

INTERNATIONAL STANDARD

IEC
60335-2-24

Fifth edition
2000-07

**Safety of household and similar
electrical appliances –**

**Part 2-24:
Particular requirements for refrigerating
appliances, ice-cream appliances and ice-makers**

Sécurité des appareils électrodomestiques et analogues –

*Partie 2-24:
Règles particulières pour les appareils de réfrigération,
les appareils de glaces à la crème et les fabriques de glace*



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International Electrotechnical Commission
Telefax: +41 22 919 0300

3, rue de Varembe Geneva, Switzerland
e-mail: inmail@iec.ch IEC web site <http://www.iec.ch>



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –

Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
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- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60335-2-24 has been prepared by subcommittee 61C: Household appliances for refrigeration, of IEC technical committee 61: Safety of household and similar electrical appliances.

It forms the fifth edition of IEC 60335-2-24 and replaces the fourth edition published in 1997, its amendment 1 (1998) and amendment 2 (1999).

The text of this standard is based on the fourth edition, amendments 1 and 2 and the following documents:

FDIS	Report on voting
61C/176/FDIS	61C/183/RVD

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

Annex AA forms an integral part of this standard.

Annex BB is for information only.

The contents of the corrigendum of March 2001 have been included in this copy.

This part 2-24 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the third edition (1991) of that standard.

This part 2-24 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for **refrigerating appliances, ice-cream appliances and ice-makers**.

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

NOTE 1 In this standard, the following print types are used:

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

Words in **bold** in the text are defined in clause 2. When a definition of part 1 concerns an adjective, the adjective and the associated noun are also in **bold**.

NOTE 2 Subclauses, notes, tables and figures which are additional to those in part 1 are numbered starting from 101, annexes which are additional to those in part 1 are lettered AA, BB, etc.

The following additional differences exist in some countries:

- 6.101: Only appliances of tropical class T are allowed (Australia, Israel, New Zealand).

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

SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –

Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers

1 Scope

This clause of part 1 is replaced by:

This standard deals with the safety of the following appliances, their **rated voltage** being not more than 250 V for single-phase appliances, 480 V for other appliances and 24 V d.c. for appliances when battery operated.

- **refrigerating appliances** for household and similar use;
- **ice-makers** incorporating a motor-compressor and **ice-makers** intended to be incorporated in frozen food storage compartments;
- **refrigerating appliances** and **ice-makers** for use in camping, touring caravans and boats for leisure purposes.

These appliances may be operated from the mains, from a separate battery or operated either from the mains or from a separate battery.

This standard also deals with the safety of **ice-cream appliances** intended for household use, their **rated voltage** being not more than 250 V for single-phase appliances and 480 V for other appliances.

It also deals with **compression-type appliances** for household and similar use, which use **flammable refrigerants**.

This standard does not cover features of the construction and operation of those **refrigerating appliances** which are dealt with in ISO standards.

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

As far as is practicable, this standard deals with the common hazards presented by appliances which are encountered by all persons in and around the home.

This standard does not in general take into account

- the use of appliances by young children or infirm persons without supervision;
- playing with the appliance by young children.

NOTE 1 Attention is drawn to the fact that

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

NOTE 2 This standard does not apply to

- appliances intended to be used in the open air;
- appliances designed exclusively for industrial purposes;
- appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas);
- appliances incorporating a battery intended as a power supply for the refrigerating function;
- appliances assembled on site by the installer;
- appliances with remote motor-compressors;
- motor-compressors (IEC 60335-2-34);
- commercial dispensing appliances and vending appliances (IEC 60335-2-75);
- commercial ice-cream appliances.

