

भारतीय मानक

IS 18689 : 2024

Indian Standard

(Superseding IS/IEC 60335-2-89 : 2010)

घरेलू और समान इलेक्ट्रिकल साधित्र —
सुरक्षा — निगमित या रिमोट प्रशीतक इकाई
या मोटर-संपीडक वाले व्यावसायिक प्रशीतन
साधित्र और आइस-मेकर की विशेष अपेक्षाएँ
(IEC 60335-2-89 : 2019, संशोधित)

**Household and Similar Electrical
Appliances — Safety — Particular
Requirements for Commercial
Refrigerating Appliances and Ice-
Makers with an Incorporated or
Remote Refrigerant Unit or
Motor-Compressor**

(IEC 60335-2-89 : 2019, MOD)

ICS 97.130.20

© BIS 2024

© IEC 2019



भारतीय मानक ब्यूरो

BUREAU OF INDIAN STANDARDS

मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002

MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002

www.bis.gov.in www.standardsbis.in

September 2024

Price Group 15

NATIONAL FOREWORD

This Indian Standard which is modified adoption of IEC 60335-2-89 : 2019 'Household and similar electrical appliances — Safety — Part 2-89: Particular requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on recommendation of the Refrigeration and Air Conditioning Sectional Committee and approval of the Mechanical Engineering Division council.

This standard was earlier published as IS/IEC 60335-2-89 : 2010 'Household and similar electrical appliances — Safety: Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor'. The new standard has been taken up to adopt the standard IEC 60335-2-89 : 2019 with modifications.

The IEC standard has been approved for publication as Indian Standard with modifications (see [National Annex DD](#)). Additionally, certain terminologies and conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

- a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'; and
- b) Comma (,) has been used as a decimal marker while in Indian Standards the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standard for which Indian Standard also exist. The corresponding Indian Standard, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

<i>International Standard</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
ISO 817 : 2014 Refrigerants — Designation and safety classification ISO 817 : 2014/AMD 1 : 2017	IS 16656 : 2017/ISO 817 : 2014 Refrigerants — Designation and safety classification	Identical
ISO 4126-2 : 2018 Safety devices for protection against excessive pressure — Bursting disc safety devices	IS 12370 (Part 2) : 2023/ ISO 4126-2 : 2018 Safety devices for protection against excessive pressure: Part 2 Bursting disc safety devices (<i>second revision</i>)	Identical
ISO 5149-1 : 2014 Refrigerating systems and heat pumps — Safety and environmental requirements — Part 1: Definitions, classification and selection criteria ISO 5149-1 : 2014/AMD 1 : 2015	IS 16678 (Part 1) : 2018/ ISO 5149-1 : 2014 Refrigerating systems and heat pumps — Safety and environmental requirements: Part 1 Definitions, classification and selection criteria	Identical
ISO 7010 Graphical symbols — Safety colours and safety signs — Registered safety signs	IS 16451 : 2023/ISO 7010 : 2019 Graphical symbols — Safety colours and safety signs — Registered safety signs (<i>first revision</i>)	Identical

[\(Continued on third cover\)](#)

CONTENTS

INTRODUCTION.....	v
1 Scope	1
2 Normative references	2
3 Terms and definitions	2
4 General requirement.....	5
5 General conditions for the tests	5
6 Classification	6
7 Marking and instructions	7
8 Protection against access to live parts	11
9 Starting of motor-operated appliances	11
10 Power input and current.....	11
11 Heating.....	12
12 Void.....	14
13 Leakage current and electric strength at operating temperature.....	14
14 Transient overvoltages	14
15 Moisture resistance	14
16 Leakage current and electric strength	15
17 Overload protection of transformers and associated circuits	15
18 Endurance	15
19 Abnormal operation	15
20 Stability and mechanical hazards.....	17
21 Mechanical strength	17
22 Construction	19
23 Internal wiring.....	30
24 Components	31
25 Supply connection and external flexible cords	32
26 Terminals for external conductors.....	33
27 Provision for earthing	33
28 Screws and connections	33
29 Clearances, creepage distances and solid insulation	33
30 Resistance to heat and fire	33
31 Resistance to rusting	34
32 Radiation, toxicity and similar hazards	34
Annexes	37
Annex C (normative) Ageing test on motors	38
Annex D (normative) Thermal motor protectors	39
Annex P (informative) Guidance for the application of this standard to appliances used in tropical climates	40
Annex R (normative) Software evaluation	41
Annex AA (normative) Locked-rotor test of fan motors	42
Annex BB (normative) Non-sparking "n" electrical apparatus	44

Annex CC (normative) Test method for determining gas concentration beyond the boundary of the appliance.....	52
Bibliography.....	57
Figure 101 – Apparatus for spillage test.....	42
Figure 102 – Scratching tool tip details	43
Figure AA.1 – Supply circuit for locked-rotor test of a single-phase fan motor	50
Figure CC.1 – Schematic illustration of the refrigerant concentration sampling points	56
Table 101 – Maximum temperatures for motor-compressors	20
Table 102 – Refrigerant flammability parameters	36
Table CC.1 – Relevant properties and mass flux for selected flammable refrigerants	54

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 AND ICE-MAKERS WITH AN INCORPORATED OR REMOTE REFRIGERANT UNIT OR MOTOR-COMPRESSOR

(IEC 60335-2-89 : 2019, MOD)

1 Scope

This clause of Part 1 is replaced by the following.

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

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

- **refrigerated display** and **storage cabinets**;
- refrigerated trolley cabinets;
- service counters and self-service counters;
- blast chillers and blast freezers;
- **commercial ice-makers**.

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

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

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

NOTE 102 Attention is drawn to the fact that

- for appliances intended to be used in vehicles or aboard ships or aircraft, additional requirements can be necessary;
- in many countries, additional requirements are specified by national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

NOTE 103 This standard does not apply to

- appliances using **flammable refrigerant** in **transcritical refrigeration systems**;
- domestic refrigerating appliances (IEC 60335-2-24);
- split systems having a **refrigerant charge** of **flammable refrigerant** exceeding 150 g in any **refrigerating circuit**;
- industrial refrigerating systems;
- motor-compressors (IEC 60335-2-34);
- commercial dispensing appliances and vending machines (IEC 60335-2-75);
- commercial ice-cream appliances;
- cold temperature rooms;
- multiple refrigerated chambers with a remote motor-compressor.

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 60079-7:2015, *Explosive atmospheres – Part 7: Equipment protection by increased safety "e"*

IEC 60079-7:2015/AMD1:2017¹,

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

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

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

IEC 60335-2-34/AMD1:2015

IEC 60335-2-34/AMD2:2016²

IEC 60335-2-34:2021, *Household and similar electrical appliances – Safety – Part 2-34: Particular requirements for motor-compressors*

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

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

ISO 817:2014/AMD1:2017

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

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

ISO 5149-1:2014/AMD1:2015

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

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

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

3.1.9 Replacement:

normal operation

operation of the appliance under the following conditions:

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

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

Appliances are operated at an ambient temperature in accordance with 5.7, empty, with doors or lids closed, or roller blinds closed or open, whichever is the more unfavourable. User adjustable temperature control devices are short-circuited or otherwise rendered inoperative. Devices that are switched, by dew-point controls or clocks, are switched on or off, whichever is the more unfavourable.

For appliances connected to a water supply, the water other than cooling water, is at a temperature of $15\text{ °C} \pm 2\text{ °C}$. The cooling water is at the maximum temperature specified in the instructions.

3.1.101

design pressure

gauge pressure that has been assigned to the high-pressure side of a **transcritical refrigeration system**

Note 1 to entry: The **design pressure** assigned should take into account pressures that could be expected during transportation of the **transcritical refrigeration system**.

3.1.102

refrigerant charge

mass of refrigerant within a **refrigerating circuit**

3.5 Definitions relating to types of appliances

3.5.101

refrigerated display and storage cabinet

cabinet which displays or stores beverages or chilled or frozen foodstuff placed therein and which is cooled by a **refrigerant unit**

3.5.102

ice-maker

appliance in which ice is made by freezing water by a device consuming electrical energy

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

3.6 Definitions relating to parts of an appliance

3.6.101

ancillary heating element

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

3.6.102

free space

space with a volume exceeding 60 l in which a child can be entrapped and which is accessible after opening any door, lid or drawer and removing any **detachable internal part**, including shelves, containers or removable drawers which are themselves only accessible after opening any door or lid

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

3.6.103

gas cooler

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

Note 1 to entry: A **gas cooler** is normally used in **transcritical refrigeration systems**.

3.6.104

refrigerating circuit

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

3.6.105

refrigerant unit

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

3.6.106

transcritical refrigeration system

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

3.6.107

hermetically sealed system

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

3.6.108

critical point

point in a **refrigerating circuit** where **flammable refrigerant** may leak

Note 1 to entry: The following are considered to be **critical points**:

- interconnecting joints between parts of the **refrigerating circuit**;
- pipes with a bend radius, measured along the centre line, of less than 2,5 times the external pipe diameter.

Note 2 to entry: The following are not considered to be **critical points**:

- pipes with a bend radius, measured along the centre line, equal to or greater than 2,5 times the external pipe diameter;
- welded telescopic joints of the motor-compressor;
- welding of the pipes through the motor-compressor housing;
- welding of hermetic glass to metal seals (fusite).

