– appliance of class 6;
– appliance of class 7;
– appliance of class 8.

Compliance is checked by inspection.

NOTE The climatic classes are specified in ISO 23953-2.

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:

– the power input, in watts, of heating systems, if greater than 100 W;
– the defrosting power input, in watts, if the current corresponding to the defrosting power input is greater than the **rated current** of the appliance;
– one or more of the numerals; 0, 1, 2, 3, 4, 5, 6, 7 or 8, indicating the climatic class of the appliance;
– for incandescent lamps, the maximum rated wattage of the lamp, in watts;
– for discharge lamps, the rated wattage of the lamp, in watts;
– the total mass of refrigerant for each separate refrigerant circuit;
– for a single component refrigerant, at least one of the following:
  - the chemical name,
  - the chemical formula,
  - the refrigerant number;
– for a blended refrigerant, at least one of the following:
  - the chemical name and nominal proportion of each of its components,
  - the chemical formula and nominal proportion of each of its components,
  - the refrigerant number and nominal proportion of each of its components,
  - the refrigerant number of the refrigerant blend.
– the chemical name or refrigerant number of the principal component of the insulation blowing gas.

Refrigerent numbers shall be quoted in accordance with ISO 817.

NOTE 101 Pipe insulation or small items of insulation are not required to be marked.

Appliances which use **flammable refrigerants** shall be marked with the symbol ~~"Caution: risk of fire"~~ ISO 7010 W021.

Appliances employing R-744 in a **transcritical refrigeration system** shall be marked with the substance of the following:

WARNING: System contains refrigerant under high pressure. Do not tamper with the system. It must be serviced by qualified persons only.

Appliances employing R-744 in a **transcritical refrigeration system** shall be marked with symbol ISO 7000-1701 (2004-01).

Appliances without automatic liquid-level control and which are intended to be connected to the water supply mains or to be filled with liquid by the user shall be marked with the maximum liquid level.

7.6 *Addition:*

~~Symbol ISO 3864-B.3.2 Caution: risk of fire~~

Symbol ISO 7010 W021 Warning; Risk of fire / flammable materials

Symbol ISO 7000-1701 (2004-01) Pressure

NOTE The rules for warning signs in ISO 3864-1 apply to the colour and shape of the symbol ~~Caution: risk of fire~~ ISO 7010 W021.

7.12 *Modification:*

The instructions concerning persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge and children playing with the appliance are not required.

Addition:

The instructions shall contain information regarding the maximum loading of each type of shelf.

The instructions shall state the substance of the following.

Do not store explosive substances such as aerosol cans with a flammable propellant in this appliance.

If symbol ISO 7000-1701 (2004-01) is used, its meaning shall be explained.

For appliances which use **flammable refrigerants**, the instructions shall include information pertaining to the handling, servicing and disposal of the appliance.

The instructions for appliances which use **flammable refrigerants** shall include the substance of the following warnings:

– WARNING: Keep clear of obstruction all ventilation openings in the appliance enclosure or in the structure for building-in.

– WARNING: Do not use mechanical devices or other means to accelerate the defrosting process, other than those recommended by the manufacturer.

– WARNING: Do not damage the refrigerant circuit.

NOTE 101 This warning is only applicable for appliances with refrigerating circuits which are accessible by the user.

– WARNING: Do not use electrical appliances inside the food storage compartments of the appliance, unless they are of the type recommended by the manufacturer.

For appliances which use flammable insulation blowing gases, the instructions shall include information regarding disposal of the appliance.

For appliances provided with double-capped fluorescent lamps, the instructions shall include the information that lamps have to be replaced by identical lamps only.

An explanation shall be given of the meaning of the alpha-numeric characters, indicating the climatic class of the appliance, that are marked on the appliance.

The instructions for split-systems that use a **flammable refrigerant** shall include the substance of the following warning.

WARNING: In order to reduce flammability hazards the installation of this appliance must only be carried out by a suitably qualified person.

If symbol ISO 7010 W021 is used, its meaning shall be explained.

7.12.1 *Addition:*

For appliances with a separate **refrigerant unit**, the instructions shall include a statement containing the substance of the following:

The installation of the appliance and the **refrigerant unit** must only be made by the manufacturer's service personnel or similarly **skilled person**.

The information provided with an appliance with a separate **refrigerant unit** shall include

– information on the type of separate **refrigerant unit** to which the cabinet shall be connected;

– an electrical diagram showing the electrical terminals for connections.

In appliances employing R-744 in a **transcritical refrigeration system** the instructions shall include the substance of the following

WARNING: The refrigeration system is under high pressure. Do not tamper with it. Contact qualified service personal before disposal.

For appliances intended for connection to a water supply for cooling purposes, the instructions shall contain information on the maximum permitted temperature of the inlet water consistent with safe operation of the appliance.

7.14 *Addition:*

The height of the triangle in the symbol ~~"Caution: risk of fire"~~ ISO 7010 W021 shall be at least 15 mm.

The height of the letters used for the marking of the type of flammable insulation blowing gas shall be at least 40 mm.

7.15 *Addition:*

The marking of the wattage of illuminating lamps shall be easily discernible while the lamp is being replaced.

For appliances which use **flammable refrigerant**, the marking of the type of **flammable refrigerant** and of the flammable insulation blowing gas, shall be visible when gaining access to the motor-compressors, and, in the case of appliances with a remote **refrigerant unit**, the pipe connections.

The symbol ~~"Caution: risk of fire"~~ ISO 7010 W021 shall be placed on the nameplate of the unit near the declaration of the refrigerant type and charge information. It shall be visible after installation of the appliance.

7.101 Equipotential bonding terminals shall be indicated by the symbol IEC 60417-5021 (2002-10).

These indications shall not be placed on screws, removable washers or other parts which can be removed when conductors are being connected.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1.1 ~~*Modification:*~~

~~*Replace the second paragraph of the test specification by the following.*~~

~~*Lamps are not removed, provided that the appliance can be isolated from the supply by means of a plug or an* **all-pole disconnection**~~. ~~*However during insertion or removal of lamps, protection against contact with* **live parts** *of the lamp cap shall be ensured.*~~

Addition:

Where an appliance has parts which require adjustment under operating conditions by a ***skilled person*** *after removal of* ***non-detachable parts****,* ***live parts*** *shall not be accessible and they shall be protected at least by* ***basic insulation****.*

NOTE 101 Examples of adjustable parts are inaccessible **thermostats**, **temperature limiters** and thermostatic expansion valves.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.2 *Modification:*

Instead of the last paragraph of the test specification, the following applies.

The appliance is operated for a period of 1 h and excluding starting current, the maximum value of the current, averaged over any 5 min period, is obtained. The interval between current measurements shall not exceed 30 s.

NOTE Starting current is considered to be excluded if the first current measurement is made approximately 1 min after starting.

10.101 The power input of a defrosting system shall not deviate from the defrosting power input marked on the appliance by more than the deviation shown in Table 1.

*Compliance is checked by operating the appliance at **rated voltage** for the duration of the defrosting period and measuring the maximum value of the current, averaged over any representative 5 min period. The interval between current measurements shall not exceed 30 s.*

11 Heating

This clause of Part 1 is applicable except as follows.

11.1 *Replacement:*

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

Compliance is checked by determining the temperature rise of the various parts under the conditions specified in 11.2 to 11.7.

If the temperature rise of any part exceeds the value given in 11.8, compliance is checked by the test of 11.101.

*For appliances incorporating **ancillary heating elements**, compliance is checked by the tests of 11.102 and 11.103.*

11.2 *Replacement:*

***Built-in appliances** are installed in accordance with the instructions for installation.*

Other appliances are placed in a test enclosure, the walls enclosing the appliance as closely as possible to all its sides and top surface, unless the manufacturer indicates in the instructions for installation that a free distance shall be observed from the walls or the ceiling, in which case this distance is observed during the test.

*Dull black painted plywood approximately 20 mm thick is used for the test corner, the supports and for the installation of **built-in appliances** and the test enclosure for other appliances.*

11.7 *Replacement:*

The appliance is operated until steady conditions are established.

11.8 *Modification:*

Replace the text above Table 3 by the following:

*During the test, **protective devices** other than self-resetting thermal motor-protectors for motor-compressors shall not operate. When steady conditions are established, thermal motor-protectors for motor-compressors shall not operate.*

During the test, sealing compound, if any, shall not flow out.

During the test, the temperature rises are monitored continuously.

For appliances of climatic classes 0, 1, 2, 3, 4, 6 or 8, the temperature rises shall not exceed the values given in Table 3.

For appliances of class 5 or 7, the temperature rises shall not exceed the values given in Table 3, reduced by 7 K.

Addition:

For motor-compressors not conforming to IEC 60335-2-34 (including its Annex AA), the temperatures of

- *housings of motor-compressors and*
- *windings of motor-compressors*

shall not exceed the values given in Table 101.

For motor-compressors conforming to IEC 60335-2-34 (including its Annex AA), the temperatures of their

- *housings of motor-compressors,*
- *windings of motor-compressors and*
- *other parts such as its protection system and control system, and all other components that have been tested together with the motor-compressor during the tests of IEC 60335-2-34 and its Annex AA*

are not measured.

*The entry in Table 3 relating to the temperature rise of the external enclosure of **motor-operated appliances** is applicable to all appliances covered by this standard. However, it is not applicable to those parts of the external enclosure of the appliance that are,*

- *for **built-in appliances**, not **accessible parts** after installation in accordance with the instructions for installation;*
- *for other appliances, on that part of the appliance that according to the instructions for installation is intended to be placed against a wall with a free distance not exceeding 75 mm.*

Table 101 – Maximum temperatures for motor-compressors

Part of the motor-compressor	***Temperature*** °C
Windings with	
– synthetic insulation	*140*
– cellulose insulation or the like	*130*
Housing	*150*

The temperature of ballast windings and their associated wiring shall not exceed the values specified in Subclause 12.4 of IEC 60598-1, when measured under the conditions stated.

11.101 *If the temperature of any part of the appliance is higher than the required limits given in 11.8, the test is performed again, the* ***thermostats*** *or similar control devices being set at the lowest temperature with the short circuit removed.*

11.102 *The appliance is supplied at the most unfavourable voltage between 0,94 and 1,06 times the* ***rated voltage****. If the defrosting time is controlled by an adjustable device, the device is set to the time given by the manufacturer.*

If a control device is used which stops the defrosting at a given temperature or pressure, the defrosting period is automatically terminated when the control operates.

The temperatures and temperature rises shall not exceed the values given in Tables 3 and 101.

11.103 ***Ancillary heating elements*** *are energized with the refrigerating system switched off, if this is possible in normal use. They are supplied at 1,15 times their power input rating, until steady conditions are reached.*

Temperature rises are measured by thermocouples fixed on the outside surface of the insulation of the ***ancillary heating element****.*

Temperature rises shall not exceed the values specified in 11.8.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.2 *Addition*

For appliances which are directly connected to the water supply, the water container, or that part of the appliance which serves as the container, is filled with water as in normal use. The inlet valve is then held open and the filling is continued for 5 min after first evidence of spillage.

Where no spillage occurs due to the operation of a device that prevents such spillage, the inlet valve is held open for a further 5 min following the operation of this device.

15.101 Appliances subject to spillage of liquid from containers on the inside walls of the cabinet or compartment, or on the top of the cabinet, shall be constructed so that such spillage does not affect their electrical insulation.

Compliance is checked by the relevant tests of 15.102 and 15.103.

15.102 *The apparatus shown in Figure 101 is filled with water, containing approximately 1 % NaCl and 0,6 % of acid rinsing agent as specified in Annex AA of IEC 60335-2-5, to the level*

of the lip. The displacement block is supported just above the water by means of any suitable release mechanism and bridge support.