2 Definitions

This clause of part 1 is applicable except as follows:

2.2.9 Replacement:

normal operation

operation of the appliance under the following conditions:

2.2.9.1

normal operation of a refrigerating appliance

operation at an ambient temperature according to 4.7, empty, with the doors and lids closed. User-adjustable temperature control devices which control the operation of the motor-compressor in **compression-type appliances**, are short-circuited or otherwise rendered inoperative

2.2.9.2

normal operation of an ice-maker

operation at an ambient temperature according to 4.7, with the supply water at a temperature of $15\text{ °C} \pm 2\text{ °C}$

2.2.9.3

normal operation of an incorporated ice-maker

operation at the normal temperature of the frozen food storage compartment, with the supply water at a temperature of $15\text{ °C} \pm 2\text{ °C}$

2.2.9.4

normal operation of an ice-cream appliance

operation of the appliance using the maximum quantity of the mixture of ingredients indicated in the instructions; the mixture used being that which gives the most unfavourable results, the mixture being at an initial temperature of $23\text{ °C} \pm 2\text{ °C}$

2.101

refrigerating appliance

enclosed thermally insulated appliance of suitable volume for household use, cooled by an incorporated device and having one or more compartments intended for the preservation of foodstuffs

2.102

compression-type appliance

appliance in which refrigeration is effected by the vaporization at low pressure in a heat exchanger (**evaporator**) of a liquid refrigerant, the vapour thus formed being restored to the liquid state by mechanical compression at a higher pressure and subsequent cooling in another heat exchanger (**condenser**)

2.103

ice-maker

appliance in which ice is made by freezing water by a device consuming electrical energy and having a compartment for storing the ice

2.104

incorporated ice-maker

ice-maker specially designed to be incorporated into a frozen food storage compartment and without independent means for freezing water

2.105

heating system

heating element with associated components such as timers, switches, **thermostats** and other controls

2.106

absorption-type appliance

appliance in which refrigeration is effected by the evaporation in a heat exchanger (**evaporator**) of a liquid refrigerant, in the liquid state, the resulting vapour being then absorbed by an absorbent medium from which it is subsequently expelled at a higher partial vapour pressure by heating and liquefied by cooling in another heat exchanger (**condenser**)

2.107

condenser

heat exchanger in which, after compression, vaporized refrigerant is liquefied by losing heat to an external cooling medium

2.108

evaporator

heat exchanger in which, after pressure reduction, the liquid refrigerant is vaporized by absorbing heat from the medium to be refrigerated

2.109

flammable refrigerant

refrigerant with a flammability classification of group 2 or 3 according to ISO 5149

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

2.110

ice-cream appliance

compression-type appliance which is used to make ice-cream

2.111

free space

space with a volume exceeding 60 l where a child can be entrapped and which is accessible after opening any door, lid or drawer and removing any **detachable internal part**, including shelves, containers or removable drawers which are themselves only accessible after opening any door or lid. In calculating the volume, a space with any single dimension not exceeding 150 mm or any two orthogonal dimensions, each of which do not exceed 200 mm, is ignored

3 General requirement

This clause of part 1 is applicable except as follows:

Addition:

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

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

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

4 General conditions for the tests

This clause of part 1 is applicable except as follows:

4.2 Addition:

At least one additional specially prepared sample is required for the tests of 22.107.

NOTE 1 Separate samples of the motor compressors may be needed for the tests of 19.1.

NOTE 2 The test of 22.7 may be carried out on separate samples.

NOTE 3 Due to the potentially hazardous nature of the tests of 22.107, 22.108 and 22.109, special precautions may need to be taken when carrying out the tests.

4.3 Addition:

Before starting the tests

- **ice-cream appliances** are operated empty at **rated voltage** for 1 h or the maximum setting of an incorporated timer, whichever is shorter;
- other **compression-type appliances** shall be operated at **rated voltage** for at least 24 h, then switched off and left to stand for at least 12 h.

The test of 11.102 is carried out immediately after the tests of clause 13.

The test of 15.105 is carried out immediately after the test of 11.102.

The tests of 15.102, 15.103 and 15.104 are carried out immediately after the test of 15.2.

4.4 Replacement:

Tests are carried out using each source of energy (electricity, gas or other fuel) in turn. Gas appliances are supplied at the appropriate rated pressure.