3.7 Definitions relating to safety components

3.7.101

bursting disc

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

3.7.102

pressure relief device

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

3.8 Definitions relating to miscellaneous matters

3.8.101

flammable refrigerant

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

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

3.8.102**qualified person**

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

4 General requirement

This clause of Part 1 is applicable except as follows.

Addition:

NOTE 101 The use of **flammable refrigerants** involves some additional hazards that are not associated with appliances which use non-**flammable refrigerants**.

This standard addresses the hazard due to ignition of leaked **flammable refrigerant** by potential ignition sources associated with the appliance.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.2 Addition:

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

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

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

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

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

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

5.3 Addition:

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

5.7 Addition:

*For **ice-makers**, the tests in accordance with Clauses 10, 11 and 13 are performed at an ambient temperature of $32\text{ °C} \pm 2\text{ °C}$*

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

- $32\text{ °C} \pm 2\text{ °C}$ on appliances of test room climatic class 0, 1, 2, 3, 4, 6 or 8;
- $43\text{ °C} \pm 2\text{ °C}$ on appliances of test room climatic class 5 or 7.

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

Other tests are performed at an ambient temperature of $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

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

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

5.10 Addition:

*For appliances with a remote **refrigerant unit**, the **refrigerant unit** is connected to the cabinet in accordance with the instructions provided with the appliance before testing.*

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

*Appliances, other than **built-in appliances**, are placed in a test enclosure, the walls of which enclose the appliance as closely as possible to all its sides and top surface, unless the manufacturer indicates in the instructions that a free distance shall be observed from the walls or the ceiling, in which case this distance is observed during the test. If the appliance has a remote **refrigerant unit** or motor-compressor, then only the **refrigerated display and storage cabinet** is installed in the test enclosure, the remote **refrigerant unit** or motor-compressor is placed on the floor of the test corner away from walls.*

*For appliances incorporating remote **refrigerant units** or remote motor-compressors, the refrigerant line between the **refrigerant unit** or motor-compressor and the **refrigerated display and storage cabinet** shall have a length of 5 m to 7,5 m. The refrigerant line shall be installed with thermal insulation applied in accordance with the instructions. If the appliance employs R-744 refrigerant in a **transcritical refrigeration system**, a **pressure relief device** shall be installed on the high-pressure side between the motor-compressor and the **gas cooler** unless it is pre-fitted to the motor-compressor.*

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

NOTE An example of such electrical appliances are deodorizers.

***Ice-makers** that use **flammable refrigerants** and that, according to the instructions, may be used in conjunction with accessories such as ice-bins are tested with such recommended accessories installed and in operation as they would be in normal use.*

6 Classification

This clause of Part 1 is applicable except as follows.

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

- test room climate class 0;
- test room climate class 1;
- test room climate class 2;

- test room climate class 3;
- test room climate class 4;
- test room climate class 5;
- test room climate class 6;
- test room climate class 7;
- test room climate class 8.

Compliance is checked by inspection.

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

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 Modification:

Replace the third dash by:

- **rated current**, in amperes;

Addition:

- power input, in watts, of heating systems, if greater than 100 W;
- defrosting power input, in watts, if the current corresponding to the defrosting power input is greater than the **rated current** of the appliance;
- one or more of the numerals; 0, 1, 2, 3, 4, 5, 6, 7 or 8, indicating the test room climatic class for **refrigerated display and storage cabinets**;
- for lamps, the rated wattage of the lamp, in watts;
- **refrigerant charge** for each **refrigerating 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.
- chemical name or refrigerant number of the principal component of the insulation blowing gas.

Refrigerant numbers shall be designated in accordance with ISO 817.

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

Appliances that use **flammable refrigerants** shall be marked with the warning sign ISO 7010-W021 (2011-05).

Appliances having a **refrigerant charge** exceeding 150 g of **flammable refrigerants** within any **refrigerating circuit** shall be marked with the maximum allowable pressure for which the system is designed to withstand.

Appliances having a **refrigerant charge** within any **refrigerating circuit** exceeding 4 times the lower flammability limit (LFL) for refrigerants having a flammability classification of Class A2 or Class A3 and exceeding 6 times the lower flammability limit (LFL) for refrigerants having a flammability classification of Class A2L, shall be marked with symbol IEC 60417-6412 (2019-03).

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

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

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



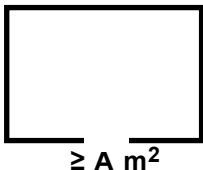
Appliances with a remote **refrigerant unit** employing R-744 refrigerant in a **transcritical refrigeration system** shall be marked with the **design pressure**, unless the appliance incorporates a **pressure relief device** pre-fitted to the high-pressure side of the motor-compressor.

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.

Ice-makers intended to be connected to the water supply shall be marked with symbol IEC 60417-6375 (2017-03) or with the substance of the following warning:

WARNING: Connect to potable water supply only.

7.6 Addition:

	[symbol IEC 60417-6375 (2017-03)]	connection to potable water supply
	[Warning sign ISO 7010-W021 (2011-05)]	warning; Risk of fire/flammable materials
	[symbol ISO 7000-1701 (2004-01)]	pressure
	[symbol IEC 60417-6412 (2019-03)]	minimum room floor area

7.12 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 refrigerating 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/ice storage compartments 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 test room 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 warning sign ISO 7010-W021 (2011-05) is used, its meaning shall be explained.

7.12.1 Addition:

For appliances with a remote **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 suitably qualified person.

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

- information on the type of remote **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 with a remote **refrigerant unit** employing R-744 refrigerant in a **transcritical refrigeration system**, unless the appliance incorporates a **pressure relief device** pre-fitted to the high-pressure side of the motor-compressor, the instructions shall include a statement containing the substance of the following:

A pressure relief device shall be installed in the high-pressure side of the refrigeration system between the motor-compressor and the gas cooler. There shall be no shut off devices or other components except piping between the motor-compressor and the pressure relief device that could introduce a pressure drop.

The pressure relief device shall be mounted so that any refrigerant released from the system during its operation cannot cause harm to the user of the appliance. The aperture shall be located so that it is unlikely to be obstructed in normal use.

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

The pressure setting of the installed pressure relief device shall be no higher than the design pressure of the high-pressure side.

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.

If symbol IEC 60417-6375:2017-03 is used, its meaning shall be explained.

If symbol IEC 60417-6412:2019-03 is used, its meaning shall be explained.

All site made joints in **hermetically sealed systems** shall be tested for leaks at a pressure of at least $0,25 \times$ maximum allowable pressure using detection equipment with a sensitivity of at least 3 g/year of refrigerant.

If other fluid circuits, such as water heat exchangers, are connected to an appliance that uses **flammable refrigerant**, the instructions shall state the substance of the following:

Any fluid circuits connected to the appliance shall safely release abnormal pressure. It shall not allow the release of **flammable refrigerant** into areas served by the other circuits if these do not comply with minimum room area limit.

7.14 Addition:

The height of the triangle in the warning sign ISO 7010-W021:2011-05 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.

The height of the rectangle in symbol IEC 60417-6412:2019-03 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 warning sign ISO 7010-W021:2011-05 shall be placed on or adjacent to the nameplate of the unit near the declaration of the refrigerant type and **refrigerant charge** information. It shall be visible after installation of the appliance.

Symbol IEC 60417-6412:2019-03 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 that require adjustment under operating conditions by a **qualified 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 101 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 power input, averaged over any representative 5 min period. The interval between power input 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.

*For appliances incorporating **ancillary heating elements**, compliance is also checked by the tests of 11.101 and 11.102.*

11.2 Replacement:

Built-in appliances are installed in accordance with the instructions.

*Other appliances are placed in a test enclosure with the walls and ceiling enclosing the appliance being as close as possible to all its sides and top surface. If the instructions state that the appliance is to be installed with a free distance between the appliance and the walls or the ceiling, then the appliance is installed in the test enclosure in accordance with these instructions. If the appliance has a remote **refrigerant unit** or motor-compressor, then only the **refrigerated display and storage cabinet** is installed in the test enclosure, the remote **refrigerant unit** or motor-compressor is placed on the floor of the test corner away from walls.*

*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.*

11.5 Addition:

*The appliance is operated under **normal operation** but with user adjustable temperature control devices set to give the lowest temperature.*

11.6 Addition:

*The appliance is operated under **normal operation** but with user adjustable temperature control devices set to give the lowest temperature.*

11.7 Replacement:

The appliance is operated until steady conditions are established.

11.8 Modification:

Replace the paragraph 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 **ice-makers** and **refrigerated display and storage cabinets** of test room climatic classes 0, 1, 2, 3, 4, 6 or 8, the temperature rises shall not exceed the values given in Table 3.

For **refrigerated display and storage cabinets** of test room climatic 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 60335-2-34:2012 or IEC 60335-2-34:2021 (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 60335-2-34:2012 or IEC 60335-2-34:2021 (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 60335-2-34:2012 or IEC 60335-2-34:2021 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,

- for **built-in appliances**, that are not **accessible parts** after installation in accordance with the instructions;
- for other appliances, that are on that part of the appliance that, according to the instructions, 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 12.4 of IEC 60598-1:2008, when measured under the conditions stated.