All shelves and containers which can be removed without the use of a tool are removed and the appliance is disconnected from the supply. Lamp covers are not removed.

The apparatus is supported with its base horizontal, and so positioned and at such a height that the water is discharged over the back and side interior walls of the cabinet or compartment, including any electrical components mounted thereon, in the most unfavourable manner when the release mechanism is operated.

The test is made only once with the apparatus in any one position, but the test may be repeated as many times as necessary in different positions, provided that there is no residual water on parts wetted by a previous test.

Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation which could result in a reduction of ***clearances*** *and* ***creepage distances*** *below the values specified in Clause 29.*

Furthermore, if the inspection shows that water is in contact with the defrost heating element or its insulation, it shall withstand the test of 22.102.

15.103 *Appliances, other than* ***built-in appliances****, are tilted at an angle of up to 2° to the position of normal use in the direction which is likely to be the most unfavourable for this test. The appliance is disconnected from the supply and the controls are set to the on position. From a height of approximately 50 mm, 0,5 l of water, containing approximately 1 % NaCl and 0,6 % of acid rinsing agent as specified in Annex AA of IEC 60335-2-5, is poured uniformly in approximately 60 s over any surface of the appliance with less than 2° inclination to the horizontal. Only surfaces measuring more than 60 mm in at least one direction, and less than 2,2 m above the floor are taken into consideration.*

Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation which could result in a reduction of ***clearances*** *and* ***creepage distances*** *below the values specified in Clause 29.*

16 Leakage current and electric strength

This clause of Part 1 is applicable.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is not applicable.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

Addition:

19.1 *Addition*:

In addition, fan motors and their thermal motor-protectors, if any, are subjected to the test of Annex AA.

NOTE 101 For a given type of fan motor, thermal motor-protector combination, this test is performed only once.

Motor-compressors not complying with IEC 60335-2-34 are subjected to the tests of 19.101 and 19.102 of IEC 60335-2-34 and compliance with these tests is checked in accordance with 19.104 of that standard. Unless otherwise specified, compliance with the tests of this clause is checked as described in 19.13, however winding temperatures of motor-compressors are not measured.

NOTE 102 For a given type of motor-compressor this test is performed only once.

19.8 *Addition:*

This test is not applicable to three-phase motor-compressors complying with IEC 60335-2-34.

19.9 Not applicable.

19.101 **Ancillary heating elements** shall be dimensioned and located so that there is no risk of fire even in the case of abnormal operation.

Compliance is checked by the following test.

Doors and lids of the appliance are closed and the refrigerating unit is switched off.

Fans are switched on or off, whichever is more unfavorable

***Ancillary heating elements** are continuously energized at a voltage equal to 1,1 times the **rated voltage** of the appliance, until steady conditions are established. If there is more than one **ancillary heating element**, they are operated each in turn, unless failure of a single component will cause two or more to operate together, in which case they are tested in combination.*

During and after the tests, compliance is checked in accordance with 19.13.

The refrigerating system is not switched off if this prevents the heating elements from operating.

NOTE It may be necessary to short-circuit one or more components, which operate during normal use, to ensure that the **ancillary heating elements** are continuously energized.

19.102 Appliances shall be constructed so that they shall not cause any risk of fire, mechanical hazard or electric shock even in the case of abnormal operation.

*Compliance is checked by applying any defect which may be expected in normal use, while the appliance is operated under conditions of **normal operation** at **rated voltage.** Only one fault condition is reproduced at a time. The tests are made consecutively.*

NOTE 1 Examples of fault conditions are:

– timer stopping in any position;
– disconnection and reconnection of one or more phases of the supply during any part of the cycle;
– open-circuiting or short-circuiting of components;
– failure of a magnetic valve;
– operation with an empty container.

NOTE 2 The main contacts of a contactor intended for switching on and off **ancillary heating elements** in normal use are locked in the on position. However, if two contactors operate independently of each other or if a contactor operates two independent sets of main contacts, these contacts are locked in the on position in turn.

NOTE 3 In general, tests are limited to those cases which may be expected to give the most unfavourable results.

NOTE 4 For the purpose of these tests, thermal controls are not short-circuited.

NOTE 5 Components incorporated in the appliance, other than contactors for **ancillary heating elements**, complying with the relevant IEC standard are not short-circuited, provided the appropriate standard covers the conditions which occur in the appliance.

NOTE 6 For appliances to be connected to the supply water, the tests are made with the tap closed or opened, whichever gives the most unfavourable results. Water level switches complying with IEC 61058 are not short-circuited during the tests.

NOTE 7 The test during which the automatic filling device is held open has already been made during the test of 15.101.

During and after the tests, compliance is checked as described in 19.13.

19.103 Illuminating equipment shall not cause a hazard under abnormal operating conditions.

*Compliance is checked by the following test, for which the appliance is empty, the **refrigerant unit** is switched off, and doors or lids are fully opened or closed, whichever is the more unfavourable.*

*The complete illuminating equipment including its protective cover, fitted with a lamp as recommended by the manufacturer, is operated for 12 h at 1,06 times the **rated voltage**.*

*If an incandescent lamp does not attain the maximum rated wattage at **rated voltage**, the voltage is varied until the maximum rated wattage is reached and is then increased to 1,06 times this voltage.*

*Illuminating equipment having discharge lamps is operated under the fault conditions specified in items a), d) and e) of subclause 12.5.1 of IEC 60598-1, the appliance being supplied at **rated voltage** until temperature stabilization of the measured parts.*

During and after the test, the appliance shall comply with 19.13.

The temperatures of ballast windings shall not exceed the values specified in 12.5 of IEC 60598-1 when measured under the conditions specified.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 *Modification:*

The appliance is tested empty when tilted through an angle of 5° instead of an angle of 10°.

The test with the appliance tilted to 15° is not carried out.

Addition:

The test is repeated with doors, lids and similar parts placed in the most unfavourable position; however, the appliance is only tilted to an angle of 5°.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

21.1 *Addition:*

NOTE 101 Covers of lamps within the appliance are considered likely to be damaged in normal use. Lamps are not tested.

*For **accessible glass panels** which provide insulation for **ancillary heating elements** of other than **class III construction**, the blows applied to the panel are made with the hammer spring adjusted so that the impact energy is 2,00 J ± 0,05 J. For other **accessible glass panels** the hammer spring is adjusted so that the impact energy is 1,00 J ± 0,05 J.*

21.101 Lamps liable to be accessible to users shall either:

– be subject to the test given in Clause 21; or

– be protected against mechanical shock such that when subjected to the following test for protection against mechanical shock, no contact with the lamp occurs.

Compliance is checked by applying a 75 mm ± 0,5 mm diameter sphere without appreciable force in an attempt to touch the lamp with any lamp cover in place.

The sphere shall not touch the lamp.

21.102 Shelves in appliances for displaying or storing beverages shall have adequate mechanical strength.

Compliance is checked as follows.

Each shelf shall be uniformly loaded in turn with a load/unit area of 25 kg/m^2 for a period of 1 h.

During the test, the shelf deflection shall not exceed 3 mm/meter of shelf width.

The test is then repeated with a uniform load/unit area of 230 kg/m^2 or the maximum load specified by the manufacturer whichever is more onerous. The load is applied for a period of 1 h.

During this test, the shelf shall not fall out of position.

For appliances intended to display or store barrels, this test is repeated a further four times, the load being removed and the reapplied each time.

*After the tests, the appliance shall show no damage that could impair compliance with this standard and compliance with 8.1, 15.1 and clause 29 shall not be impaired. In case of doubt, **supplementary insulation** and **reinforced insulation** are subjected to the electric strength test of 16.3.*

NOTE Damage to the finish, small dents that do not reduce **clearances** or **creepage distances** below the values specified in clause 29, and small chips that do not adversely affect protection against access to **live parts** or moisture, are ignored.

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 *Addition:*

Thermostats, except their temperature sensitive parts, shall not be placed in contact with an evaporator unless they are adequately protected against the effects of condensation appearing on cold surfaces and against the effect of water formed during the defrosting process.

22.7 *Replacement:*

Appliances, including protective enclosures of a protected cooling system, that use **flammable refrigerants** shall withstand:

– a pressure of 3,5 times the saturated vapour pressure of the refrigerant at 70 °C, or equal to 3,5 times the pressure at the critical temperature if this is lower than 70 °C, the test pressure being rounded up to the next 0,5 MPa (5 bar), for parts exposed to the high side pressure during normal use;

– a pressure of 5 times the saturated vapour pressure of the refrigerant at 20 °C, or equal to 2,5 MPa (25 bar), whichever is the greater, the test pressure being rounded up to the next 0,2 MPa (2 bar) for parts exposed only to low side pressure during normal use.

NOTE 101 Specific constructional requirements of appliances with a protected cooling system are given in 22.106.

NOTE 102 All pressures are gauge pressures.

Compliance is checked by the following test.

The appropriate part of the appliance under test is subjected to a pressure that is gradually increased hydraulically until the required test pressure is reached. This pressure is maintained for 1 min. The part under test shall show no leakage.

NOTE 103 The test is not performed on motor-compressors complying with IEC 60335-2-34.

22.33 *Addition:*

Heating conductors having only one layer of insulation shall not be in direct contact with water or ice during normal use.

NOTE 101 Frozen water is regarded as a conducting liquid.

22.101 Lampholders shall be fixed so that they do not work loose in normal use.

NOTE Normal use includes replacement of the lamp.

Compliance is checked by inspection and by the following tests.

Edison screw and bayonet lampholders are subjected for 1 min to the following torque:

a) 0,15 Nm for E14 and B15 lampholders;

b) 0,25 Nm for E27 and B22 lampholders.

These lampholders shall then withstand a pull test with 50 N, applied for 1 min in the direction of the axis of the lampholder.

After the tests, the lampholders shall not have worked loose.

Lampholders for a fluorescent lamp shall comply with the test of 4.4.4 i) in IEC 60598-1.

22.102 Insulated wire heaters and their joints, located in, and in integral contact with, thermal insulation, shall be protected against entry of water.

Compliance is checked by immersing for a period of 24 h, three samples of the complete heating element in water containing approximately 1 % NaCl and having a temperature of 20 °C ± 5 °C.

A voltage of 1 250 V is then applied for 15 min between live parts of the heating element and the water.

During the test, no breakdown shall occur.

NOTE Connections to electrical terminals are not joints.

22.103 Appliances employing a **transcritical refrigeration system** shall in the high pressure side of the refrigeration system include a **pressure relief device** on the compressor or between the compressor and the **gas cooler**. There shall be no shut off devices or other components except piping between the compressor and the **pressure relief device**, which could introduce a pressure drop.

The **pressure relief device** shall be mounted so that the refrigerant released from the system cannot cause any harm to the user of the appliance. The aperture shall be located so that it is unlikely to be obstructed in normal use. This requirement is not applicable where the pressure is controlled automatically by shutting down the motor-compressor.

The **pressure relief device** shall have no provisions for setting by the end user.

The operating pressure of the **pressure relief device** shall be no higher than the **design pressure** of the high pressure side.

The **design pressure** of the high pressure side shall be not less than the minimum high side test pressure required in Table 101 of IEC 60335-2-34 divided by 3.

The refrigeration system, including all components, shall withstand the pressures expected in normal and abnormal use and during standstill.

Pressure testing has to be done on the complete refrigeration system, however it can be done separately for the low pressure side and for the high pressure side.