Tests are additionally carried out with all combinations of energy sources supplied simultaneously unless this is prevented by interlocking devices.

4.7 Addition:

*For **ice-cream appliances**, tests specified in clauses 10, 11 and 13 are carried out at an ambient temperature of $23\text{ °C} \pm 2\text{ °C}$.*

For other appliances, tests specified in clauses 10, 11, 13 and subclause 19.103 are carried out at an ambient temperature of

32 °C ± 1 °C on appliances of extended temperate (SN) and temperate (N) classes;

38 °C ± 1 °C on appliances of subtropical (ST) class;

43 °C ± 1 °C on appliances of tropical (T) class.

Before starting these tests, the appliance with the doors or lids open is brought to within 2 K of the ambient temperature specified.

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

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

NOTE 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.

4.8.1 Addition:

Appliances which can be battery operated are tested at the more unfavourable polarity when the supply terminals or terminations for the connection of the battery have no indication for polarity.

4.9 Addition:

Appliances incorporating an **ice-maker** are tested with the **ice-maker** operating to give the most unfavourable results.

4.10 Addition

For the tests of 22.107, 22.108 and 22.109, the appliance is empty and installed as outlined below:

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

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

NOTE Commonly available fixing hardware, such as screws and bolts, need not be delivered with a fixed appliance.

4.101 Appliances which are constructed so that an **ice-maker** may be incorporated are tested with the intended **ice-maker**.

4.102 Compression-type appliances with heating systems and Peltier-type appliances are tested as **combined appliances**.

4.103 Compression-type appliances which use flammable refrigerants and which, according to the instructions, may be used with other electrical appliances inside a food storage compartment are tested with such recommended appliances incorporated and being operated as in normal use.

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

5 Void

6 Classification

This clause of part 1 is applicable except as follows:

6.101 Appliances, other than **ice-cream appliances**, shall be of one or more of the following climatic classes:

- appliances of extended temperate class (SN);
- appliances of temperate class (N);
- appliances of subtropical class (ST);
- appliances of tropical class (T).

Compliance is checked by inspection.

NOTE The climatic classes are specified in ISO standards.

7 Marking and instructions

This clause of part 1 is applicable except as follows.

7.1 Addition:

Appliances shall also be marked with

- the power input, in watts, of **heating systems**, if greater than 100 W;
- the defrosting input, in watts, if greater than the input corresponding to the **rated power input**;
- **rated power input** in watts or **rated current** in amperes, except that **compression-type appliances**, other than **ice-cream appliances**, shall be marked only with the **rated current** in amperes;
- the letters SN, N, ST or T indicating the climatic class of the appliance;
- the maximum rated wattage of lamps, in watts;
- the total mass of the refrigerant;

NOTE 101 For **absorption-type appliances** using ammonia, the total mass of the refrigerant is considered to be the mass of ammonia used.

- 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 the components,
 - the chemical formula and nominal proportion of each of the components,
 - the refrigerant number and nominal proportion of each of the components,
 - the refrigerant number of the refrigerant blend.

- the chemical name or refrigerant number of the principal component of the insulation blowing gas.

NOTE 102 Refrigerant numbers are given in ISO 817.

For **compression-type appliances**, the defrosting power input in watts shall be marked separately if the current corresponding to the defrosting power input is greater than the **rated current** of the appliance.

Appliances which can be mains and battery operated shall be marked with the battery voltage.

Appliances which can be battery operated shall be marked with the type of battery, distinguishing between rechargeable and non-rechargeable batteries, if necessary, unless the type is irrelevant for the operation of the appliance.

The means provided for connection of any additional electrical supply shall be marked with the voltage and nature of the supply.

Appliances designed for incorporating an **ice-maker** shall be marked with the maximum power input for an **incorporated ice-maker**, if greater than 100 W.

Ice-makers without automatic water level control shall be marked with the maximum permissible water level.

Appliances shall be marked with details of the source of supply other than electrical, if any.

For **compression-type refrigerating systems**, the appliance shall also be marked with the mass of the refrigerant for each separate refrigerant circuit.