For ice-makers, the temperature rises shall not exceed the values given in Table 3.

11.101 *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 that 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.

11.102 ***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 the 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 the solution as specified in 15.2 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 that 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 the solution 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 the solution is in contact with the defrost heating element or its insulation, then the defrost heating element and its insulation 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 the solution as specified in 15.2 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 the solution 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.

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 60335-2-34:2012 or 19.101 and 19.102 of IEC 60335-2-34:2021 and compliance with these tests is checked in accordance with 19.104 of that standard. Unless otherwise specified, compliance with the tests of Clause 19 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 unfavourable.

***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 can be necessary to short-circuit one or more components, that 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 can 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 61058-1 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 15.2.

*During the tests, the temperatures of the windings of **ice-makers**, shall not exceed the values given in Table 8.*

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 60598-1:2008, 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 60598-1:2008 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 $2,00 \text{ J} \pm 0,05 \text{ J}$. For other accessible glass panels, the hammer spring is adjusted so that the impact energy is $1,00 \text{ J} \pm 0,05 \text{ J}$.*

21.101 Lamps liable to be accessible to users shall either:

- be subject to the test given in 21.1; 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 $75 \text{ mm} \pm 0,5 \text{ mm}$ 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/metre 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 unfavourable. 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 then 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.

21.103 For appliances having a **refrigerant charge** within any **refrigerating circuit** exceeding 150 g of **flammable refrigerant**, the refrigerant-containing parts shall be protected and shall not be an **accessible part**. Any external surface that is adjacent or in contact with parts containing refrigerant shall have adequate mechanical impact withstand strength.

Compliance is checked by inspection and by applying blows to the relevant outer surface in accordance with test Eha of IEC 60068-2-75.

The appliance is rigidly supported and three blows, having an impact energy of $5,00 \text{ J} \pm 0,05 \text{ J}$, are applied to points on the surface adjacent to parts containing refrigerant, which are likely to be weak.

*After the test, the parts containing refrigerant shall remain not **accessible parts** and there shall be no visible deformation of the refrigerant-containing parts.*

If there is doubt as to whether a defect has occurred by the application of the preceding blow, or the previous tests, this defect is neglected and the group of three blows is repeated to the same place on a new sample which shall then withstand the test.

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 22.111.

NOTE 102 All pressures are gauge pressures.

Appliances that use R-744 refrigerant in subcritical applications, shall withstand, for parts exposed to the:

- high side pressure during normal use, 3,5 times the saturated vapour pressure of the refrigerant at 27 °C, rounded up to the next 0,5 MPa;
- low side pressure during normal use, 5 times the saturated vapour pressure of the refrigerant at -6,5 °C rounded up to the next 0,2 MPa;

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 60598-1:2008.

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 Glass panels with an area having any two orthogonal dimensions exceeding 75 mm, that are **accessible parts**, shall be made from

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

An example of an appliance that could contain glass panels with an area having any two orthogonal dimensions exceeding 75 mm, that are **accessible parts**, is an appliance incorporating one or more swing doors containing glass panels that incorporate glass sheets that are exposed to the user accessible area when the door is placed in the most unfavourable position that may occur in normal use.

The requirement is not applicable to

- for glass panels in stacker doors or sliding doors, the glass sheet that is exposed to refrigerated space;
- for glass panels in doors containing more than two sheets of glass, the glass sheet sandwiched between the glass sheet exposed to the refrigerated space and the glass sheet exposed to the user accessible area.

Compliance is checked by tests in a) or b) as applicable.

- 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 $75\text{ g} \pm 5\text{ g}$ and a conical tungsten carbide tip with an angle of $60^\circ \pm 2^\circ$. 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 $50\text{ mm} \times 50\text{ mm}$ is placed on the fractured glass except within a peripheral margin of 25 mm from the edge of the sample.

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 crack-free 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 $75\text{ g} \pm 5\text{ g}$ and a conical tungsten carbide tip with an angle of $60^\circ \pm 2^\circ$. 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.

22.104 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.

22.105 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 can 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 can 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 can be determined by the proportional calculation relating to the distances of the handle and the accessible inside point from the hinge axis.

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

Compliance is checked by inspection and measurement.

22.107 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 the 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.

22.108 Appliances having a **refrigerant charge** within any **refrigerating circuit** exceeding 150 g of **flammable refrigerant** shall be constructed so that their operation does not cause excessive vibration or resonance points in the piping connected to the motor-compressor.

Compliance is checked by the following test:

*The appliance is installed in accordance with the installation instructions. It is supplied at **rated voltage** or at the upper limit of the **rated voltage range**.*

*For motor-compressors, other than variable speed motor-compressors in the appliance, the supply frequency to the motor-compressor is varied in 1 Hz steps between 0,9 times and 1,1 times the **rated frequency**.*

For variable speed motor-compressors in the appliance, the supply frequency from the inverter to the motor-compressor is increased in 1 Hz steps from minimum frequency to maximum frequency over the speed range in the appliance.

The vibration amplitude is measured at points in the piping with a large amplitude.

When measured with a low pass filter at 200 Hz, vibrations shall not exceed an acceleration of 0,3 g RMS in the refrigerant containing parts.

Care shall be taken that the measurement sensors do not influence the line vibration level.

22.109 Appliances employing R-744 refrigerant in 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 60335-2-34:2012/AMD2:2016 or Table 101 of IEC 60335-2-34:2021, 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 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 60335-2-34:2012/AMD2:2016 or Table 101 of IEC 60335-2-34:2021 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 60335-2-34:2012/AMD2:2016 or Table 102 of IEC 60335-2-34:2021 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.

22.110 The **refrigerant charge** of **flammable refrigerant** in appliances with an incorporated **refrigerant unit** or motor-compressor shall not exceed 13 times the LFL of the **flammable refrigerant** or 1,2 kg in any **refrigerating circuit**, whichever is smaller. The LFL is expressed in kg/m³. The LFL values for refrigerants are given in Table 102.

The **refrigerant charge** of **flammable refrigerant** in appliances with a remote **refrigerant unit** or motor-compressor (split system), shall not exceed 150 g in any **refrigerating circuit**.

The molar mass of the refrigerant in appliances having a **refrigerant charge** exceeding 150 g of **flammable refrigerant** in any **refrigerating circuit** shall not be less than 30 kg/kmol.

Compliance is checked by inspection.

22.111 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.

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 that 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 shall also withstand the test of 22.7. No **critical point** in the protective enclosure shall be located within the food storage compartment.

NOTE 2 Separate compartments with a common air circuit are considered to be a single compartment.

Compliance is checked by inspection and by the tests of 22.111.1 and 22.111.2.

NOTE 3 An appliance with a protected cooling system which, when tested, is found not to comply with the requirements specified for a protected cooling system, can be considered as having an unprotected cooling system if it is tested in accordance with 22.112 and found to comply with the requirement for an unprotected cooling system.

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

NOTE 1 To find the most **critical point** of the cooling system, it can 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 \pm 0,05 mm and a length between 2 m and 3 m.*

*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 **refrigerant charge** \pm 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 flammability limit.

The gas bottle is kept at a temperature of:

- a) $32\text{ °C} \pm 2\text{ °C}$ for leakage simulation on low-side pressure circuits;
- b) $70\text{ °C} \pm 2\text{ °C}$ for leakage simulation on high-side pressure circuits.

NOTE 2 The quantity of gas injected can 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.

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

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

NOTE 2 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 flammability limit of the refrigerant as specified in Table 102, and shall not exceed 50 % of the lower flammability limit of the refrigerant as specified in Table 102 for a period exceeding 5 min.

22.111.2 *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 $35\text{ N} \pm 3\text{ N}$;
- 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 %.

22.112 For compression-type appliances with unprotected cooling systems and which use **flammable refrigerants**, any electrical component, other than luminaires, located inside the food storage compartment, that during **normal operation** or abnormal operation produces arcs or sparks, 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 luminaires and electrical components that produce arcs and sparks during **normal operation** or abnormal operation are mounted, when doors or lids remain closed or when opening or closing doors or lids, unless these electrical components, other than luminaries, 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 22.111.

NOTE 3 Other types of protection for electrical apparatus for potentially explosive atmospheres covered by IEC 60079 (all parts) 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.

For luminaires compliance is checked by inspection and by the appropriate tests in 5.3 of IEC 60079-7:2015.

For electrical components, other than luminaires, compliance is checked by inspection and by the appropriate tests of IEC 60079-15 and by the following test.

NOTE 5 The tests contained in Annex BB can 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 Clause 5 of IEC 60079-15:2017, surface temperature limits are specified in 22.114.

*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 flammability limit.

Through an appropriate orifice, 80 % of the nominal **refrigerant charge** $\pm 1,5$ 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 flammability limit of the refrigerant as specified in Table 102, and shall not exceed 50 % of the lower flammability 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.

22.113 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 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 and luminaires have been tested and found at least to comply with the requirements in 5.3 of IEC 60079-7.

IS 18689 : 2024

NOTE 2 Irrespective of the requirements given in Clause 5 of IEC 60079-15:2017, surface temperature limits are specified in 22.114.

NOTE 3 Other types of protection for electrical apparatus for potentially explosive atmospheres covered by IEC 60079 (all parts) 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** $\pm 1,5$ 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 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 flammability limit of the refrigerant as specified in Table 102, and shall not exceed 50 % of the lower flammability limit of the refrigerant as specified in Table 102 for a period exceeding 5 min.