Compliance is checked by inspection and by the following test:

*The **pressure relief device** is made inoperable and the test pressure is ~~raised~~ gradually increased hydraulically*

- *for the high pressure side until a pressure not less than the minimum high side test pressure required in Table 101 of IEC 60335-2-34 is reached, however not less than 3 times the **design pressure**;*
- *for the low pressure side until a pressure not less than the minimum low side test pressure required in Table 102 of IEC 60335-2-34 is reached.*

For a refrigeration system with an intermediate pressure between high pressure side and low pressure side, all parts subjected to the intermediate pressure are considered to be on the low pressure side.

The pressure is maintained for one minute and the parts under test shall show no leakage.

NOTE The test is not carried out on motor-compressors complying with IEC 60335-2-34.

22.104 Accessible glass panels with an area having any two orthogonal dimensions exceeding 75 mm shall be made from

- glass that ~~shatters~~ breaks in small pieces when ~~broken~~ it fractures; or
- glass that is not released or dropped from its normal position when broken.

a) *For glass that breaks into small pieces when it fractures, compliance is checked by the following test which is performed on two samples.*

Frames or other parts attached to the glass panel to be tested are removed and the glass is placed on a rigid horizontal flat surface.

NOTE 1 The edges of the sample to be tested are contained within a frame of adhesive tape in such a manner that the broken pieces remain in place after breakage but without hindering expansion of the sample.

The sample under test is broken by means of a test punch having a head with a mass of 75 g ± 5 g and a conical tungsten carbide tip with an angle of 60 ° ± 2 °. The punch shall be positioned approximately 13 mm in from the longest edge of the glass at the midpoint of that edge. The punch is then hit by a hammer so that the glass breaks.

A transparent mask of 50 mm × 50 mm is placed on the fractured glass except within a peripheral margin of 25 mm from the edge of the sample ~~and a semi-circular area having a radius of 100 mm from the point of impact~~.

The assessment shall be undertaken on at least two areas of the sample, and the areas chosen shall contain the largest particles.

The number of crackfree particles within the mask are counted and for each assessment shall not be less than 40. The particle count shall be made within 5 minutes of the fracture. Each particle wholly contained within the area of the mask shall be counted as one particle and each particle that is partially within the mask shall be counted as a half particle.

NOTE 2 In the case of curved glass, plane pieces of the same material can be used for the test.

b) *For glass that is not released or dropped from its normal position when broken, compliance is checked by braking the glass when mounted in its normal position in the appliance by means of a test punch having a head with a mass of 75 g ± 5 g and a conical tungsten carbide tip with an angle of 60° ± 2°. The punch shall be positioned approximately 13 mm in from the longest edge of the glass at the midpoint of that edge. The punch is then hit by a hammer so that the glass breaks.*

At the conclusion of this test, the glass shall not be broken or cracked in such a way that pieces are released or dropped from their normal position. Glass that is released within the immediate vicinity of the punch tip as a result of the punch impacting the sample under test is ignored.

22.105 The mass of refrigerant in appliances which use **flammable refrigerant** in their cooling system shall not exceed 150 g in each separate refrigerant circuit.

Compliance is checked by inspection.

22.106 Appliances with a protected cooling system and which use **flammable refrigerants** shall be so constructed as to avoid any fire or explosion hazard in the event of leakage of the refrigerant from the cooling system.

NOTE 1 Separate components such as **thermostats** which contain less than 0,5 g of flammable gas are not considered to cause a fire or explosion hazard in the event of a leakage from the component itself.

NOTE 2 Appliances with a protected cooling system are those

– without any part of the cooling system inside a food storage compartment;

– where any part of the cooling system which is located inside a food storage compartment is constructed so that the refrigerant is contained within an enclosure with at least two layers of metallic materials separating the refrigerant from the food storage compartment, each layer having a thickness of at least 0,1 mm. The

enclosure has no joints other than the bonded seams of the evaporator where the bonded seam has a width of at least 6 mm;

– where any part of the cooling system which is located inside a food storage compartment has the refrigerant contained in an enclosure which itself is contained within a separate protective enclosure. If leakage from the containing enclosure occurs, the leaked refrigerant is contained within the protective enclosure and the appliance will not function as in normal use. The protective enclosure must also withstand the test of 22.7. No critical point in the protective enclosure must be located within the food storage compartment.

NOTE 3 Separate compartments with a common air circuit are considered to be a single compartment.

Compliance is checked by inspection and by the tests of 22.106.1 and 22.106.2.

NOTE 4 An appliance with a protected cooling system which, when tested, is found not to comply with the requirements specified for a protected cooling system, may be considered as having an unprotected cooling system if it is tested in accordance with 22.107 and found to comply with the requirement for an unprotected cooling system.

22.106.1 *A leakage is simulated at the most critical point of the cooling system.*

NOTE 1 Critical points are only considered to be the interconnecting joints between parts of the refrigerant circuit, including the gasket of a semi-hermetic motor-compressor. Welded telescopic joints of the motor-compressor, the welding of the pipes through the compressor housing and the welding of hermetic glass to metal seals (fusite) are not considered critical points. To find the most critical point of the cooling system, it may be necessary to perform more than one test.

The method for simulating a leakage is to inject the refrigerant vapour through a capillary tube at the critical point. The capillary tube shall have a diameter of 0,7 mm ± 0,05 mm and a length between 2 m and 3 m.

NOTE 2 Care should be taken that the installation of the capillary tube does not unduly influence the results of the test and that the foam does not enter the capillary tube during foaming. The capillary tube may need to be positioned before the appliance is foamed.

*During this test the appliance is tested with doors and lids closed, and is switched off or operated under **normal operation** at **rated voltage**, whichever gives the more unfavourable result.*

During a test in which the appliance is operated, gas injection is started at the same time as the appliance is first switched on.

The quantity of refrigerant of the type indicated by the manufacturer to be injected is equal to 80 % of the nominal charge of the refrigerant ±1,5 g or the maximum that can be injected in 1 h, whichever is the smaller.

The quantity injected is taken from the vapour side of a gas bottle which shall contain enough liquid refrigerant to ensure that, at the end of the test, there is still liquid refrigerant left in the bottle.

If a blend can fractionate, the test is performed using the fraction that has the smallest value of the lower explosive limit.

The gas bottle is kept at a temperature of:

a) 32 °C ± 2 °C for leakage simulation on low-side pressure circuits;

b) 70 °C ± 2 °C for leakage simulation on high-side pressure circuits.

NOTE 3 The quantity of gas injected should preferably be measured by weighing the bottle.

*The concentration of leaked refrigerant is measured at least every 30 s from the beginning of the test and for at least 1 h after injection of the gas has stopped, inside and outside the food storage compartment, as close as possible to electrical components which, during **normal operation** or abnormal operation, produce sparks or arcs.*

The concentration is not measured close to

– ***non-self-resetting protective devices*** *necessary for compliance with Clause 19, even if they produce arcs or sparks during operation,*
– *intentionally weak parts that become permanently open-circuited during the tests of Clause 19 even if they produce arcs or sparks during operation,*
– *electrical apparatus that has been tested and found to comply with at least the requirements in Annex BB.*

NOTE 4 The instrument used for monitoring gas concentrations (such as those which use infra-red sensing techniques) should have a fast response, typically 2 s to 3 s, and not unduly influence the result of the test.

NOTE 5 If gas chromatography is to be used, the gas sampling in confined areas should occur at a rate not exceeding 2 ml every 30 s.

NOTE 6 Other instruments are not precluded from being used provided that they do not unduly influence the results.

The measured value shall not exceed 75 % of the lower explosive limit of the refrigerant as specified in Table 102, and shall not exceed 50 % of the lower explosive limit of the refrigerant as specified in Table 102 for a period exceeding 5 min.

NOTE 7 For appliances with a protected cooling system, no additional requirements apply to electrical components located inside food storage compartments.

22.106.2 *All accessible surfaces of protected cooling system components, including accessible surfaces in intimate contact with the protected cooling system, are scratched using the tool the tip of which is shown in Figure 102.*

The tool is applied using the following parameters:

– *force at right angles to the surface to be tested ..... 35 N ± 3 N;*
– *force parallel to the surface to be tested ..... not exceeding 250 N.*

The tool is drawn across the surface to be tested at a rate of approximately 1 mm/s.

The surface to be tested is scratched at three different positions in a direction at right angles to the axis of the channel and at three different positions on the channel in a direction parallel to it. In the latter case, the length of the scratch shall be approximately 50 mm.

The scratches shall not cross each other.

The appropriate part of the appliance shall withstand the test of 22.7, the test pressure being reduced by 50 %.

22.107 For compression-type appliances with unprotected cooling systems and which use **flammable refrigerants**, any electrical component located inside the food storage compartment, which during **normal operation** or abnormal operation produces arcs or sparks, and luminaries, shall be tested and found at least to comply with the requirements of Annex BB for group IIA gases or the refrigerant used.

This requirement does not apply to

– **non-self-resetting protective devices** necessary for compliance with Clause 19, nor to
– intentionally weak parts that become permanently open-circuited during the tests of Clause 19,

even if they produce arcs or sparks during operation.

Refrigerant leakage into food storage compartments shall not result in an explosive atmosphere outside the food storage compartments in areas where electrical components that produce arcs and sparks during normal operation or abnormal operation, or luminaries are mounted, when doors or lids remain closed or when opening or closing doors or lids, unless these components have been tested and found at least to comply with Annex BB for group IIA gases or the refrigerant used.

This requirement does not apply to

– **non-self-resetting protective devices** necessary for compliance with Clause 19, nor to
– intentionally weak parts that become permanently open-circuited during the tests of Clause 19,

even if they produce arcs or sparks during operation.

NOTE 1 Separate components such as **thermostats** which contain less than 0,5 g of flammable gas are not considered to cause a fire or explosion hazard in the event of a leakage from the component itself.

NOTE 2 Appliances with an unprotected cooling system are those where at least one part of the cooling system is placed inside a food storage compartment or those which do not comply with 22.106.

NOTE 3 Other types of protection for electrical apparatus for potentially explosive atmospheres covered by the IEC 60079 series are also acceptable.

NOTE 4 Changing of a lamp is not considered a potential explosion hazard, because the door or lid is open during this operation.

Compliance is checked by inspection, by the appropriate tests of IEC 60079-15 and by the following test.

NOTE 5 The tests contained in Annex BB may be carried out using the stoichiometric concentration of the refrigerant used. However, apparatus which has been independently tested and found to comply with Annex BB using the gas specified for group IIA need not be tested.

NOTE 6 Irrespective of the requirement given in 5.4 of IEC 60079-15, surface temperature limits are specified in 22.109.

*The test is performed in a draught-free location with the appliance switched off or operated under conditions of **normal operation** at **rated voltage**, whichever gives the more unfavourable result.*

During a test in which the appliance is operated, gas injection is started at the same time as the appliance is first switched on.

The test is performed twice and is repeated a third time if one of the first tests gives more than 40 % of the lower explosive limit.

Through an appropriate orifice, 80 % of the nominal refrigerant charge ±1,5 g, in the vapour state is injected into a food storage compartment in a time not exceeding 10 min. The orifice is then closed. The injection shall be as close as possible to the centre of the back wall of the compartment at a distance from the top of the compartment approximately equal to one-third of the height of the compartment. Thirty minutes after the injection is completed, the door or lid is opened at a uniform rate in a time between 2 s and 4 s, to an angle of 90° or to the maximum possible, whichever is less.

For appliances having more than one door or lid, the most unfavourable sequence or combination of opening the lids or doors is used.

For appliances fitted with fan motors, the test is performed with the most unfavourable combination of motor operation.

The concentration of leaked refrigerant is measured every 30 s from the beginning of the test, at positions as close as possible to electrical components. However, it is not measured at the positions of

– ***non-self-resetting protective devices*** *necessary for compliance with Clause 19, nor to*
– *intentionally weak parts that become permanently open-circuited during the tests of Clause 19,*

even if they produce arcs or sparks during operation.