Compression-type appliances which use **flammable refrigerants** shall be marked with warning sign B.3.2 from ISO 3864.

7.6 Addition:

The perpendicular height of the triangle containing the warning sign B.3.2 from ISO 3864 shall be at least 15 mm.

7.10 Addition:

NOTE 101 As an alternative, temperature values in degrees Celsius may be indicated on a control scale.

7.12 Addition:

The instructions for **refrigerating appliances** and **ice-makers** for camping or similar use shall include the substance of the following:

- suitable for camping use;
- the appliance may be connected to more than one source of energy;

NOTE 101 This item is not applicable to appliances which are intended to be supplied by electricity only.

- the appliance shall not be exposed to rain

NOTE 102 This item is not applicable to appliances with a degree of protection against harmful ingress of water of at least IPX4.

The instructions for **ice-makers** not intended to be connected to the water supply shall state the substance of the following warning:

WARNING – fill with potable water only.

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

The instructions shall also include the substance of the warnings listed below:

WARNING – keep ventilation openings, in the appliance enclosure or in the built-in structure, clear of obstruction.

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

WARNING – do not damage the refrigerant circuit.

NOTE 103 This warning is only applicable to appliances with refrigerating circuits which are accessible to the user.

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

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

The instructions for **ice-cream appliances** shall include the ingredients and maximum quantity of mixtures that can be used in the appliance.

7.12.1 Addition:

Instructions shall include the method for replacing illuminating lamps.

For appliances designed for incorporating **ice-makers**, the instructions shall include the types of **ice-makers** which can be incorporated.

The instructions shall include information on the installation of **incorporated ice-makers** which are available as optional accessories and intended to be installed by the user. If it is intended that **incorporated ice-makers** are to be installed only by the manufacturer or its service agent, this shall be stated.

The instructions for **ice-makers** intended to be connected to the water supply shall state

- the maximum permissible inlet water pressure, in pascals or bars;
- the minimum permissible inlet water pressure, in pascals or bars, if this is necessary for the correct operation of the appliance;
- the substance of the following warning:

WARNING – connect to potable water supply only.

The instructions for **fixed appliances** shall include the substance of the following warning:

WARNING – to avoid a hazard due to instability of the appliance, it must be fixed according to the instructions.

7.12.4 Modification:

This subclause is also applicable to **fixed appliances**.

7.15 Addition:

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

For **compression-type appliances** the marking of the type of **flammable refrigerant** and of the flammable insulation blowing gas, as well as the warning sign B.3.2 from ISO 3864, shall be visible when gaining access to the motor-compressors.

For other appliances the marking of the type of flammable insulation blowing gas shall be on the external enclosure.

7.101 For appliances which can be battery operated the supply terminals or terminations for connections to the battery shall be clearly indicated by the symbol "+" or the colour red for the positive polarity, and by the symbol "-" or the colour black for the negative polarity, unless the polarity is irrelevant.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of part 1 is applicable except as follows:

8.1.1 Modification:

Replace the second paragraph of the test specification by the following:

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

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:

10.1 Modification:

Replace the third dashed item of the first paragraph of the test specification by the following:

- *the appliance being operated under **normal operation** except that user adjustable temperature controls are set to give the lowest temperature.*

Addition:

The power input is considered to be stabilized when steady conditions are established or when any incorporated timer operates, whichever occurs first.

A representative period is one between the making and the breaking of the temperature control, or between the highest and lowest values of power input measured, excluding starting power input but including the power input of the **incorporated ice-maker**, if any.

NOTE 101 The power input of a defrosting system which is separately marked on the appliance is not taken into consideration during the test.

10.2 Modification:

Replace the third dashed item of the first paragraph of the test specification by the following:

- the appliance being operated under **normal operation** except that user adjustable temperature controls are set to give the lowest temperature.

Addition:

The appliance is operated for a period of 1 h or the maximum setting of an incorporated timer whichever is shorter. 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 the 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** and measuring the power input of the defrosting system after the power input has stabilized.