22.114 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

R number ISO 817	Safety Group ISO 817	Auto-ignition temperature^a °C ISO 5149-1	LFL^b % v/v ISO 817	LFL^c kg/m³ ISO 5149-1.	Molar mass^d kg/kmol ISO 817
R-32	A2L	648	14,4	0,307	52,0
R-143a	A2	750	8,2	0,282	84,0
R-152a	A2	455	4,8	0,130	66,0
R-170	A3	515	3,1	0,038	30,0
R-290	A3	470	2,1	0,038	44,0
R-600	A3	365	1,6	0,038	58,1
R-600a	A3	460	1,8	0,043	58,1
R-1150	A3	440	3,1	0,036	28,1
R-1270	A3	455	2,7	0,046	42,1
R-E170	A3	235	3,4	0,064	46,1
R-142b	A2L	750	8,0	0,329	100,5
R-1234yf	A2L	405	6,2	0,289	114,0
R-1234ze(E)	A2L	368	6,5	0,303	114,0

^a Auto-ignition temperature values for other **flammable refrigerants** can be obtained from ISO 5149-1.

^b LFL values for other **flammable refrigerants** can be obtained from ISO 817. The values are the concentration of refrigerant in dry air.

^c LFL values for other **flammable refrigerants** can be obtained from ISO 5149-1.

^d Molar mass values for other **flammable refrigerants** can be obtained from ISO 817 or calculated using Molar mass = 2445 x LFL (kg/m³)/ LFL (% v/v).

22.115 Split system appliances that use a **flammable refrigerant** shall not be fitted with pre-charged interconnection refrigerant piping.

Compliance is checked by inspection.

22.116 Appliances having a **refrigerant charge** exceeding 150 g of **flammable refrigerant** in any **refrigerating circuit** shall be constructed such that a leak of refrigerant shall not result in a **flammable refrigerant** concentration surrounding the appliance.

In the event of a leak from the appliance while energised, if airflow is required to meet these requirements, the airflow shall be guaranteed.

If airflow is not maintained at a level sufficient to comply with the requirements of Annex CC, the motor-compressors and heating elements shall be switched off within 5 minutes and an alarm shall be given. The motor-compressor and heating elements shall only be capable of restarting after the required airflow level has been reinstated.

The airflow shall be produced by components that are part of the appliance.

Compliance is checked by inspection and by the tests specified in Annex CC.

*If compliance relies on the operation of an **electronic circuit**, the tests in Annex CC are repeated under the following conditions applied separately:*

- *the fault conditions in a) to g) of 19.11.2 applied one at a time to the **electronic circuit**;*

- the electromagnetic phenomena tests of 19.11.4.2 and 19.11.4.5 applied to the appliance.

If the **electronic circuit** is programmable, the software shall contain measures to control the fault/error conditions specified in Table R.1 and is evaluated in accordance with the relevant requirements of Annex R.

22.117 In appliances having a **refrigerant charge** exceeding 150 g of **flammable refrigerant** in any **refrigerant circuit**, the refrigerant tubing shall be protected from potential damage during normal use relocation, repositioning and user maintenance.

Compliance is checked by inspection.

22.118 Low-temperature solder alloys having melting point of less than 450 °C shall not be used for pipe connections in a **refrigerating circuit**, if the **refrigerant charge** exceeds 150 g of **flammable refrigerant**

Compliance is checked by inspection and test.

22.119 For appliances having a **refrigerant charge** within any **refrigerating circuit** exceeding 150 g of **flammable refrigerant**, capped valves and capped service ports fitted to **hermetically sealed systems** for the purposes of compliance with the requirements for permanent connections on systems containing **flammable refrigerants** shall comply with the requirements of ISO 14903, tightness control level A1.

Compliance is checked by inspection and the relevant tests in ISO 14903.

22.120 For appliances having a **refrigerant charge** within any **refrigerating circuit** exceeding 150 g of **flammable refrigerant**, only **hermetically sealed systems** shall be used in appliances.

All the connections in a **hermetically sealed system** shall comply with ISO 14903 tightness control level A1.

Compliance is checked by inspection and the relevant tests in ISO 14903.

22.121 If symbol IEC 60417-6412:2019-03 is marked on the appliance, the value of **A** in the symbol shall be equal to or greater than the largest value of the room floor area limit A_{lim} that is determined from the following:

$$A_{lim} = \frac{M}{2,2 \times (0,25 \times LFL)}$$

where

M is the **refrigerant charge** (kg);

LFL is the lower flammability limit of the **flammable refrigerant** (kg/m³);

2,2 is the assumed minimum room height (m);

0,25 coefficient that gives 25% of LFL

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 in accordance with 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:	30 000
• for manual reset	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 shall 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 4126-2:2018. 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 Addition:

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 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.

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 $75\text{ °C} \pm 2\text{ °C}$ is replaced by $65\text{ °C} \pm 2\text{ °C}$.*

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.

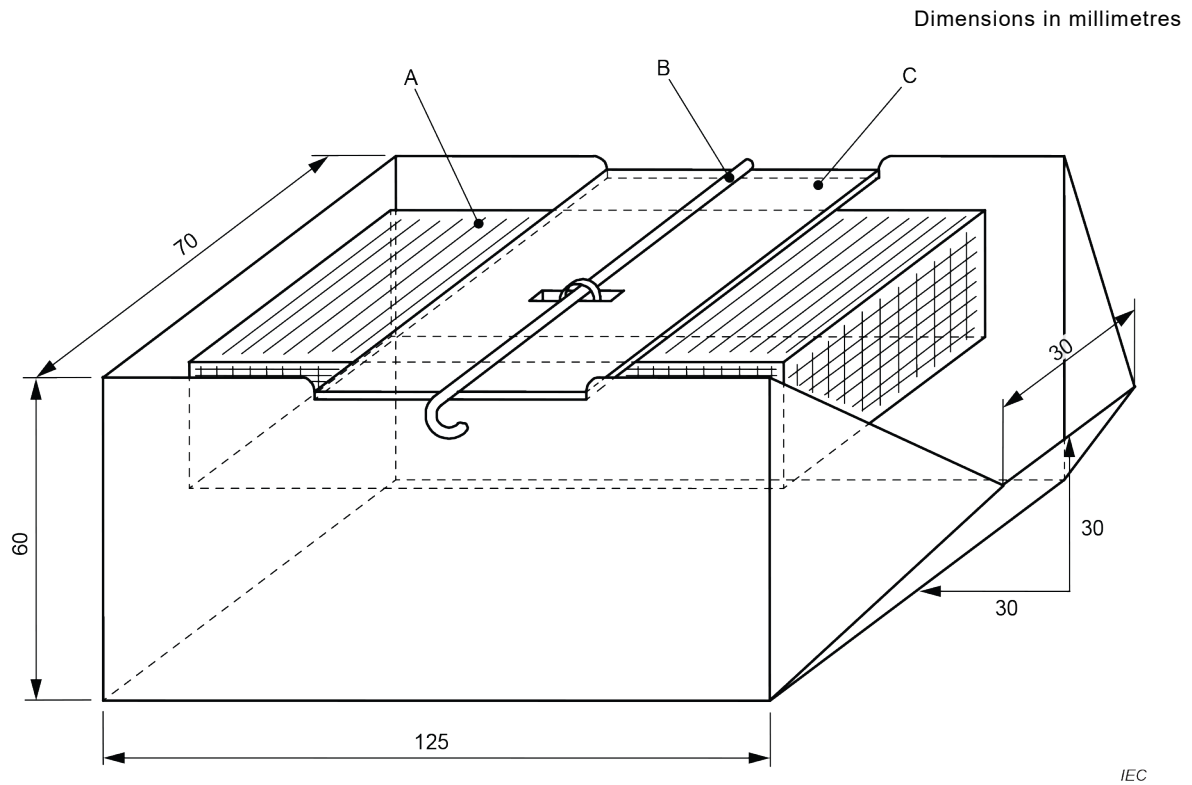
30.2.2 Not applicable.

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.



This displacement block has a volume of $140 \text{ ml} \pm 5 \text{ ml}$ and a mass of $200 \text{ g} \pm 10 \text{ g}$.

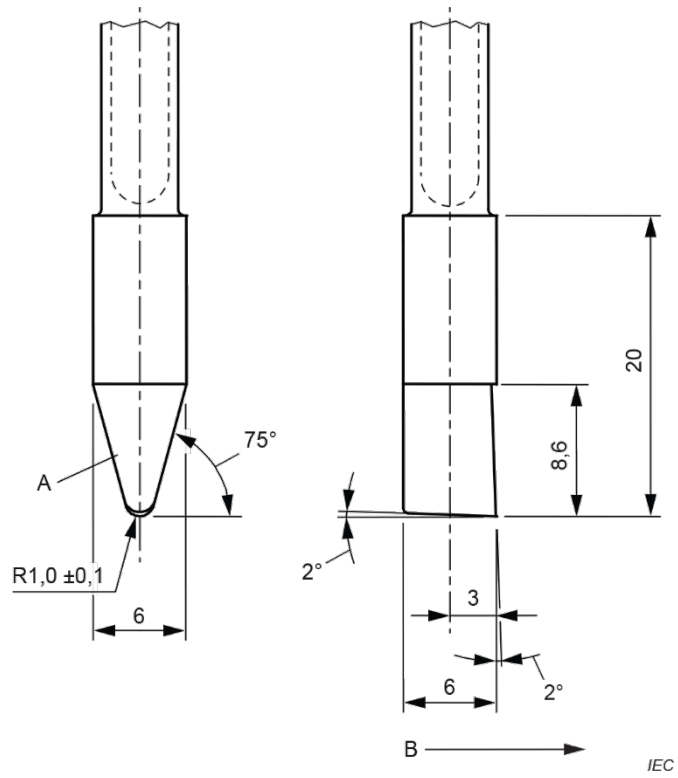
Its dimensions are approximately $112 \text{ mm} \times 50 \text{ mm} \times 25 \text{ mm}$.