The concentration values are recorded until they tend to go down.

The measured value shall not exceed 75 % of the lower explosive limit of the refrigerant as specified in Table 102, and shall not exceed 50 % of the lower explosive limit of the refrigerant as specified in Table 102 for a period exceeding 5 min.

The above test is repeated except that the door or lid is subjected to an open/close sequence at a uniform rate in a time of between 2 s and 4 s, the door or lid being opened to an angle of 90° or to the maximum possible, whichever is less, and closed during the sequence.

22.108 Compression-type appliances which use **flammable refrigerants** shall be constructed so that leaked refrigerant will not stagnate and thus cause a fire or explosion hazard in areas outside the food storage compartments where components producing arcs or sparks or luminaires are mounted.

This requirement does not apply to areas where

– **non-self-resetting protective devices** necessary for compliance with Clause 19 or
– intentionally weak parts that become permanently open circuited during the test of Clause 19

are mounted, even if they produce arcs and sparks during operation.

NOTE 1 Separate components such as thermostats that contain less than 0,5 g of flammable gas are not considered to cause a fire or explosion hazard in the event of a leakage of the component itself.

Compliance is checked by the following test unless luminaires and components that produce arcs and sparks during ***normal operation*** *and which are mounted in the areas under consideration, have been tested and found at least to comply with the requirements in Annex BB for group II A gases or the refrigerant used.*

NOTE 2 Irrespective of the requirements given in 5.4 of IEC 60079-15, surface temperature limits are specified in 22.109.

NOTE 3 Other types of protection for electrical apparatus for potentially explosive atmospheres covered by the IEC 60079 series are also acceptable.

The test is performed in a draught-free location with the appliance switched off or operated under ***normal operation*** *at* ***rated voltage****, whichever gives the more unfavourable result.*

During a test in which the appliance is operated, gas injection is started at the same time as the appliance is first switched on.

A quantity equal to 50 % of the refrigerant charge ±1,5 g is injected into the considered area.

Injection is to be at a constant rate over a period of 1 h and is to be at the point of closest approach of

– *pipe-work joints in external parts of the cooling circuit,*

– *the gaskets of semi-hermetic motor-compressors,*

to the electrical component under consideration. Any direct injection shall be avoided.

NOTE 4 Welded telescopic joints of the motor-compressor, the welding of the pipes through the compressor housing and the welding of the hermetic glass to metal seals (fusite)are not considered to be pipework joints.

The concentration of leaked refrigerant as close as possible to the electrical component is measured continuously from the beginning of the test until it starts to decrease.

The measured value shall not exceed 75 % of the lower explosive limit of the refrigerant as specified in Table 102, and shall not exceed 50 % of the lower explosive limit of the refrigerant as specified in Table 102 for a period exceeding 5 min.

22.109 Temperatures on surfaces that may be exposed to leakage of **flammable refrigerants** shall not exceed the auto-ignition temperature of the refrigerant as specified in Table 102, reduced by 100 K.

Compliance is checked by measuring the appropriate surface temperatures during the tests specified in Clauses 11 and 19.

Temperatures of

– ***non-self-resetting protective devices*** *that operate during the tests specified in Clause 19 or*
– *intentionally weak parts that become permanently open-circuited during the tests specified in Clause 19*

are not measured during those tests specified in Clause 19 that cause these devices to operate.

Table 102 – Refrigerant flammability parameters

Refrigerant number	Refrigerant name	Refrigerant formula	Refrigerant auto-ignition temperature [a,c] °C	Refrigerant lower explosive limit [b,c,d,e] %V/V
R50	Methane	CH_4	~~537~~ 600	4,4
R290	Propane	$CH_3CH_2CH_3$	~~470~~ 450	1,7
R600	n-Butane	$CH_3CH_2CH_2CH_3$	372	1,4
R600a	Isobutane	$CH(CH_3)_3$	~~494~~ 460	~~1,8~~ 1,3

[a] Values for other **flammable refrigerants** can be obtained from ~~IEC 60079-4/IEC 60079-4A and~~ IEC 60079-20-1 and ISO 5149-1.

[b] Values for other **flammable refrigerants** can be obtained from IEC 60079-20-1 and ISO ~~5149~~ 817.

[c] IEC 60079-20-1 is the reference standard. ISO 5149-1 and ISO 817 may be used if the required data is not contained in IEC 60079-20-1.

[d] Concentration of refrigerant in dry air.

[e] In some standards, the term “flammability limit” is used for “explosive limit”.

22.110 The interior of compartments, in appliances with a **free space** which is enclosed by sliding doors or sliding lids, shall be visible from the outside with the doors or lids closed.

Compliance is checked by inspection.

22.111 The doors and lids of compartments in appliances with a **free space** shall be capable of being opened from the inside.

This requirement is not applicable to sliding doors or lids.

Compliance is checked by the following test.

The empty appliance is disconnected from the supply, placed on a horizontal support and levelled in accordance with the instructions for installation, with castors and rollers, if any, oriented, adjusted or blocked so as to prevent the appliance from moving. Locks, if any, on doors or lids are left unlocked.

Doors and lids are closed for a period of 15 min.

A force is then applied to a point, equivalent to an accessible inside point, of each appropriate door or lid of the appliance, at the midpoint of the edge furthest from the hinge axis in the direction perpendicular to the plane of the lid or door.

The force shall be applied at a rate not exceeding 15 N/s and the lid or door shall open before the force exceeds 70 N.

NOTE 1 The force may be applied by means of a spring balance with the aid of a suction pad if necessary, to the point on the outer surface of the door or lid which corresponds to the accessible inside point.

NOTE 2 If the handle of the door or lid is at the mid-point of the edge furthest from the hinge axis, the force may be applied by means of a spring balance to the handle. In this case the value of the force required to open the door or lid from the inside may be determined by the proportional calculation relating to the distances of the handle and the accessible inside point from the hinge axis.

22.112 Drawers which are only accessible after opening a door or lid shall not contain a **free space**.

Compliance is checked by inspection and measurement.

22.113 Drawers which are accessible without opening a door or lid and which contain a **free space** shall

– have an opening in their rear wall that has a height of at least 250 mm and a width of at least two-thirds of the inner width of the drawer;
– be capable of being opened from the inside.

Compliance is checked by inspection and measurement and by the following test which is performed with a weight of 23 kg placed inside the drawer.

The empty appliance is disconnected from the supply, placed on a horizontal support and levelled in accordance with manufacturer's instructions, with castors and rollers, if any, oriented, adjusted or blocked so as to prevent the appliance from moving. Locks, if any, on drawers are left unlocked.

Drawers shall be maintained closed for a period of 15 min.

The opening force is then applied to the drawer of the appliance at the geometrical centre of the front plane of the drawer equivalent to an accessible inside point, in the direction perpendicular to the front plane of the drawer.

The force shall be applied at a rate not exceeding 15 N/s.

The drawer shall open before the force exceeds 70 N.

22.114 Split-system appliances that use a **flammable refrigerant** shall not be fitted with precharged interconnection refrigerant piping.

Compliance is checked by inspection.

23 Internal wiring

This clause of Part 1 is applicable except as follows.

23.3 *Modification*:

Instead of the test being carried out while the appliance is in operation, it is carried out with the appliance disconnected from the supply.

The number of flexings for conductors flexed during normal use is increased to 200 000.

24 Components

This clause of Part 1 is applicable except as follows.

24.1 *Addition:*

Motor-compressors are not required to be separately tested according to IEC 60335-2-34 nor are they required to meet the requirements of IEC 60335-2-34, if they meet the requirements of this standard.

24.1.3 *Addition:*

The number of operations for other switches shall be as follows:

– *quick freeze switches*	*300*
– *manual and semi-automatic defrost switches*	*300*
– *door switches*	*50 000*
– *on/off switches*	*300*

24.1.4 *Addition:*

– ***thermostats*** *which control a motor-compressor*	*100 000*
– ***temperature limiters*** *which control defrosting heaters*	*100 000*
– *motor-compressor starting relays*	*100 000*
– *self resetting thermal motor-protector for motor-compressors*	*minimum 2 000, but not less than the number of operations during the 15-day locked rotor test, whichever is the greater*
– *non-self resetting thermal motor-protectors for motor-compressors*	*50*
– *other automatic thermal motor-protectors except for fan motors*	*2 000*
– *other manual reset thermal motor protectors*	*30*
– *For* ***pressure relief devices*** *of the* ***bursting disc*** *type, three separate samples of the appropriate parts of the refrigeration system are tested and the* ***bursting disc*** *shall operate in the same way for each sample tested*	*1*
– *electrical* ***pressure relief devices***	

- *for automatic operation:*
- *for manual reset* *30 000*

300

*Electrical **pressure relief devices** shall comply with IEC 60730-2-6 and*

– *shall be of type 2B and type 2N;*
– *shall have a trip free mechanism of type 2E;*
– *the deviation and drift shall not exceed + 0%.*

*For **mechanical pressure relief devices** not falling under the scope of IEC 60730, the operating pressure must be no more than the setting of the device plus 10 %.*

***Pressure relief devices** of the **bursting disc** type that are not certified to ISO 4126-2 shall be tested as part of the appliance to 14.3.4 of ISO 4126-2. They shall be marked with:*

– *name, trademark or identification mark of the manufacturer or responsible vendor;*
– *model name or type reference.*

*Replaceable **bursting discs** in **bursting disc assemblies** need only be marked with their operating pressure.*

24.5 *Addition:*

*For starting capacitors, the voltage across the capacitors shall not exceed 1,3 times the voltage rating of the capacitor when the appliance is operating at 1,1 times the **rated voltage**.*

24.7 *Modification:*

For coupling nuts used with hose-sets marked 25 °C max, the 96 h ageing test is carried out at a temperature of

- *32 °C ± 2 °C on hoses sets supplied with appliances of climatic class 0, 1, 2, 3, 4, 6 or 8;*
- *43 °C ± 2 °C on hoses sets supplied with appliances of climatic class 5 or 7.*

24.101 ~~The discharge capacity of the **pressure relief device** shall be such that it is able to release an adequate amount of refrigerant so that the pressure during the release of the refrigerant~~ **Pressure relief devices** shall be such that they are able to operate so that the pressure during abnormal operation of the appliance does not increase beyond the pressure setting of the **pressure relief device,** even if the compressor is operating.

Compliance is checked by validation of the manufacturer's calculations or by an appropriate test.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

Addition:

This clause of Part 1 is not applicable to those parts related to motor-compressors with facilities for connecting a **supply cord**, and complying with the appropriate requirements of IEC 60335-2-34.

25.2 *Modification:*

Replace the requirement by the following.

Mains-operated appliances shall not be provided with more than one means of connection to the supply unless

– the appliance consists of two or more completely independent units built together in one enclosure;
– the relevant circuits are adequately insulated from each other.

26 Terminals for external conductors

This clause of Part 1 is applicable except as follows.

Addition:

This clause of Part 1 is not applicable to those parts of motor-compressors with facilities for connecting a **supply cord** and complying with the appropriate requirements of IEC 60335-2-34.

27 Provision for earthing

This clause of Part 1 is applicable except as follows.

Addition:

Compliance is not checked on parts related to motor-compressors if the motor-compressor complies with IEC 60335-2-34.

28 Screws and connections

This clause of Part 1 is applicable except as follows.

Addition:

Compliance is not checked on parts related to motor-compressors if the motor-compressor complies with IEC 60335-2-34.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable except as follows.

Addition:

Compliance is not checked on parts related to motor-compressors if the motor-compressor complies with IEC 60335-2-34. For motor-compressors not complying with IEC 60335-2-34, the additions and modifications specified in IEC 60335-2-34 are applicable.