10.102 The power input of any **heating system** shall not deviate from the power input of these systems marked on the appliance by more than the deviation shown in table 1.

Compliance is checked by operating the appliance at **rated voltage** and measuring the power input of the **heating system** after the power input has stabilized.

11 Heating

This clause of part 1 is applicable except as follows:

11.1 Modification:

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

If the winding temperatures of motor-compressors exceed the values given in table 101, compliance is checked by the test of 11.101.

The winding temperatures of motor-compressors complying with IEC 60335-2-34 including its annex AA are not measured.

11.2 Replacement:

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

Ice-cream appliances are placed as near to the walls of the test corner as possible, unless the manufacturer indicates in the instructions for use that a free distance shall be observed from the walls, in which case, this distance is observed during the test. If means of ventilation are supplied by the manufacturer, they are mounted as intended.

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

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

11.7 Replacement:

The appliance is operated until steady conditions are established.

11.8 Modification:

Replace the text above table 3 by the following:

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

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

During the test, temperature rises are monitored continuously.

For appliances of extended temperate (SN) or temperate (N) class, the temperature rises shall not exceed the values given in table 3.

For appliances of subtropical (ST) or tropical (T) class, the temperature rises shall not exceed the values given in table 3 reduced by 7 K.

Addition:

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 which are:

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

Temperatures of

- enclosures of motor-compressors other than those with an enclosure for which the temperature rise is specified in table 3;
- windings of motor-compressors;

shall not exceed the values given in table 101.

For motor-compressors complying with IEC 60335-2-34 including its annex AA, the temperatures of their

- enclosures, other than those with an enclosure for which the temperature rise is specified in table 3;
 - windings and other parts;
- are not measured.

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
External enclosure	150

11.101 If the temperatures of the windings of motor-compressors other than those complying with IEC 60335-2-34 including its annex AA are higher than the temperature limits given in table 101, the test is carried out again, the **thermostat** or similar control device being set at the lowest temperature, and the short circuit of the user-adjustable temperature control device removed.

The winding temperatures are measured at the end of a running cycle.

The temperatures shall be not higher than the temperature limits given in table 101.

11.102 Any defrosting system shall not give rise to excessive temperatures.

Compliance is checked by the following test:

The appliance is supplied at the most unfavourable voltage between 0,94 and 1,06 times the **rated voltage**:

- in the case of appliances where defrosting is manually controlled, until the **evaporator** is coated with a layer of frost;
- in the case of appliances where defrosting is automatically or semi-automatically controlled, until the **evaporator** is coated with a layer of frost; however, this layer shall be not thicker than that which occurs in normal use during the intervals between the successive automatic defrosting operations or, for the semi-automatic defrosting, during the intervals between the defrosting operations recommended by the manufacturer, if any.

NOTE 1 One method of accumulation of frost for **refrigerating appliances** is given in annex BB.

With the defrosting system operating:

- for **absorption-type appliances** and for **compression-type appliances** in which the defrosting system can be energized with the rest of the appliance unenergized, the supply voltage is as specified in 11.4;
- for other **compression-type appliances**, the supply voltage is as specified in 11.6.

NOTE 2 The defrosting system is regarded as being able to be energized separately if this can be done without the use of a **tool**.

If the defrosting time is controlled by an adjustable device, the device is set to the time recommended by the manufacturer. If a control device is used which stops the defrosting at a given temperature or pressure, the defrosting period is automatically terminated when the control operates.

For manually controlled defrosting, the test is continued until steady conditions are established, otherwise the test is continued until the defrosting period is automatically terminated by a control device.

The temperatures of combustible materials and of electrical components liable to be affected by the defrosting operation are measured with thermocouples.

The temperatures and temperature rises shall not exceed the values given in 11.8.

NOTE 3 During the recovery period after defrosting, the thermal overload protector of the motor compressor may operate.

11.103 Heating systems, other than defrosting systems, incorporated in an appliance shall not give rise to excessive temperatures.