The dimensions of the vessel are the inside dimensions and the tolerance is $\pm 2 \text{ mm}$ (see 15.102).

Key

- A displacement block
- B release pin
- C removeable bridge support

Figure 101 – Apparatus for spillage test



(See 22.111.2)

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 tropical 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 Clauses 10, 11 and 13 is $43\text{ °C} \pm 1\text{ °C}$.

11 Heating

11.8 Modification:

The values of Table 3 are reduced by 18 K.

Annex R
(normative)

Software evaluation

R.2.2.5 *Modification:*

For **programmable electronic circuits** with functions requiring software incorporating measures to control the fault/error conditions specified in Table R.1, detection of a fault/error shall occur before compliance with Clause 19 and 22.116 is impaired.

R.2.2.9 *Modification:*

The software and safety-related hardware under its control shall be initialized and shall terminate before compliance with Clause 19 and 22.116 is impaired.

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 motors are supplied at their supplied voltage when the appliance is supplied at **rated voltage** or at the upper limit of the **rated voltage range**. 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.

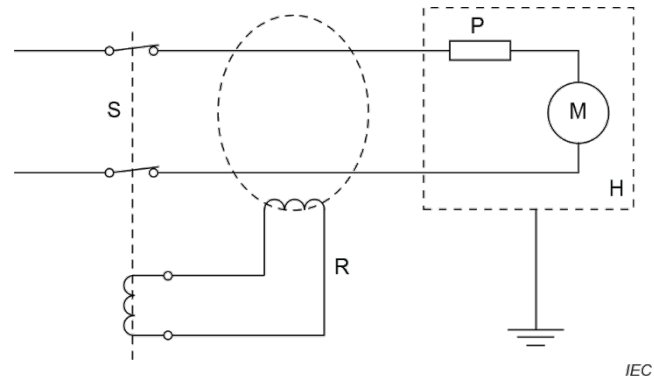
Temperatures are measured under conditions specified in 11.3.

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.

For other than DC motors, 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.*

**Key**

S supply source

H housing

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

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

M motor

The circuit shall be modified for three-phase fan motors. For DC motors the RCD is not necessary.

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.

7 Requirements for non-incendive components

Clause 7 is applicable.

8 Requirements for hermetically sealed devices

Clause 8 is applicable.

9 Requirements for sealed devices

All of the subclauses of Clause 9 are applicable, except 9.1 and 9.6, which are replaced by the following.

9.1 Non-metallic materials

Seals are tested using 11.2. However, if the device is tested in the appliance, then 11.2.1 and 11.2.2 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.

9.6 Type tests

The type tests described in 11.2 shall be performed where relevant.

10 Requirements for restricted-breathing enclosures

Clause 10 is applicable.

Annex CC (normative)

Test method for determining gas concentration beyond the boundary of the appliance

CC.1 Arrangement

The appliance is installed according to the instructions empty with doors or lids closed, or roller blinds closed or open, whichever is the more unfavourable and energized if necessary. Positioning of the appliance shall be against the centre of the shortest wall within the test room at a distance from the wall of the distance specified in the instructions or 50 mm whichever is greater. If the appliance can be fitted with any accessories, they shall be used or arranged in a manner that gives the most unfavourable result.

NOTE Accessories can include condensing unit cover, roof panels and kick-plates.

The test room floor area A (m^2) is given by

$$24 \geq A \geq \frac{M}{0,55LFL}$$

where

M is the **flammable refrigerant charge** (kg);

LFL is the lower flammability limit of the **flammable refrigerant** (kg/m^3).

The room height shall be not less than 2,2 m. The distance between the top of the appliance and the ceiling shall be not less than 0,5 m. The floor aspect ratio shall be not more than 2:1 (width:length).

During the test, the temperature of the room shall be maintained within 2 K of any convenient value between 15 °C and 25 °C. The room temperature is measured at one of the air velocity measurement locations.

Air velocity shall be measured at two positions located 1 m from the centreline of the appliance front at a height above floor level of 0,1 m and 2 m. The air velocity is measured using omnidirectional anemometers. The air velocity measured shall not exceed 0,1 m/s with the appliance and all its fans off.

CC.2 Release conditions

*Refrigerant is leaked from any **critical point**, in the direction that gives the most unfavourable result.*

*The test is carried out with the appliance supplied at **rated voltage** and with the motor-compressor operating. If fan operation can be controlled manually and independent of the motor-compressor operation fans are switched on or off whichever is more unfavourable. The test is then repeated with the appliance operating in the most unfavourable operational mode that automatically changes the fan operation.*

*The test shall include a **critical point** inside the refrigerated space with the door or drawers closed. After a period of 30 s \pm 5 s at the end of the leak, the door or drawer shall be opened at a uniform rate over 3 s \pm 0,5 s except that automatic doors are opened at the maximum speed setting. The position of the door or drawer after opening is as follows:*

- drawers are fully opened;
- hinged doors are opened to an angle of 60°;
- sliding doors are opened to the end of the opening stroke;

Thereafter, the door or drawer shall remain open for the duration of the test.

Appliances with more than one **refrigerating circuit** require tests on each **refrigerating circuit** containing more than 150 g of **flammable refrigerant**.

The mass released during the test shall be equal to the **refrigerant charge** of the tested **refrigerating circuit**. It shall be released at a mass flow rate given by

$$\begin{aligned}\dot{m} &= 0,32 \times \dot{q} \times M \times \left(\frac{476}{\rho_r} \right) \\ &= \frac{152 \dot{q} M}{\rho_r}\end{aligned}$$

where

\dot{m} is the mass flow rate of the release in g/min;

\dot{q} is the mass flux from Table CC.1 in (g/min)/mm²;

ρ_r is the density in kg/m³ of the saturated liquid refrigerant at the dew point temperature of 35 °C;

M is the **refrigerant charge** in kg;

0,32 is a constant (mm²/kg);

476 is the saturated liquid density of R-290 at 35°C in kg/m³.

The values of \dot{q} and ρ_r for some **flammable refrigerants** are given in Table CC.1.

The refrigerant shall be released such that the pressure at the inlet to the release orifice is not less than 300 kPa (gauge).

For low-pressure parts of the system, the mass flux \dot{q} shall be in accordance with condition A in Table CC.1.

For high-pressure parts of the system, the mass flux \dot{q} shall be in accordance with condition A in Table CC.1 to simulate motor-compressor off operating conditions and in accordance with condition B in Table CC.1 to simulate motor-compressor on operating conditions.

Table CC.1 – Relevant properties and mass flux for selected flammable refrigerants

Refrigerant	Saturated Liquid density at 35 °C, ρ_r [kg/m ³]	Condition A (Dew point temperature 35 °C)				Condition B (Dew point temperature 63 °C)			
		Vapour pressure, p_o [Pa]	Ratio of specific heats k	Vapour density, ρ_o [kg/m ³]	Mass flux \dot{q} [(g/min)/mm ²]	Vapour pressure, p_o [Pa]	Ratio of specific heats k	Vapour density, ρ_o [kg/m ³]	Mass flux \dot{q} [(g/min)/mm ²]
R-32	917	$2,190 \times 10^6$	1,84	63	316	$4,200 \times 10^6$	3,37	150	810
R-143a	885	$1,620 \times 10^6$	1,52	77	279	$3,060 \times 10^6$	3,18	189	762
R-152a	873	$0,790 \times 10^6$	1,30	25	101	$1,610 \times 10^6$	1,46	52	225
R-E170	645	$0,780 \times 10^6$	1,26	16	81	$1,550 \times 10^6$	1,37	33	172
R-290	476	$1,220 \times 10^6$	1,32	27	134	$2,250 \times 10^6$	1,60	53	281
R-600	561	$0,330 \times 10^6$	1,14	8	32	$0,690 \times 10^6$	1,17	17	74
R-600a	538	$0,460 \times 10^6$	1,16	12	49	$0,930 \times 10^6$	1,21	24	106
R-1234yf	1054	$0,900 \times 10^6$	1,24	50	152	$1,760 \times 10^6$	1,49	108	343
R-1234ze(E)	1129	$0,670 \times 10^6$	1,19	35	106	$1,370 \times 10^6$	1,32	76	241
R-1270	488	$1,470 \times 10^6$	1,40	31	165	$2,690 \times 10^6$	1,83	64	352

NOTE For refrigerants for which the critical temperature is below the dew point temperature in condition A or condition B the vapour pressure at the critical temperature is used.