29.2 *Addition:*

Unless insulation is enclosed or located so that it is unlikely to be exposed to pollution by condensation due to normal use of the appliance, insulation in appliances is in Pollution Degree 3 and shall have a CTI value of not less than 250.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.1 *Addition:*

NOTE 101 **Accessible parts** of non-metallic material within the storage compartment are regarded as external parts.

The ball pressure test is not applied to parts related to the motor-compressor if the motor-compressor complies with IEC 60335-2-34.

NOTE 102 The temperature rises attained during the test of 19.101 are not taken into account.

Modification:

*For **accessible parts** of non-metallic material within the food storage compartment, the temperature of 75 °C ± 2 °C is replaced by 65 °C ± 2 °C.*

30.2 *Addition:*

These tests are not applied to parts related to the motor-compressor if the motor-compressor complies with IEC 60335-2-34 with no ignition.

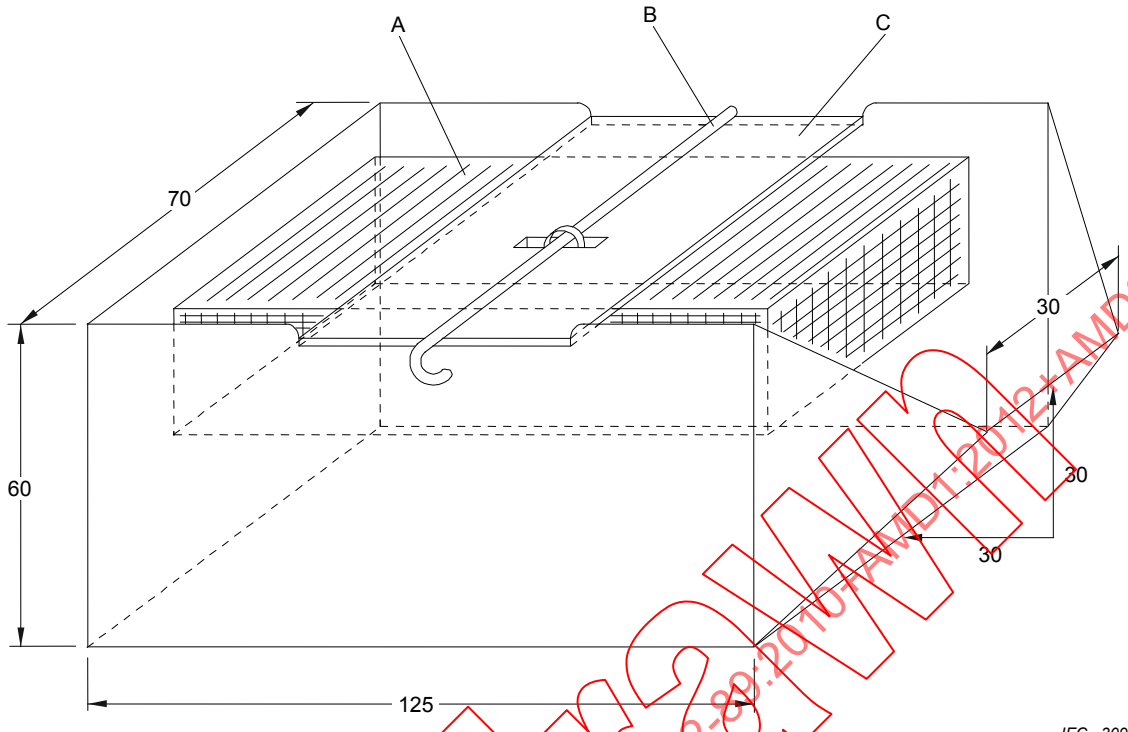
30.2.2 Not applicable.

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is not applicable.



Dimensions in millimetres

This displacement block has a volume of 140 ml ± 5 ml and a mass of 200 g ± 10 g.

Its dimensions are approximately 112 mm × 50 mm × 25 mm.

The dimensions of the vessel are the inside dimensions and the tolerance is ±2 mm.

(See 15.102)

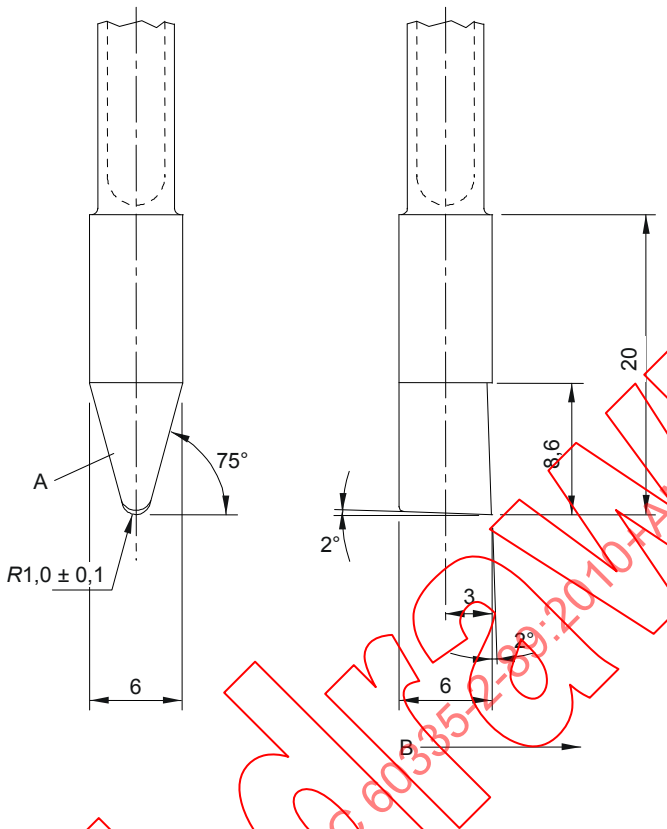
Key

A Displacement block

B Release pin

C Removeable bridge support

Figure 101 – Apparatus for spillage test



Dimensions in millimetres

(See 22.106.2)

Key

A Hard-soldered carbide tip K10

B Direction of movement

Figure 102 – Scratching tool tip details

Annexes

The annexes of Part 1 are applicable except as follows.

Annex C
(normative)

Ageing test on motors

This annex of Part 1 is applicable except as follows.

Addition:

This annex does not apply to motor-compressors.

Annex D
(normative)

Thermal motor protectors

This annex of Part 1 is applicable except as follows.

Addition:

This annex does not apply to motor-compressors or condenser fan motors.

Annex P
(informative)

Guidance for the application of this standard to appliances used in warm damp equable climates

This annex of Part 1 is applicable except as follows.

5 General conditions for the tests

5.7 *Modification:*

The ambient temperature of the tests of Clause 10, 11 and 13 is 43 °C ±1 °C.

11 Heating

11.8 *Modification:*

The values of Table 3 are reduced by 18 K.

Annex AA
(normative)

Locked-rotor test of fan motors

The winding of a fan motor shall not reach excessive temperatures if the motor locks or fails to start.

Compliance is checked by the following test.

The fan and its motor are mounted on wood or similar material. The motor's rotor is locked. Fan blades and motor brackets are not removed.

*The motor is supplied at **rated voltage**. The supply circuit is given in Figure AA.1.*

*The assembly is to operate under these conditions for 15 days (360 h) unless the **protective device**, if any, permanently open circuits prior to the expiration of that time. In this case, the test is discontinued.*

If the temperature of motor windings stays lower than 90 °C, the test is discontinued when steady conditions are established.

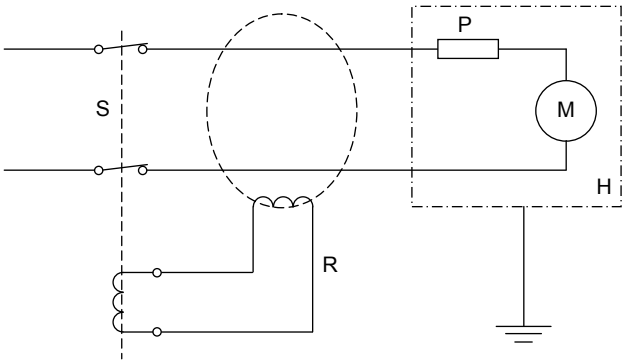
Temperatures are measured under conditions specified in 11.3.

During the test, winding temperatures shall not exceed the values given in Table 8.

After a period of 72 h from the beginning of the test, the motor shall withstand the electric strength test of 16.3.

A residual current device with a rated residual current of 30 mA is connected so as to disconnect the supply in the event of an excessive earth leakage current.

*At the end of the test, the leakage current is measured between windings and the body at a voltage equal to twice the **rated voltage**; its value shall not exceed 2 mA.*



IEC 311/10

Key

S Supply source

H Housing

R Residual current device ($I_{\Delta n}$ = 30 mA)

P Thermal motor-protector (external or internal) if fitted

M Motor

NOTE 1 The circuit must be modified for three-phase fan motors.

NOTE 2 Care has to be taken to complete the earthing system to permit the correct operation of the residual current device (RCCB/RCBO).

Figure AA.1 – Supply circuit for locked-rotor test of a single-phase fan motor

Annex BB
(normative)

Non-sparking “n” electrical apparatus

Where reference is made to IEC 60079-15, the following clauses are applicable as modified below.

21 Supplementary requirements for non-sparking luminaires

All of the subclauses of Clause 21 are applicable, except subclauses 21.2.5.1, 21.2.5.5, 21.2.7, 21.2.8, 21.2.9, 21.2.10, 21.2.11, 21.2.12 and 21.3.

26 General supplementary requirements for apparatus producing arcs, sparks or hot surfaces

Clause 26 is applicable.

27 Supplementary requirements for enclosed-break devices and non-incendive components producing arcs, sparks or hot surfaces

Clause 27 is applicable.

28 Supplementary requirements for hermetically sealed devices producing arcs, sparks or hot surfaces

Clause 28 is applicable.

29 Supplementary requirements for sealed devices or encapsulated devices producing arcs, sparks or hot surfaces

All of the subclauses of 29 are applicable, except 29.1 and 29.8, which are replaced by the following.

29.1 Non-metallic materials

Seals are tested using 33.5. However if the device is tested in the appliance, then 33.5.1 and 33.5.2 are not applicable. However, after the tests of Clause 19 in IEC 60335-2-89, an inspection shall reveal no damage of the encapsulation, such as cracks in the resin or exposure of encapsulated parts that could impair the type of protection.

29.8 Type tests

The type tests described in 33.5 shall be performed where relevant.

30 Supplementary requirements for energy-limited apparatus and circuits producing arcs, sparks or hot surfaces

All of the subclauses of Clause 30 are applicable, except subclauses 30.5, 30.6 and 30.10.

31 Supplementary requirements for restricted-breathing enclosures protecting apparatus producing arcs, sparks or hot surfaces

All of the subclauses of Clause 31 are applicable, except 31.6, which is replaced by the following:

~~31.6 Maintenance considerations~~

~~Restricted-breathing enclosures shall be type tested, including the cable entry devices.~~

Where reference is made to IEC 60079-15, the following clauses are applicable as modified below.

11 Supplementary requirements for non-sparking luminaires

All of the subclauses of Clause 11 are applicable, except 11.2.4.1, 11.2.4.5, 11.2.5, 11.2.6, 11.2.7, 11.3.4, 11.3.5, 11.3.6 and 11.4.

16 General supplementary requirements for apparatus producing arcs, sparks or hot surfaces

Clause 16 is applicable.

17 Supplementary requirements for enclosed-break devices and non-incendive components producing arcs, sparks or hot surfaces

Clause 17 is applicable.

18 Supplementary requirements for hermetically sealed devices producing arcs, sparks or hot surfaces

Clause 18 is applicable.

19 Supplementary requirements for sealed devices producing arcs, sparks or hot surfaces

All of the subclauses of Clause 19 are applicable, except 19.1 and 19.6, which are replaced by the following.