Compliance is checked by the following test:

Heating systems other than defrosting systems are energized as follows:

- for **absorption-type appliances** and for **compression-type appliances** in which the **heating system** can be energized with the rest of the appliance unenergized, the supply voltage is as specified in 11.4;
- for other **compression-type appliances** the supply voltage is as specified in 11.6.

NOTE The defrosting system is regarded as being able to be energized separately, if this can be done without the use of a tool.

The test is continued until steady conditions are established.

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

Temperature rises shall not exceed the values given in 11.8.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of part 1 is applicable except as follows:

13.1 Addition:

The test of 13.2 does not apply to battery circuits.

13.2 Modification:

Instead of the values specified for **class 0I appliances** and the various types of **class I appliances**, the following values apply:

- for **class 0I appliances** 0,75 mA
- for **class I appliances** 1,5 mA

14 Void

15 Moisture resistance

This clause of part 1 is applicable except as follows:

15.2 Addition:

Lamp covers are not removed.

15.101 Appliances subject to spillage of liquid from containers onto the inside walls of the cabinet or compartment, or onto 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, 15.103 and 15.104.

15.102 *The apparatus shown in figure 101 is filled with water containing approximately 1 % NaCl to the level of the lip and the displacement block is supported just above the water by means of any suitable release mechanism and bridge support.*

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

The apparatus is supported with its base horizontal and so positioned and at such a height that when the release mechanism is operated, 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. The test is made only once with the apparatus in any one position, but the test may be repeated as many times as necessary in different positions, provided that there is no residual water on parts wetted by a previous test.

*Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation which could result in a reduction of **creepage distances** and **clearances** below the values given in 29.1.*

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

15.103 *Appliances, other than **built-in appliances, ice-makers** and **ice-cream appliances** are tilted at an angle of up to 2° in relation to the position of normal use in the direction which is likely to be the most unfavourable for this test. One half-litre of water containing approximately 1 % NaCl is poured uniformly over the top of the appliance in approximately 60 s at the most unfavourable place from a height of approximately 50 mm with the controls in the on position and the appliance disconnected from the supply.*

*Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation which could result in a reduction of **creepage distances** and **clearances** below the values given in 29.1.*

15.104 *For **ice-makers** which are directly connected to the water supply, the 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 1 min after the first evidence of overflow.*

Where no spillage occurs due to 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.

Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation which could result in a reduction of **creepage distances** and **clearances** below the values given in 29.1.

15.105 Operation of a defrosting system shall not affect the electrical insulation of defrost heating elements.

Compliance is checked by the following test:

Immediately after the test of 11.102, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation which could result in a reduction of **creepage distances** and **clearances** below the values given in 29.1.

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

16 Leakage current and electric strength

This clause of part 1 is applicable except as follows:

16.1 Addition:

The test of 16.2 does not apply to battery circuits.

16.2 Modification:

Instead of the values specified for **class 0I appliances** and the various types of **class I appliances**, the following values apply.

- for **class 0I appliances** 0,75 mA
- for **class I appliances** 1,5 mA

16.3 Addition:

Add the following item in the table:

Points of application	Class III appliances and class III constructions	Class II appliances and class II constructions	Other appliances
101 Between separate circuits for battery operation and mains supply operation	–	3 750	3 750

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:

*Subclauses 19.2 and 19.3 do not apply to **heating systems**.*

*Compliance for **compression-type appliances** is checked by a locked-rotor test on a separate motor-compressor, only once for a given type of motor-compressor under conditions specified in 19.101 and 19.102 of IEC 60335-2-34, unless the motor-compressor complies with IEC 60335-2-34.*

In addition, fan motors and their thermal motor-protectors, if any, are checked by a locked-rotor test carried out on separate motors and their thermal motor-protectors, only once for a given type of fan motor, thermal motor-protector combination, under the conditions specified in annex AA.