For other refrigerants not listed, the following classical formula for choked mass flux through an orifice shall be used.

$$\dot{q} = 0,06c_d \sqrt{k\rho_o(p_o - p_{atm}) \left(\frac{2}{k+1}\right)^{\frac{k+1}{k-1}}}$$

where

\dot{q} is the mass flux in (g/min)/mm²;

c_d is the discharge coefficient (set to 0,61);

k is the ratio of specific heats of refrigerant vapour at the applicable dew point temperature;

ρ_o is the density in kg/m³ of refrigerant vapour at the applicable dew point temperature;

p_o is the vapour pressure in Pa of refrigerant vapour at the applicable dew point temperature;

p_{atm} is the atmospheric pressure $1,01325 \times 10^5$ in Pa.

NOTE Mass flux of refrigerant vapour through an orifice is used and considered representative of any leak that occurs from a part that contains two phases or liquid.

Properties for ratio of specific heats (k), density of refrigerant vapour (ρ_o) and vapour pressure (p_o) for **flammable refrigerants** not listed in Table CC.1 can be obtained from the refrigerant supplier.

For determination of leak mass flow rate condition A, the vapour pressure at the dew point temperature of 35 °C is taken and for leak mass flow rate condition B, the vapour pressure at the dew point temperature of 63 °C is taken.

If an alternative gas is used to mimic the refrigerant, it shall have a vapour density relative to dry air within $\pm 5\%$ that of the refrigerant at atmospheric pressure (1,01325 MPa) at a temperature of 25 °C.

CC.3 Measurement

The concentration of refrigerant is measured at points as shown schematically in Figure CC.1.

The measurements shall be taken at the points as follows:

- two at the top along the side edges (black squares in Figure CC.1) positioned along the axis A-C and B-D so as to give the most unfavourable result;

NOTE This is only necessary if there are refrigerant-containing parts present on the top of the appliance.

- four at the bottom corners (black circles in Figure CC.1) positioned along the axis A-C and B-D so as to give the most unfavourable result;
- one at the front of the cabinet at position E and one at rear of the cabinet at position F (black circles in Figure CC.1). Measurement at the positions E and F are only carried when testing for leaks inside the cabinet.

The centreline of the sampling points at the base of the appliance shall be $50 \text{ mm} \pm 5 \text{ mm}$ above the floor level.

Sampling points shall be located so as to not unduly influence the results of the test.

The gas concentration is measured at intervals of no more than 5 s. The instruments used for monitoring the refrigerant gas concentration shall have a $t(90)$ response time of not more than 20 s in accordance with IEC 60079-29-1.

The duration of test shall be no less than two times the duration of the time required (t_c) for the **refrigerant charge** to be released.

$$t_c = \frac{10^3 M}{\dot{m}}$$

where

\dot{m} is the mass flow rate of the release in g/min;

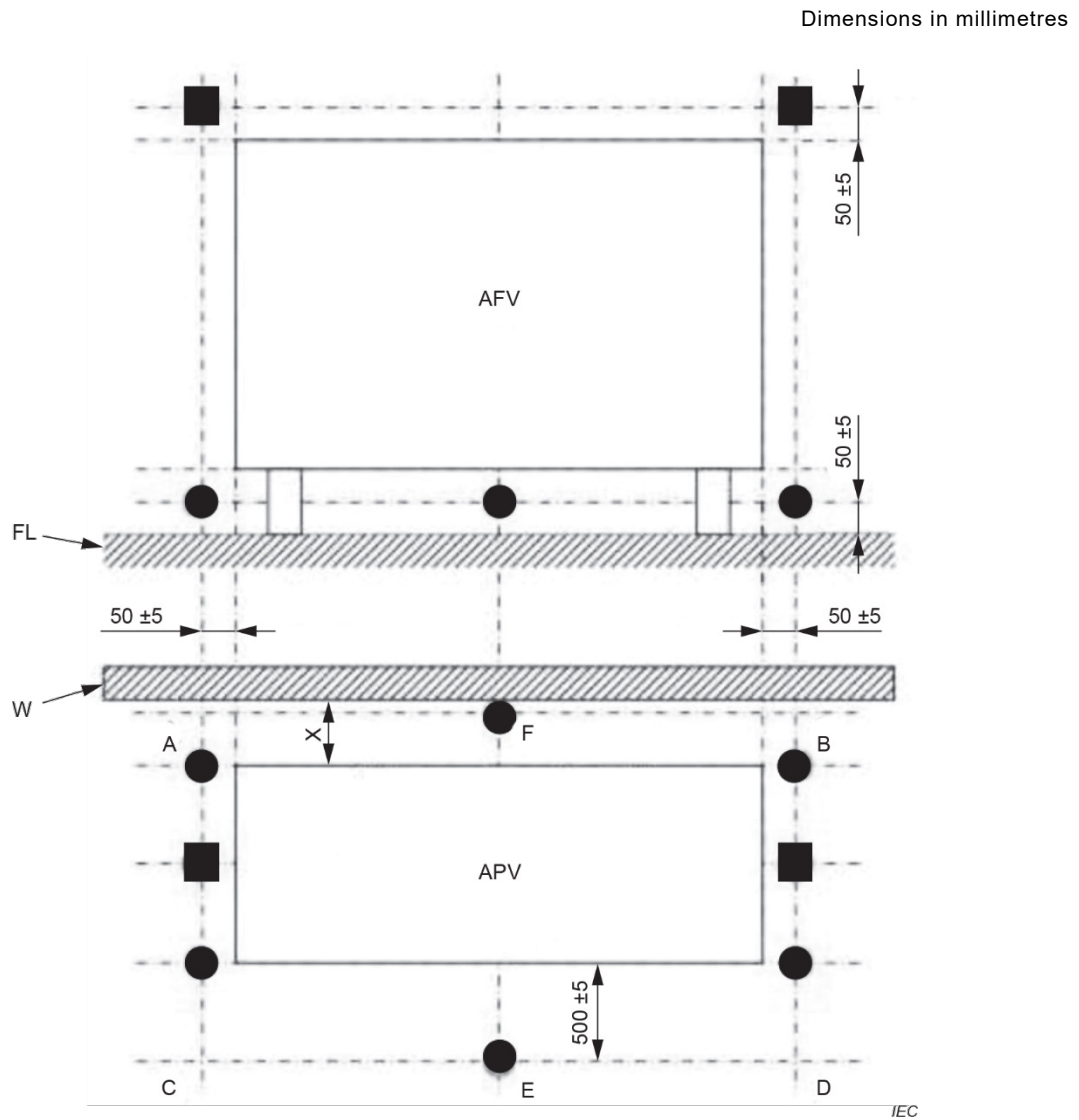
M is the **refrigerant charge** in kg.

After the time t_c , the test may be stopped if the gas concentration has not increased over a period of 10 minutes.

CC.4 Compliance

The concentration at any of the sampling points shall not exceed 50 % of LFL of the refrigerant used for a period exceeding 5 min.

The test is performed twice and is repeated a third time if one or more of the tests gives more than 40 % of the LFL.



Key

- AFV appliance front view
- APV appliance plan view
- X minimum separation distance from the wall specified in the instructions or allowed by the construction or 50 mm whichever is greater
- FL test room floor
- W test room wall

Figure CC.1 – Schematic illustration of the refrigerant concentration sampling points

Bibliography

The Bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60079 (all parts), *Explosive atmospheres*

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

NATIONAL ANNEX DD

[\(National Foreword\)](#)

LISTS OF TECHNICAL DEVIATIONS

DD-1 The text of the International Standard IEC 60335-2-89:2019 has been approved for publication as Indian Standard with agreed modifications as indicated below.

a) Para 5, Clause 1 Scope is replaced with the following:

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

- 1) A1;
- 2) B1; and
- 3) A2L, A2, and A3, refrigerants.

b) Add the following list of references to clause 2 Normative Reference:

- 1) IS/IEC 60529 : 2001 Degrees of Protection provided by Enclosures (IP CODE)
- 2) IS/IEC 61800-5-2 : 2016 Adjustable Speed Electrical Power Drive Systems Part 5 Safety Requirements Section 2 Functional
- 3) IEC 60079 (all parts) Explosive Atmospheres
- 4) IEC 60079-1 : 2014 Explosive Atmospheres — Part 1: Equipment Protection by Flameproof Enclosures “d” (First Revision)
- 5) IEC 60335-2-40 : 2022 Household and similar Electrical Appliances — Safety — Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers
- 6) IEC 60598-1 : 2020 Luminaires - Part 1: General Requirements and Tests
- 7) IEC 61800-5-1:2016 Adjustable Speed Electrical Power Drive Systems Part 5 Safety Requirements Section 1 Electrical, Thermal and Energy'

c) Add the following to Clause 6.2 of the Part 1 at the end:

Appliances or parts of appliances intended for outdoor use shall be at least IPX4 or equivalent as per IS/IEC 60529.

Appliances shall be classified according to the accessibility either as appliance accessible to the general public or as appliance not accessible to the general public.

d) Add the following dashed item after the first dashed item in the “Addition” of Clause 7.1:

- 1) For appliances not accessible to the general public, the classification according to Clause 6.101 shall be marked as “Caution – appliance shall be installed in areas with restricted access or at a level not less than 2.5 m.

e) Add the following to clause **7.1** at the end:

The short-circuit current rating (SCCR) as determined in Annex 101. For motor controllers, equipment control panels, overall equipment panels, or industrial control panels when employed with multiple motor load and combination load equipment.