19.1 Non-metallic materials

Seals are tested using 22.5. However, if the device is tested in the appliance, then 22.5.1 and 22.5.2 are not applicable. After the tests of Clause 19 in IEC 60335-2-89, by inspection, no damage that could impair the type of protection shall be evident.

19.6 Type tests

The type tests described in 22.5 shall be performed where relevant.

20 Supplementary requirements for restricted-breathing enclosures protecting apparatus producing arcs, sparks or hot surfaces

Clause 20 is applicable.

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60079 (all parts), *Explosive atmospheres*[2)]

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

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

~~ISO 13732-1 *Ergonomics of the thermal environment – Methods for the assessment of human responses to contact with surfaces – Part 1: Hot surfaces*~~

ISO 23953-2, *Refrigerated display cabinets – Part 2: Classification, requirements and test conditions*

2) Previously the title of this series was IEC 60079, *Electrical apparatus for explosive gas atmospheres.*.

IEC 60335-2-89

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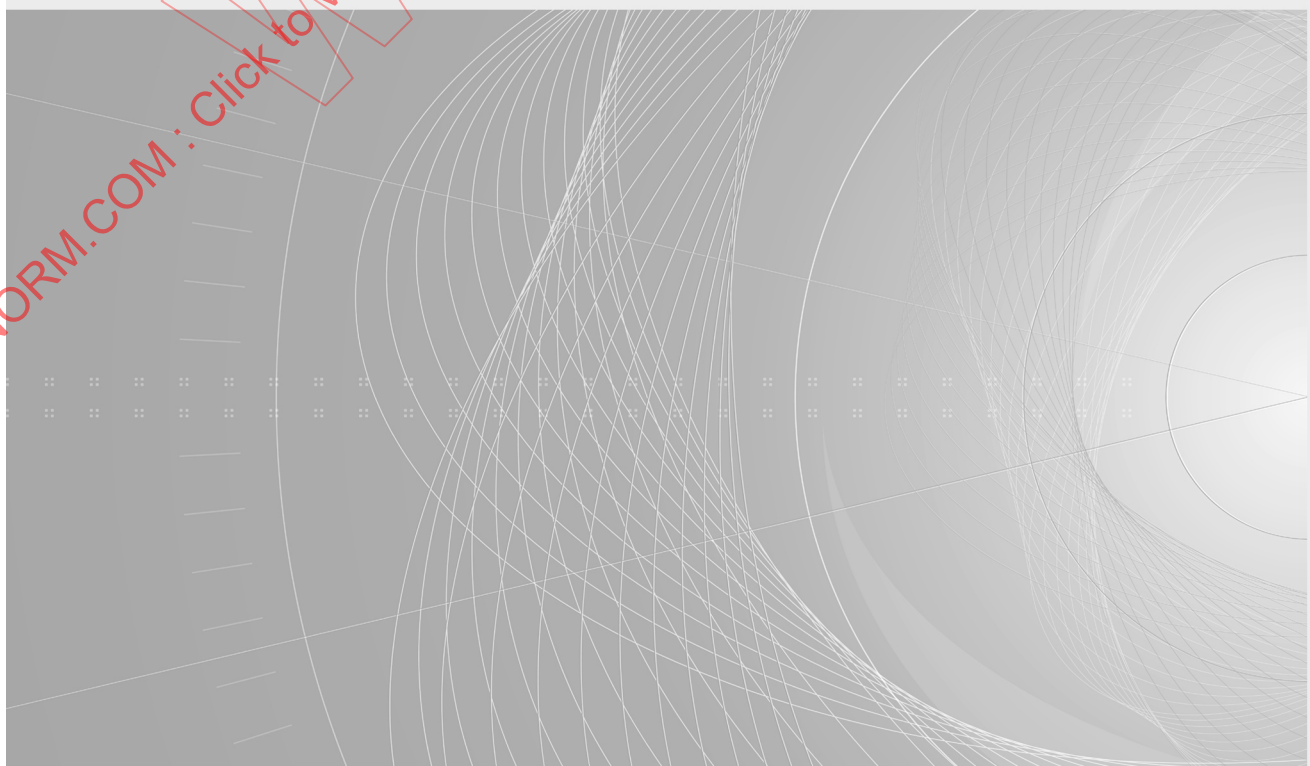
Household and similar electrical appliances – Safety – Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor



IEC 60335-2-89:2010-02+AMD1:2012-07+AMD2:2015-05 CSV(en)

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by subcommittee 61C: Safety of refrigeration appliances for household and commercial use, of technical committee 61: Safety of household and similar electrical appliances

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
61C/562/ISH	61C/571/RVISH

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

SC 61C interpretation sheet on: Pressure relief devices used in transcritical refrigeration systems

Introduction

Requirements for refrigeration systems that use transcritical refrigerants such as CO_2 (R 744) were introduced into the standard in 2010; however at the time few manufacturers saw transcritical refrigerants as a future progression. It is only recently that commercial refrigerating appliances using such systems are being developed and as a result some clarification of the standard is required due to practicalities of technology being applied.

There is a requirement in 22.103 that appliances employing **a transcritical refrigeration system** shall include a **pressure relief device** in the high pressure side of the refrigeration system. The intent of this device is to prevent the pressure of the system exceeding the **design pressure** should a malfunction occur, such as a failure of the gas cooler fan motor.

A pressure test is carried out on the system with the **pressure relief device** rendered inoperative to ensure that the high side of the system and components can withstand at least 3 times the **design pressure** or as a minimum the high side pressure specified in IEC 60335-2-34, which in the case of R 744 (CO_2) is 420 bar (42 MPa).

The **pressure relief device** is defined in 3.111 as a “pressure sensing device intended to reduce pressure automatically when pressures within the refrigeration system exceed the setting pressure of the device”.

As per the text of 22.103 the operating pressure of the pressure relief device shall be no higher than the **design pressure** of the high pressure side. The component test parameters for several different types of **pressure relief device** such as mechanical, electrical and those of the burst disc type are listed in the addition of 24.1.4.

Questions

On the basis that the **pressure relief device** can maintain the **design pressure** by either venting refrigerant from the refrigeration system or by automatically shutting down the pressure generating element (the compressor),

1) How to apply the second paragraph of 22.103 where the pressure is controlled by automatically shutting down the pressure generating element (the compressor).

2) Subclause 24.101 specifies requirements to ensure that the discharge capacity of the pressure relief device is adequate and which can be verified by calculation or by a test. In the case of an electrical pressure relief device that automatically shuts down the compressor instead of externally venting refrigerant is this clause relevant?

Relevant text from IEC 60335-2-89:

The second paragraph of 22.103 states in regard to the mounting of the pressure relief device: "*The **pressure relief device** shall be mounted so that the refrigerant released from the system cannot cause any harm to the user of the appliance. The aperture shall be located so that it is unlikely to be obstructed in normal use.*"

Subclause 24.101 states:

24.101 The discharge capacity of the **pressure relief device** shall be such that it is able to release an adequate amount of refrigerant so that the pressure during the release of the refrigerant does not increase beyond the pressure setting of the **pressure relief device,** even if the compressor is operating.

Compliance is checked by validation of the manufacturer's calculations or by an appropriate test.

ANSWERS

1) The second paragraph of 22.103 is not relevant where the pressure is controlled by automatically shutting down the pressure generating element (the compressor) since the pressure is not controlled by releasing refrigerant from the system.

2) Subclause 24.101 is not relevant to a pressure relief device that senses pressure and shuts down the compressor automatically if the system high side pressure exceeds the high side design pressure since such a device does not have a discharge capacity.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor

FOREWORD

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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 consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

IEC 60335-2-89 edition 2.2 contains the second edition (2010-02) [documents 61C/208/FDIS and 61C/211/RVD], its amendment 1 (2012-07) [documents 61C/507/FDIS and 61C/510/RVD] and its amendment 2 (2015-05) [documents 61C/598/FDIS and 61C/604/RVD].

This Final version does not show where the technical content is modified by amendments 1 and 2. A separate Redline version with all changes highlighted is available in this publication.

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.

The principal changes in this edition as compared with the first edition of IEC 60335-2-89 are as follows (minor changes are not listed):

– aligns the text with IEC 60335-1, and its Amendments 1 and 2;
– introduces requirements for appliances using transcritical refrigerant systems (3.107, 3.108, 3.109, 3.110, 3.111, 7.1, 7.6, 7.12.1, 22.103, 24.1.4, 24.102)
– introduces an enhanced flexing test (23.3)

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 fourth edition (2001) 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.

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.

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 following differences exist in the countries indicated below.

– 22.101: E12 and E17 lamp holders are checked as specified for E14 and B15 lamp holders. E26 lamp holder is checked as specified for E27 and B22 lamp holders (Japan).
– 22.109: For unsealed glass tube heaters, the temperature requirements are different (Japan).

The committee has decided that the contents of the base publication and its amendments 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.

The contents of the interpretation sheet of July 2014 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.

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.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard specifies safety requirements for electrically operated commercial refrigerating appliances that have an incorporated compressor or that are supplied in two units for assembly as a single appliance in accordance with the manufacturer's 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.

As far as is practicable, this standard deals with the common hazards presented by these types of appliances.

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

NOTE 102 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;
– in many countries, additional requirements are specified by national authorities.

NOTE 103 This standard does not apply to

– domestic refrigerating appliances (IEC 60335-2-24)
– industrial refrigerating systems;
– motor-compressors (IEC 60335-2-34);
– commercial dispensing appliances and vending machines (IEC 60335-2-75);
– commercial ice-cream appliances;
– commercial ice makers;
– cold temperature rooms;
– multiple refrigerated chambers with a remote compressor.

NOTE 104 Appliances with a charge of more than 150 g of **flammable refrigerant** in each separate refrigerant circuit are not covered by this standard. For appliances with a charge greater than 150 g of **flammable refrigerant** in each refrigerant circuit and for the installation, ISO 5149-1 may be applied. Consequently, such appliances cannot be assessed for safety using this part 2.

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 60079-4, *Electrical apparatus for explosive gas atmospheres – Part 4: Method of test for ignition temperature*

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

IEC 60079-20-1, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

IEC 60335-2-5, *Household and similar electrical appliances – Safety – Part 2-5: Particular requirements for dishwashers*

IEC 60335-2-34:2002, *Household and similar electrical appliances – Safety – Part 2-34: Particular requirements for motor-compressors*
Amendment 1 (2004)
Amendment 2 (2008)[1)]

ISO 817, *Refrigerants – Designation and safety classification*

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs in workplaces and public areas*

ISO 4126-2:2003, *Safety devices for protection against excessive pressure – Bursting disc safety devices*

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

ISO 7010:2011, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.9 *Replacement:*

normal operation
operation of the appliance under the following conditions:

Refrigerating 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 which 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 instruction.

For appliances with a separate **refrigerant unit,** the **refrigerant unit** is connected to the cabinet in accordance with the manufacturer's instructions.

1) There exists a consolidated edition 4.2 (2009) that includes Edition 4 and its Amendment 1 and Amendment 2.

3.101
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**

3.102
ancillary heating element
heating device which performs an auxiliary function, such as a defrost heater, door heater or anti-condensation heater

3.103
skilled 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 his or herself or other persons

3.104
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

3.105
flammable refrigerant
refrigerant with a flammability classification of group 2 or 3 in accordance with ISO 5149-1

NOTE For refrigerant blends which have more than one flammability classification, the most unfavourable classification is taken for the purposes of this definition.

3.106
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. 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

3.107
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

3.108
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 A gas cooler is normally used in **transcritical refrigeration systems**.

3.109
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**.