*Fan motors of **ice-cream appliances** are not subject to the locked-rotor test of annex AA.*

19.7 Addition:

*Fan motors of **ice-cream appliances** are tested for 5 min.*

19.8 Addition:

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

19.9 Not applicable

19.13 Addition:

The temperature of the housing of motor-compressors other than those which comply with IEC 60335-2-34 is determined at the end of the test period and shall not exceed 150 °C.

19.101 Heating systems shall be so dimensioned and located that there is no risk of fire even in the case of abnormal operation.

Compliance is checked by inspection and the following test:

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

*Any **heating system** intended to be switched on and off by the user is switched on.*

Heating systems are continuously energized at a voltage equal to 1,1 times their **working voltage**, until steady conditions are established. If there is more than one **heating system**, 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.

NOTE It may be necessary to short-circuit one or more components which operate during **normal operation** in order to ensure that the **heating systems** are continuously energized. **Self-resetting thermal cut-outs** are short-circuited unless they comply with 24.1.2, the number of cycles of operation being 100 000.

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

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

19.102 Ice-makers 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 **ice-maker, incorporated ice-maker or ice-cream appliance** is operated under **normal operation at rated voltage**. Only one fault condition is reproduced at a time and the tests are made consecutively.*

*During the tests, the temperatures of the windings of the **ice-maker, incorporated ice-maker, ice-cream appliance** or of the appliance incorporating the **ice-maker** shall not exceed the values given in table 6.*

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

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 programme;
- open-circuiting or short-circuiting of components;
- failure of a magnetic valve;
- operation with an empty container.

NOTE 2 In general, tests are limited to those cases which may be expected to give the most unfavourable results.

NOTE 3 The tests are made with the tap closed or opened, whichever gives the more unfavourable result.

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

NOTE 5 Components complying with the relevant IEC Standard are not open-circuited or short-circuited, provided the appropriate standard covers the conditions which occur in the appliance.

NOTE 6 Water level switches complying with IEC 61058-1 are not short-circuited during these tests.

NOTE 7 The test during which the automatic filling device is held open has already been made during the test of 15.104.

19.103 Appliances intended for camping and similar use shall be constructed so that the risk of fire, mechanical hazard or electric shock is obviated as far as is practicable in the event of the appliance being operated whilst inclined.

Compliance is checked by the following test:

*The appliance is placed on a support inclined by 5° in the most unfavourable position and is operated under **normal operation at rated voltage** until steady conditions are established.*

*During the test, **non-self-resetting thermal cut-outs** which are accessible only with the aid of a **tool** or which require the replacement of a part shall not operate and no ignitable gas shall accumulate in the appliance.*

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

19.104 Illuminating equipment shall not cause any fire hazard under abnormal operating conditions.

Compliance is checked by the following test:

*The appliance complete with illuminating equipment including its protective cover, fitted with a lamp of a type as recommended by the manufacturer and with a rated wattage equal to the maximum rated wattage marked on the appliance, is operated for 12 h at 1,06 times **rated voltage**. The refrigerating system is switched off with the appliance empty and doors or lids fully opened.*

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

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

19.105 Appliances intended for battery operation and having the polarity marked on or adjacent to the terminals or terminations shall be constructed so that the risk of fire, mechanical hazard or electric shock is obviated in the event of an inverted polarity connection.

Compliance is checked by operating the appliance under the conditions specified in clause 11 but with a fully charged 70 Ah battery connected with reversed polarity.

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

20 Stability and mechanical hazards

This clause of part 1 is applicable except as follows:

20.1 Modification:

Instead of the requirement, the following applies:

Ice-cream appliances shall have adequate stability.

20.101 Refrigerating appliances and ice-makers shall have adequate stability. If stability of the appliance is provided by an open door, the door shall be designed to provide support.

This requirement does not apply to **built-in appliances**.

*Compliance is checked by inspection and by the tests of 20.102, 20.103 and 20.104 which are carried out after the empty appliance has been 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 or adjusted to the most unfavourable position. **Fixed appliances** having a height exceeding 1,3 m are installed according to the instructions for installation.*

NOTE 1 **Fixed appliances** with a height not exceeding 1,3 m are tested as free-standing appliances.