The short-circuit current rating of motor controllers, overall equipment panels, equipment control panels, or industrial control panels shall include the following marking or the equivalent as specified for the motor controllers, equipment control panels, overall equipment panels or industrial control panels: "Short-circuit current: ____kA rms symmetrical, ____V maximum.

For motors controlled by adjustable speed drive, FLA shall be replaced with either the motor's maximum operating current (MOC) or the rated input current of the power conversion equipment. When there is bypass utilized, the FLA shall be replaced with the largest of the motor's MOC, the rated input current to the power conversion equipment or the FLA of the motor.

f) Add the following to Clause **19.11.1** of the Part 1 at the end:

In order to ensure that the heating systems are continuously energized. self-resetting thermal cutouts should be short-circuited unless they comply with Clause **24.1.4**, the number of cycles of operation being 1 00 000.

g) Add the following dashed item to NOTE 1 of Clause **19.102**:

- 1) Loss of heat transfer medium flow, to include the following
- 2) Condenser fan failure;
- 3) Evaporator fan failure (if evaporator has defrost heater in accordance with Clause **19.101**);
and
- 4) Cooling water failure (completely shut off and/or partially restricted).

h) Add the following to "Addition" of Clause **20.1**:

The test is conducted with shelving installed if shipped within the unit. Each horizontally-hinged door that provide access to the refrigerated storage compartments of chest-type units and that may cause injury to persons upon unintentional closing shall be:

- 1) Counterweighted;
- 2) Spring loaded; or
- 3) Provided with an automatic latch to retain them in the open position. Action members, such as springs and latches that may cause injury to persons due to pinching or the like, shall be enclosed or guarded.

j) Add the following to Clause **22.46** of the Part 1 at the end:

Annex R evaluation is not required for adjustable speed drives that have been evaluated to IEC 61800-5-1, IEC 61800-5-2 if the adjustable speed drive protective electronic circuit was evaluated as a safety function in IEC 61800-5-2 (SIL2)

k) Replace the existing of Clause **22.110** with the following:

22.110 The refrigerant charge of a flammable refrigerant in self-contained appliances with an incorporated refrigerant unit or motor-compressor shall not exceed $13 \text{ m}^3 \times \text{LFL}$ of the flammable refrigerant. The LFL is expressed in kg/m^3 . The LFL values for refrigerants are given in Table 102 and used as WCF values for refrigerant blends.

Table 102 Refrigerant Flammability Parameters

SI No.	Refrigerant designation ^a	Description	Formula (nominal composition mass fraction %)	Safety group <i>f</i>	Auto ignition temperature	Hot surface ignition temperature	Maximum allowable surface temperature	Density	Molar mass <i>c</i> at nominal composition	Molar mass <i>c</i> at worst case formulation	Lower flammable limit <i>b, d</i> at nominal composition	Lower flammability limit <i>b, d</i> at worst case formulation
					°C	°C (A2L only)	°C	kg/m ³	kg/ kmol	kg/ kmol	kg/m ³	kg/m ³
i)	R32	Difluoromethane	CH ₂ F ₂	A2L	648	> 800	700	2.13	52.0	NA	0.307	NA
ii)	R50	Methane	CH ₄	A3	645		545	0.65	16.0	NA	0.032	NA
iii)	R143a	1,1,1 – Trifluoroethane	CF ₃ CH ₃	A2L	750		650	3.43	84.0	NA	0.282	NA
iv)	R152a	1, 1 – Difluoroethane	CHF ₂ CH ₃	A2	455		355	2.70	66.0	NA	0.130	NA
v)	R170	Ethane	CH ₃ CH ₃	A3	515		415	1.23	30.1	NA	0.038	NA
vi)	R290	Propane	CH ₃ CH ₂ CH ₃	A3	470		370	1.80	44.1	NA	0.038	NA
vii)	R600	n-Butane	CH ₃ CH ₂ CH ₂ CH ₃	A3	365		265	2.37	58.1	NA	0.038	NA
viii)	R600a	Isobutane	CH(CH ₃) ₃	A3	460		360	2.37	58.1	NA	0.043	NA
ix)	R1150	Ethylene	CH ₂ =CH ₂	A3	425			1.15	28.1	NA	0.036	NA
x)	R1270	Propylene	CH ₂ =CHCH ₃	A3	455		355	1.72	42.1	NA	0.046	NA

SI No.	Refrigerant designation ^a	Description	Formula (nominal composition mass fraction %)	Safety group <i>f</i>	Auto ignition temperature	Hot surface ignition temperature	Maximum allowable surface temperature	Density	Molar mass <i>c</i> at nominal composition <i>h</i>	Molar mass <i>c</i> at worst case formulation <i>i</i>	Lower flammable limit <i>b, d</i> at nominal composition <i>hej</i>	Lower flammability limit <i>b, d</i> at worst case formulation <i>iej</i>
					°C	°C (A2L only)	°C	kg/m ³	kg/ kmol	kg/ kmol	kg/m ³	kg/m ³
xi)	E170	Dimethyl ether	(CH ₃) ₂ O	A3	235		135	1.88	46.1	NA	0.064	NA
xii)	R142b	1-chloro-1,1-difluoroethane	CH ₃ CClF ₂	A2L	750e		650	4.11	100.5	NA	0.329	NA
xiii)	R1234yf	2,3,3,3-tetrafluoro-1-propene	CF ₃ CF=CH ₂	A2L	405	> 800	700	4.66	114.0	NA	0.289	NA
xiv)	R1234ze(E)	Trans-1,3,3,3-tetrafluoro-1-propene	CF ₃ CF=CHF	A2L	368	> 800	700	4.66	114.0	NA	0.303	NA
xv)	R-444A	R-32/152a/1234ze(E)	(12/5/83)	A2L	ND	> 800	700	4.03	98.7	95.2	0.324	0.323
xvi)	R-444B	R-32/152a/1234ze(E)	(41.5/10/48.5)	A2L	ND	> 800	700	3.02	72.8	73.0	0.277	0.277
xvii)	R-447A	R-32/125/1234ze(E)	(68/3.5/28.5)	A2L	ND			2.61	63.0	63.1	0.304	0.330
xviii)	R-447B	R-32/125/1234ze(E)	(68/8/24)	A2L	ND	> 800	700	2.58	63.1	63.1	0.312	0.312

SI No.	Refrigerant designation ^a	Description	Formula (nominal composition mass fraction %)	Safety group <i>f</i>	Auto ignition temperature	Hot surface ignition temperature	Maximum allowable surface temperature	Density	Molar mass <i>c</i> at nominal composition <i>h</i>	Molar mass <i>c</i> at worst case formulation <i>i</i>	Lower flammable limit <i>b, d</i> at nominal composition <i>hej</i>	Lower flammability limit <i>b, d</i> at worst case formulation <i>iej</i>
					°C	°C (A2L only)	°C	kg/m ³	kg/ kmol	kg/ kmol	kg/m ³	kg/m ³
xix)	R-451A	R-1234yf/134a	(89.8/10.2)	A2L	ND	> 800	700	4.61	112.7	112.7	0.322	0.346
xx)	R-451B	R-1234yf/134a	(88.8/11.2)	A2L	ND	> 800	700	4.60	112.6	112.6	0.322	0.341
xxi)	R-452B	R-32/125/1234yf	(67/7/26)	A2L	ND	> 800	700	2.60	63.5	63.7	0.309	0.310
xxii)	R-454A	R-32/1234yf	(35/65)	A2L	ND	> 800	700	3.29	80.5	81.8	0.273	0.278
xxiii)	R-454B	R-32/1234yf	(68.9/31.1)	A2L	ND	> 800	700	2.56	62.6	63.0	0.307	0.301
xxiv)	R-454C	R-32/1234yf	(21.5/78.5)	A2L	ND	> 800	700	3.71	90.8	92.5	0.286	0.291
xxv)	R-455A	R-744/32/1234yf	(3/21.5/75.5)	A2L	ND	> 800	700	3.63	87.5	87.7	0.316	0.317
xxvi)	R-457A	R-32/1234yf/152a	(18/70/12)	A2L	ND	> 800	700	3.58	87.6	88.0	0.215	0.216
xxvii)	R-468A	R-1132A/32/1234yf	(3.5/21.5/75)	A2L	ND	> 800	700	3.69	88.8	90.4	0.265	0.270

- k) Replace the existing of Clause **22.114** with the following:

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. For A2L refrigerants, temperatures on surfaces that may be exposed to leakage of refrigerant may not exceed the hot surface ignition temperature of the refrigerant as specified in Table 102, reduced by 100 K.