3.110
bursting disc
disc or foil which bursts at a predetermined pressure to reduce a pressure in a refrigeration system

3.111
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

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 which 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.

The hazard due to ignition of leaked **flammable refrigerant** by an external potential ignition source associated with the environment in which the appliance is installed is compensated for by the low probability of ignition.

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 22.107.

Unless the motor-compressor complies with IEC 60335-2-34, at least one additional specially prepared sample is required for the tests of 22.103.

NOTE 101 Unless the motor-compressor complies with IEC 60335-2-34, at least one additional specially prepared sample may be required for the test of 19.1.

NOTE 102 At least one additional sample of the fan motor, thermal motor protector combination may be required for the test of 19.1.

NOTE 103 The test of 22.7 may be performed on separate samples.

NOTE 104 Due to the potentially hazardous nature of the tests of 22.107, 22.108 and 22.109, special precautions may need to be taken when performing the tests.

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:*

Tests in accordance with Clauses 10, 11 and 13 are performed at an ambient temperature of

– *32 °C ± 2 °C on appliances of climatic class 0, 1, 2, 3, 4, 6 or 8;*
– *43 °C ± 2 °C on appliances of 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 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.

5.10 *Addition:*

For the tests of 22.107, 22.108 and 22.109, the appliance is empty and 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 for installation that a free distance shall be observed from the walls or the ceiling, in which case this distance is observed during the test.*

*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 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 which use **flammable refrigerants** and which, according to the instructions, may be used with other electrical appliances inside a food storage compartment, are tested with such recommended appliances incorporated and in operation as they would be in normal use.*

NOTE Examples of such electrical appliances are ice-cream makers and deodorizers.

6 Classification

This clause of Part 1 is applicable except as follows.

6.101 Refrigerated display and storage cabinets shall be at least one of the following climatic classes:

– appliance of class 0;
– appliance of class 1;
– appliance of class 2;
– appliance of class 3;
– appliance of class 4;
– appliance of class 5;
– appliance of class 6;
– appliance of class 7;
– appliance of class 8.

Compliance is checked by inspection.

NOTE The climatic classes are specified in ISO 23953-2.

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:

– the power input, in watts, of heating systems, if greater than 100 W;
– the defrosting power input, in watts, if the current corresponding to the defrosting power input is greater than the **rated current** of the appliance;
– one or more of the numerals; 0, 1, 2, 3, 4, 5, 6, 7 or 8, indicating the climatic class of the appliance;
– for incandescent lamps, the maximum rated wattage of the lamp, in watts;
– for discharge lamps, the rated wattage of the lamp, in watts;
– the total mass of refrigerant for each separate refrigerant circuit;
– for a single component refrigerant, at least one of the following:
  - the chemical name,
  - the chemical formula,
  - the refrigerant number;
– for a blended refrigerant, at least one of the following:
  - the chemical name and nominal proportion of each of its components,
  - the chemical formula and nominal proportion of each of its components,
  - the refrigerant number and nominal proportion of each of its components,
  - the refrigerant number of the refrigerant blend.
– the chemical name or refrigerant number of the principal component of the insulation blowing gas.

Refrigerent numbers shall be quoted in accordance with ISO 817.

NOTE 101 Pipe insulation or small items of insulation are not required to be marked.

Appliances which use **flammable refrigerants** shall be marked with the symbol ISO 7010 W021.

Appliances employing R-744 in a **transcritical refrigeration system** shall be marked with the substance of the following:

> WARNING: System contains refrigerant under high pressure. Do not tamper with the system. It must be serviced by qualified persons only.

Appliances employing R-744 in a **transcritical refrigeration system** shall be marked with symbol ISO 7000-1701 (2004-01).

Appliances without automatic liquid-level control and which are intended to be connected to the water supply mains or to be filled with liquid by the user shall be marked with the maximum liquid level.

7.6 *Addition:*

Symbol ISO 7010 W021 Warning; Risk of fire / flammable materials

Symbol ISO 7000-1701 (2004-01) Pressure

NOTE The rules for warning signs in ISO 3864-1 apply to the colour and shape of the symbol ISO 7010 W021.

7.12 *Modification:*

The instructions concerning persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge and children playing with the appliance are not required.

Addition:

The instructions shall contain information regarding the maximum loading of each type of shelf.

The instructions shall state the substance of the following:

> Do not store explosive substances such as aerosol cans with a flammable propellant in this appliance.

If symbol ISO 7000-1701 (2004-01) is used, its meaning shall be explained.

For appliances which use **flammable refrigerants**, the instructions shall include information pertaining to the handling, servicing and disposal of the appliance.

The instructions for appliances which use **flammable refrigerants** shall include the substance of the following warnings:

– WARNING: Keep clear of obstruction all ventilation openings in the appliance enclosure or in the structure for building-in.

– WARNING: Do not use mechanical devices or other means to accelerate the defrosting process, other than those recommended by the manufacturer.

– WARNING: Do not damage the refrigerant circuit.

NOTE 101 This warning is only applicable for appliances with refrigerating circuits which are accessible by the user.

– WARNING: Do not use electrical appliances inside the food storage compartments of the appliance, unless they are of the type recommended by the manufacturer.

For appliances which use flammable insulation blowing gases, the instructions shall include information regarding disposal of the appliance.

For appliances provided with double-capped fluorescent lamps, the instructions shall include the information that lamps have to be replaced by identical lamps only.

An explanation shall be given of the meaning of the alpha-numeric characters, indicating the climatic class of the appliance, that are marked on the appliance.

The instructions for split-systems that use a **flammable refrigerant** shall include the substance of the following warning.

WARNING: In order to reduce flammability hazards the installation of this appliance must only be carried out by a suitably qualified person.

If symbol ISO 7010 W021 is used, its meaning shall be explained.

7.12.1 *Addition:*

For appliances with a separate **refrigerant unit**, the instructions shall include a statement containing the substance of the following:

The installation of the appliance and the **refrigerant unit** must only be made by the manufacturer's service personnel or similarly **skilled person**.

The information provided with an appliance with a separate **refrigerant unit** shall include

– information on the type of separate **refrigerant unit** to which the cabinet shall be connected;
– an electrical diagram showing the electrical terminals for connections.

In appliances employing R-744 in a **transcritical refrigeration system** the instructions shall include the substance of the following

WARNING: The refrigeration system is under high pressure. Do not tamper with it. Contact qualified service personal before disposal.

For appliances intended for connection to a water supply for cooling purposes, the instructions shall contain information on the maximum permitted temperature of the inlet water consistent with safe operation of the appliance.

7.14 *Addition:*

The height of the triangle in the symbol ISO 7010 W021 shall be at least 15 mm.

The height of the letters used for the marking of the type of flammable insulation blowing gas shall be at least 40 mm.

7.15 *Addition:*

The marking of the wattage of illuminating lamps shall be easily discernible while the lamp is being replaced.

For appliances which use **flammable refrigerant**, the marking of the type of **flammable refrigerant** and of the flammable insulation blowing gas, shall be visible when gaining access to the motor-compressors, and, in the case of appliances with a remote **refrigerant unit**, the pipe connections.

The symbol ISO 7010 W021 shall be placed on the nameplate of the unit near the declaration of the refrigerant type and charge information, It shall be visible after installation of the appliance.

7.101 Equipotential bonding terminals shall be indicated by the symbol IEC 60417-5021 (2002-10).

These indications shall not be placed on screws, removable washers or other parts which can be removed when conductors are being connected.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1.1 *Addition:*

*Where an appliance has parts which require adjustment under operating conditions by a **skilled person** after removal of **non-detachable parts**, **live parts** shall not be accessible and they shall be protected at least by **basic insulation**.*

NOTE 101 Examples of adjustable parts are inaccessible **thermostats**, **temperature limiters** and thermostatic expansion valves.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.2 *Modification:*

Instead of the last paragraph of the test specification, the following applies.

The appliance is operated for a period of 1 h and excluding starting current, the maximum value of the current, averaged over any 5 min period, is obtained. The interval between current measurements shall not exceed 30 s.

NOTE Starting current is considered to be excluded if the first current measurement is made approximately 1 min after starting.

10.101 The power input of a defrosting system shall not deviate from the defrosting power input marked on the appliance by more than the deviation shown in Table 1.

*Compliance is checked by operating the appliance at **rated voltage** for the duration of the defrosting period and measuring the maximum value of the current, averaged over any representative 5 min period. The interval between current measurements shall not exceed 30 s.*

11 Heating

This clause of Part 1 is applicable except as follows.

11.1 *Replacement:*

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

Compliance is checked by determining the temperature rise of the various parts under the conditions specified in 11.2 to 11.7.

If the temperature rise of any part exceeds the value given in 11.8, compliance is checked by the test of 11.101.

For appliances incorporating ***ancillary heating elements****, compliance is checked by the tests of 11.102 and 11.103.*

11.2 *Replacement:*

Built-in appliances *are installed in accordance with the instructions for installation.*

Other appliances are placed in a test enclosure, the walls enclosing the appliance as closely as possible to all its sides and top surface, unless the manufacturer indicates in the instructions for installation that a free distance shall be observed from the walls or the ceiling, in which case this distance is observed during the test.

Dull black painted plywood approximately 20 mm thick is used for the test corner, the supports and for the installation of ***built-in appliances*** *and the test enclosure for other appliances.*

11.7 *Replacement:*

The appliance is operated until steady conditions are established.

11.8 *Modification:*

Replace the text above Table 3 by the following:

During the test, ***protective devices*** *other than self-resetting thermal motor-protectors for motor-compressors shall not operate. When steady conditions are established, thermal motor-protectors for motor-compressors shall not operate.*

During the test, sealing compound, if any, shall not flow out.

During the test, the temperature rises are monitored continuously.

For appliances of climatic classes 0, 1, 2, 3, 4, 6 or 8, the temperature rises shall not exceed the values given in Table 3.

For appliances of class 5 or 7, the temperature rises shall not exceed the values given in Table 3, reduced by 7 K.

Addition:

For motor-compressors not conforming to IEC 60335-2-34 (including its Annex AA), the temperatures of

– *housings of motor-compressors and*

– *windings of motor-compressors*

shall not exceed the values given in Table 101.

For motor-compressors conforming to IEC 60335-2-34 (including its Annex AA), the temperatures of their

– *housings of motor-compressors,*

– *windings of motor-compressors and*

– *other parts such as its protection system and control system, and all other components that have been tested together with the motor-compressor during the tests of IEC 60335-2-34 and its Annex AA*

are not measured.

The entry in Table 3 relating to the temperature rise of the external enclosure of ***motor-operated appliances*** *is applicable to all appliances covered by this standard. However, it is not applicable to those parts of the external enclosure of the appliance that are,*

– *for* ***built-in appliances****, not* ***accessible parts*** *after installation in accordance with the instructions for installation;*

– *for other appliances, on that part of the appliance that according to the instructions for installation is intended to be placed against a wall with a free distance not exceeding 75 mm.*

Table 101 – Maximum temperatures for motor-compressors

Part of the motor-compressor	***Temperature*** °C
Windings with	
– synthetic insulation	*140*
– cellulose insulation or the like	*130*
Housing	*150*

The temperature of ballast windings and their associated wiring shall not exceed the values specified in Subclause 12.4 of IEC 60598-1, when measured under the conditions stated.

11.101 *If the temperature of any part of the appliance is higher than the required limits given in 11.8, the test is performed again, the* ***thermostats*** *or similar control devices being set at the lowest temperature with the short circuit removed.*

11.102 *The appliance is supplied at the most unfavourable voltage between 0,94 and 1,06 times the* ***rated voltage****. If the defrosting time is controlled by an adjustable device, the device is set to the time given by the manufacturer.*

If a control device is used which stops the defrosting at a given temperature or pressure, the defrosting period is automatically terminated when the control operates.