- m) Replace the existing of Clause **22.112**, **22.113** with the following:

22.112 For compression-type appliances with unprotected cooling systems and which use flammable refrigerants, any electrical component located inside the food storage compartment that during normal operation or abnormal operation produces arcs or sparks, shall be tested and found at least to comply with the following requirements:

For electrical components, other than luminaires, have been tested and found at least to comply with the requirements of IEC 60079-15 : 2017 or the requirements for level protection “dc” of IEC 60079-1 : 2014, as modified by the normative Annex CC, for group IIA gases or the refrigerant used, not to for luminaires which have been checked by inspection and by the appropriate tests in **5.3** of IEC 60079-7 : 2015. For the vibration test of other than bi-pin luminaires with lampholders, the vibration test for “rough service luminaires” according **4.20** of IEC 60598-1 : 2020 shall be carried out.

This applies to the entire internal space of a prefabricated cold room.

This requirement does not apply to non-self-resetting protective devices necessary for compliance with **19**, nor to intentionally weak parts that become permanently open-circuited during the tests of **19**, even if they produce arcs or sparks during operation.

For appliances using A2L refrigerants only, this requirement also does not apply to electrical components complying with any of the following sections of the IEC 60335-2-40 : 2022 standard, as they are not considered a source of ignition:

- a) subclause **22.116.4**; or
- b) Annex JJ; or
- c) in enclosures complying with Annex NN.

Refrigerant leakage into food storage compartments shall not result in an explosive atmosphere outside the food storage compartments in areas where luminaires and electrical components that produce arcs and sparks during normal operation or abnormal operation are mounted, when doors or lids remain closed or when opening or closing doors or lids.

This requirement does not apply to non-self-resetting protective devices necessary for compliance with **19** even if they produce arcs or sparks during operation, nor to intentionally weak parts that become permanently open-circuited during the tests of **19** even if they produce arcs or sparks during operation, nor to electrical components, other than luminaires, have been tested and found at least to comply with the requirements of IEC 60079-15 : 2017 or the requirements for level protection “dc” of IEC 60079-1, as modified by the normative Annex BB, for group IIA gases or the refrigerant used, nor to luminaires which have been checked by inspection and by the appropriate tests in **5.3** of IEC 60079-7 : 2015. For the vibration test of other than bi-pin luminaires with lamp holders, the vibration test for “rough service luminaires” according **4.20** of IEC 60598-1 : 2020 shall be carried out.

For appliances using A2L refrigerants only, this requirement also does not apply to electrical components complying with any of the following sections of the IEC 60335-2-40 : 2022 standard, as they are not considered a source of ignition:

- a) subclauses **22.116.4**; or
- b) Annex JJ; or
- c) in enclosures complying with Annex NN.

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.

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 **22.111**.

Other types of protection for electrical apparatus for potentially explosive atmospheres covered by IEC 60079 (all parts) are also acceptable.

For electrical components, other than luminaires, compliance is checked by inspection and by the appropriate tests of IEC 60079-1 : 2014, IEC 60079-15 : 2017 and by the following test.

NOTES

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

2 The tests contained in Annex BB can 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.

Irrespective of the requirement given in **5** of IEC 60079-15 : 2017, surface temperature limits are specified in **22.114**.

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 percent of the lower flammability limit.

Through an appropriate orifice, 80 percent 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 release 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 **19**, nor to intentionally weak parts that become permanently open-circuited during the tests of **19**, even if they produce arcs or sparks during operation.

For appliances using A2L refrigerants only, this requirement also does not apply to electrical components complying with any of the following sections of the IEC 60335-2-40 : 2022 standard, as they are not considered a source of ignition:

- a) subclause **22.116.4**; or
- b) Annex JJ; or
- c) in enclosures complying with Annex NN.

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

The measured value shall not exceed 75 percent of the lower flammability limit of the refrigerant as specified in Table 102, and shall not exceed 50 percent of the lower flammability 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.

22.113 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 **19** or intentionally weak parts that become permanently open circuited during the test of **19** are mounted, even if they produce arcs or sparks during operation.

For appliances using A2L refrigerants only, this requirement also does not apply to electrical components complying with any of the following sections of the IEC 60335-2-40 : 2022 standard, as they are not considered a source of ignition:

- a) subclause **22.116.4**; or
- b) Annex JJ; or
- c) in enclosures complying with Annex NN.

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 components that produce arcs and sparks during normal operation or abnormal condition and which are mounted in the areas under consideration, have been tested and found at least to comply with the requirements of IEC 60079-15 : 2017 or the requirements for level of protection "dc" of IEC 60079-1 : 2014, as modified by the normative Annex BB, for group IIA gases or the refrigerant used.

For luminaires compliance is checked by inspection and by the appropriate tests in **5.3** of IEC 60079-7 : 2015. For the vibration test of other than bi-pin luminaires with lampholders, the vibration test for "rough service luminaires" according **4.20** of IEC 60598-1 : 2020 shall be carried out.

Irrespective of the requirements given in **5** of IEC 60079-15 : 2017, surface temperature limits are specified in **22.114**.

Other types of protection for electrical apparatus for potentially explosive atmospheres covered by IEC 60079 (all parts) 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 percent of the refrigerant charge $\pm 1,5$ 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 to the electrical component under consideration.

Any direct injection shall be avoided.

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 percent of the lower flammability limit of the refrigerant as specified in Table 102, and shall not exceed 50 percent of the lower flammability limit of the refrigerant as specified in Table 102 for a period exceeding 5 min.

n) Replace the existing of Annex CC.4 with the following:

Compliance:

For purposes of compliance, concentration measurements shall start at the beginning of the refrigerant release.

For leaks inside the refrigerated space of appliances equipped with doors, drawers, blinds and/or similar components, the concentration at the sampling point at the front of the unit shall not exceed 50 percent of LFL of the refrigerant as specified in Table 102 used for a period exceeding 5 min. All other sampling points for such units shall not exceed 50 percent of the LFL of the refrigerant used as specified in Table 102.

For all other Annex CC leak tests, the concentration at any of the sampling points shall not exceed 50 percent of LFL of the refrigerant used as specified in Table 102.

[\(Continued from second cover\)](#)

<i>International Standard</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
IEC 60068-2-75 Environmental testing — Part 2-75: Tests — Test Eh: Hammer tests	IS 9000 (Part 7/Sec 7) : 2020/ IEC 60068-2-75 : 2014 Environmental testing: Part 7 Tests, Section 7 Test Eh: Hammer tests (<i>first revision</i>)	Identical
IEC 60079-7 : 2015 Explosive atmospheres — Part 7: Equipment protection by increased safety "e" IEC 60079-7 : 2015/AMD 1 : 2017	IS/IEC 60079-7 : 2017 Explosive atmospheres: Part 7 Equipment protection by increased safety "e" (<i>second revision</i>)	Identical
IEC 60079-15 : 2017 Explosive atmospheres — Part 15: Equipment protection by type of protection "n"	IS/IEC 60079-15 : 2017 Explosive atmospheres: Part 15 Equipment protection by type of protection "n" (<i>second revision</i>)	Identical
IEC 60079-29-1 Explosive atmospheres — Part 29-1: Gas detectors — Performance requirements of detectors for flammable gases	IS/IEC 60079-29-1 : 2016 Explosive atmospheres: Part 29 Gas detectors, Section 1 Performance requirements of detectors for flammable gases (<i>first revision</i>)	Identical
IEC 61058-1 Switches for appliances — Part 1: General requirements	IS/IEC 61058-1 : 2016 Switches for appliances: Part 1 General requirements (<i>first revision</i>)	Identical

The Committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

<i>International Standard</i>	<i>Title</i>
ISO 14903	Refrigerating systems and heat pumps — Qualification of tightness of components and joints
IEC 60335-2-34 : 2012 IEC 60335-2-34/ AMD 1 : 2015 IEC 60335-2-34/2021 AMD 2 : 2016	Household and similar electrical appliances — Safety — Part 2-34: Particular requirements for motor-compressors
IEC 60598-1 : 2008	
IEC 60730-2-6	
	Luminaires — Part 1: General requirements and tests
	Automatic electrical controls — Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements

This standard also makes a reference of technical deviation to the IEC standard. The deviations are given in [National Annex DD](#).

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 2016* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Head (Publication & Sales), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: MED 03 (24169).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002

Telephones: 2323 0131, 2323 3375, 2323 9402

Website: www.bis.gov.in

Regional Offices:

Central : 601/A, Konnectus Tower -1, 6th Floor,
DMRC Building, Bhavbhuti Marg, New
Delhi 110002

Telephones

{ 2323 7617

Eastern : 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V,
Salt Lake, Kolkata, West Bengal 700091

{ 2367 0012
2320 9474

Northern : Plot No. 4-A, Sector 27-B, Madhya Marg,
Chandigarh 160019

{ 265 9930

Southern : C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113

{ 2254 1442
2254 1216

Western : 5th Floor/MTNL CETTM, Technology Street, Hiranandani Gardens, Powai
Mumbai 400076

{ 2570 0030
2570 2715

Branches : AHMEDABAD, BENGALURU, BHOPAL, BHUBANESHWAR, CHANDIGARH, CHENNAI, COIMBATORE, DEHRADUN, DELHI, FARIDABAD, GHAZIABAD, GUWAHATI, HARYANA (CHANDIGARH), HUBLI, HYDERABAD, JAIPUR, JAMMU, JAMSHEDPUR, KOCHI, KOLKATA, LUCKNOW, MADURAI, MUMBAI, NAGPUR, NOIDA, PARWANOO, PATNA, PUNE, RAIPUR, RAJKOT, SURAT, VIJAYAWADA.