The temperatures and temperature rises shall not exceed the values given in Tables 3 and 101.

11.103 ***Ancillary heating elements*** *are energized with the refrigerating system switched off, if this is possible in normal use. They are supplied at 1,15 times their power input rating, until steady conditions are reached.*

*Temperature rises are measured by thermocouples fixed on the outside surface of the insulation of the **ancillary heating element**.*

Temperature rises shall not exceed the values specified in 11.8.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.2 *Addition*

For appliances which are directly connected to the water supply, the water container, or that part of the appliance which serves as the container, is filled with water as in normal use. The inlet valve is then held open and the filling is continued for 5 min after first evidence of spillage.

Where no spillage occurs due to the operation of a device that prevents such spillage, the inlet valve is held open for a further 5 min following the operation of this device.

15.101 Appliances subject to spillage of liquid from containers on the inside walls of the cabinet or compartment, or on the top of the cabinet, shall be constructed so that such spillage does not affect their electrical insulation.

Compliance is checked by the relevant tests of 15.102 and 15.103.

15.102 *The apparatus shown in Figure 101 is filled with water, containing approximately 1 % NaCl and 0,6 % of acid rinsing agent as specified in Annex AA of IEC 60335-2-5, to the level of the lip. The displacement block is supported just above the water by means of any suitable release mechanism and bridge support.*

All shelves and containers which can be removed without the use of a tool are removed and the appliance is disconnected from the supply. Lamp covers are not removed.

The apparatus is supported with its base horizontal, and so positioned and at such a height that the water is discharged over the back and side interior walls of the cabinet or compartment, including any electrical components mounted thereon, in the most unfavourable manner when the release mechanism is operated.

The test is made only once with the apparatus in any one position, but the test may be repeated as many times as necessary in different positions, provided that there is no residual water on parts wetted by a previous test.

*Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation which could result in a reduction of **clearances** and **creepage distances** below the values specified in Clause 29.*

Furthermore, if the inspection shows that water is in contact with the defrost heating element or its insulation, it shall withstand the test of 22.102.

15.103 *Appliances, other than **built-in appliances**, are tilted at an angle of up to 2° to the position of normal use in the direction which is likely to be the most unfavourable for this test. The appliance is disconnected from the supply and the controls are set to the on position. From a height of approximately 50 mm, 0,5 l of water, containing approximately 1 % NaCl and 0,6 % of acid rinsing agent as specified in Annex AA of IEC 60335-2-5, is poured uniformly in approximately 60 s over any surface of the appliance with less than 2° inclination to the horizontal. Only surfaces measuring more than 60 mm in at least one direction, and less than 2,2 m above the floor are taken into consideration.*

*Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation which could result in a reduction of **clearances** and **creepage distances** below the values specified in Clause 29.*

16 Leakage current and electric strength

This clause of Part 1 is applicable.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is not applicable.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

Addition:

19.1 *Addition*:

In addition, fan motors and their thermal motor-protectors, if any, are subjected to the test of Annex AA.

NOTE 101 For a given type of fan motor, thermal motor-protector combination, this test is performed only once.

Motor-compressors not complying with IEC 60335-2-34 are subjected to the tests of 19.101 and 19.102 of IEC 60335-2-34 and compliance with these tests is checked in accordance with 19.104 of that standard. Unless otherwise specified, compliance with the tests of this clause is checked as described in 19.13, however winding temperatures of motor-compressors are not measured.

NOTE 102 For a given type of motor-compressor this test is performed only once.

19.8 *Addition:*

This test is not applicable to three-phase motor-compressors complying with IEC 60335-2-34.

19.9 Not applicable.

19.101 **Ancillary heating elements** shall be dimensioned and located so that there is no risk of fire even in the case of abnormal operation.

Compliance is checked by the following test.

Doors and lids of the appliance are closed and the refrigerating unit is switched off.

Fans are switched on or off, whichever is more unfavorable

***Ancillary heating elements** are continuously energized at a voltage equal to 1,1 times the **rated voltage** of the appliance, until steady conditions are established. If there is more than one **ancillary heating element**, they are operated each in turn, unless failure of a single component will cause two or more to operate together, in which case they are tested in combination.*

During and after the tests, compliance is checked in accordance with 19.13.

The refrigerating system is not switched off if this prevents the heating elements from operating.

NOTE It may be necessary to short-circuit one or more components, which operate during normal use, to ensure that the **ancillary heating elements** are continuously energized.

19.102 Appliances shall be constructed so that they shall not cause any risk of fire, mechanical hazard or electric shock even in the case of abnormal operation.

*Compliance is checked by applying any defect which may be expected in normal use, while the appliance is operated under conditions of **normal operation** at **rated voltage.** Only one fault condition is reproduced at a time. The tests are made consecutively.*

NOTE 1 Examples of fault conditions are:

– timer stopping in any position;
– disconnection and reconnection of one or more phases of the supply during any part of the cycle;
– open-circuiting or short-circuiting of components;
– failure of a magnetic valve;
– operation with an empty container.

NOTE 2 The main contacts of a contactor intended for switching on and off **ancillary heating elements** in normal use are locked in the on position. However, if two contactors operate independently of each other or if a contactor operates two independent sets of main contacts, these contacts are locked in the on position in turn.

NOTE 3 In general, tests are limited to those cases which may be expected to give the most unfavourable results.

NOTE 4 For the purpose of these tests, thermal controls are not short-circuited.

NOTE 5 Components incorporated in the appliance, other than contactors for **ancillary heating elements**, complying with the relevant IEC standard are not short-circuited, provided the appropriate standard covers the conditions which occur in the appliance.

NOTE 6 For appliances to be connected to the supply water, the tests are made with the tap closed or opened, whichever gives the most unfavourable results. Water level switches complying with IEC 61058 are not short-circuited during the tests.

NOTE 7 The test during which the automatic filling device is held open has already been made during the test of 15.101.

During and after the tests, compliance is checked as described in 19.13.

19.103 Illuminating equipment shall not cause a hazard under abnormal operating conditions.

Compliance is checked by the following test, for which the appliance is empty, the ***refrigerant unit*** *is switched off, and doors or lids are fully opened or closed, whichever is the more unfavourable.*

The complete illuminating equipment including its protective cover, fitted with a lamp as recommended by the manufacturer, is operated for 12 h at 1,06 times the ***rated voltage****.*

If an incandescent lamp does not attain the maximum rated wattage at ***rated voltage****, the voltage is varied until the maximum rated wattage is reached and is then increased to 1,06 times this voltage.*

Illuminating equipment having discharge lamps is operated under the fault conditions specified in items a), d) and e) of subclause 12.5.1 of IEC 60598-1, the appliance being supplied at ***rated voltage*** *until temperature stabilization of the measured parts.*

During and after the test, the appliance shall comply with 19.13.

The temperatures of ballast windings shall not exceed the values specified in 12.5 of IEC 60598-1 when measured under the conditions specified.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 *Modification:*

The appliance is tested empty when tilted through an angle of 5° instead of an angle of 10°.

The test with the appliance tilted to 15° is not carried out.

Addition:

The test is repeated with doors, lids and similar parts placed in the most unfavourable position; however, the appliance is only tilted to an angle of 5°.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

21.1 *Addition:*

NOTE 101 Covers of lamps within the appliance are considered likely to be damaged in normal use. Lamps are not tested.

For ***accessible glass panels*** *which provide insulation for* ***ancillary heating elements*** *of other than* ***class III construction****, the blows applied to the panel are made with the hammer spring adjusted so that the impact energy is 2,00 J ± 0,05 J. For other* ***accessible glass panels*** *the hammer spring is adjusted so that the impact energy is 1,00 J ± 0,05 J.*

21.101 Lamps liable to be accessible to users shall either:

– be subject to the test given in Clause 21; or

– be protected against mechanical shock such that when subjected to the following test for protection against mechanical shock, no contact with the lamp occurs.

Compliance is checked by applying a 75 mm ± 0,5 mm diameter sphere without appreciable force in an attempt to touch the lamp with any lamp cover in place.

The sphere shall not touch the lamp.

21.102 Shelves in appliances for displaying or storing beverages shall have adequate mechanical strength.

Compliance is checked as follows.

Each shelf shall be uniformly loaded in turn with a load/unit area of 25 kg/m^2 for a period of 1 h.

During the test, the shelf deflection shall not exceed 3 mm/meter of shelf width.

The test is then repeated with a uniform load/unit area of 230 kg/m^2 or the maximum load specified by the manufacturer whichever is more onerous. The load is applied for a period of 1 h.

During this test, the shelf shall not fall out of position.

For appliances intended to display or store barrels, this test is repeated a further four times, the load being removed and the reapplied each time.

After the tests, the appliance shall show no damage that could impair compliance with this standard and compliance with 8.1, 15.1 and clause 29 shall not be impaired. In case of doubt, ***supplementary insulation*** *and* ***reinforced insulation*** *are subjected to the electric strength test of 16.3.*

NOTE Damage to the finish, small dents that do not reduce **clearances** or **creepage distances** below the values specified in clause 29, and small chips that do not adversely affect protection against access to **live parts** or moisture, are ignored.

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 *Addition:*

Thermostats, except their temperature sensitive parts, shall not be placed in contact with an evaporator unless they are adequately protected against the effects of condensation appearing on cold surfaces and against the effect of water formed during the defrosting process.

22.7 *Replacement:*

Appliances, including protective enclosures of a protected cooling system, that use **flammable refrigerants** shall withstand:

– a pressure of 3,5 times the saturated vapour pressure of the refrigerant at 70 °C, or equal to 3,5 times the pressure at the critical temperature if this is lower than 70 °C, the test

pressure being rounded up to the next 0,5 MPa (5 bar), for parts exposed to the high side pressure during normal use;

– a pressure of 5 times the saturated vapour pressure of the refrigerant at 20 °C, or equal to 2,5 MPa (25 bar), whichever is the greater, the test pressure being rounded up to the next 0,2 MPa (2 bar) for parts exposed only to low side pressure during normal use.

NOTE 101 Specific constructional requirements of appliances with a protected cooling system are given in 22.106.

NOTE 102 All pressures are gauge pressures.

Compliance is checked by the following test.

The appropriate part of the appliance under test is subjected to a pressure that is gradually increased hydraulically until the required test pressure is reached. This pressure is maintained for 1 min. The part under test shall show no leakage.

NOTE 103 The test is not performed on motor-compressors complying with IEC 60335-2-34.

22.33 *Addition:*

Heating conductors having only one layer of insulation shall not be in direct contact with water or ice during normal use.

NOTE 101 Frozen water is regarded as a conducting liquid.

22.101 Lampholders shall be fixed so that they do not work loose in normal use.

NOTE Normal use includes replacement of the lamp.

Compliance is checked by inspection and by the following tests.

Edison screw and bayonet lampholders are subjected for 1 min to the following torque:

a) 0,15 Nm for E14 and B15 lampholders;

b) 0,25 Nm for E27 and B22 lampholders.

These lampholders shall then withstand a pull test with 50 N, applied for 1 min in the direction of the axis of the lampholder.

After the tests, the lampholders shall not have worked loose.

Lampholders for a fluorescent lamp shall comply with the test of 4.4.4 i) in IEC 60598-1.

22.102 Insulated wire heaters and their joints, located in, and in integral contact with, thermal insulation, shall be protected against entry of water.

Compliance is checked by immersing for a period of 24 h, three samples of the complete heating element in water containing approximately 1 % NaCl and having a temperature of 20 °C ± 5 °C.

A voltage of 1 250 V is then applied for 15 min between live parts of the heating element and the water.

During the test, no breakdown shall occur.

NOTE Connections to electrical terminals are not joints.