During these tests the appliance shall not tip and, after the tests, compliance with clauses 8, 16 and 29 shall not be impaired.

NOTE 2 Any displacement of the appliance from its horizontal position by more than 2° is considered tipping.

20.102 *Appliances provided with doors shall be subjected to the following test.*

Unless otherwise specified in this standard, all door shelves, other than those which are specifically designed for storing eggs, shall be loaded using cylindrical weights having a diameter of 80 mm and a mass of 0,5 kg.

NOTE 1 If egg racks can be removed, the relevant shelf is not considered to be specifically designed for storing eggs.

The weights are placed on the door shelves starting as far as possible from the hinge and touching each other along the shelf, except for a space less than 80 mm wide at the end of the shelf. Two of these weights are placed in each position on those shelves where a container with a height of 170 mm can be accommodated, whereas one weight at each position is used on the other shelves to be loaded.

NOTE 2 If the shelf is too narrow to accommodate the weights lying flat, the weights may overhang the shelf or be tipped up.

Liquid containers located on the door are filled with a quantity of water to their full mark or, in the absence of a full mark, are completely filled.

For appliances with only one door, this is opened through an angle of approximately 90° and a weight of 2,3 kg is placed 40 mm from the edge farthest from the hinge on top of the door.

For appliances with more than one door, any two doors, in the most unfavourable combination, are opened through an angle of approximately 90°. The shelves of closed doors are not loaded. A weight of 2,3 kg is placed 40 mm from the edge farthest from the hinge on top of one of the open doors, chosen so as to give the most onerous test conditions.

The test is repeated with the door or doors opened through an angle of approximately 180° or to the limit of the door stop, whichever results in the smaller angle of opening.

Where appliances are provided with reversible doors the test with the doors open to 180° or to the limit of the door stop is repeated with the doors hinged on the other side according to the instructions, if this will give a more unfavourable result.

20.103 *Appliances provided with sliding drawers inside food storage compartments are subjected to the following test.*

Each drawer is loaded with a uniformly distributed load/unit storage volume of the drawer of 0,5 kg/l.

NOTE Unit storage volume is the geometric volume of the drawer taking into account the free height of the space above the drawer.

In appliances provided with up to three sliding drawers within food storage compartments, one of the drawers, selected to give the most unfavourable result, is pulled to the most onerous out position or to its stops, if fitted, with the appropriate door opened through an angle of approximately 90°.

In appliances provided with more than three sliding drawers within food storage compartments, two non-adjacent drawers, selected to give the most unfavourable result, are pulled to their most onerous out position or to their stops, if fitted, with any doors necessary to gain access to the drawers opened through an angle of approximately 90°.

The door shelves on opened doors are loaded in accordance with 20.102

20.104 *Appliances provided with sliding drawers accessible without opening a door are subjected to the following test.*

Each drawer is loaded with a uniformly distributed load/unit storage volume of the compartments of 0,5 kg/l.

NOTE Unit storage volume is the geometric volume of the drawer taking into account the free height of the space above the drawer.

One drawer, selected to give the most unfavourable result is pulled to its most onerous out position or to its stops, if fitted, and a weight of 23 kg is gently applied to or suspended from the centre of the drawer.

If the appliance also is provided with a door or doors, unless otherwise specified, the door shelves are loaded as specified in 20.102.

For appliances with only one door, this is opened through an angle of approximately 90° and a weight of 2,3 kg is placed 40 mm from the edge farthest from the hinge on top of the door.

For appliances with more than one door, any two doors, in the most unfavourable combination, are opened through an angle of approximately 90°. The shelves of closed doors are not loaded. A weight of 2,3 kg is placed 40 mm from the edge farthest from the hinge on top of one of the open doors, chosen so as to give the most onerous test conditions.

21 Mechanical strength

This clause of part 1 is applicable except as follows:

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

21.101 Appliances for camping or similar use shall withstand the effects of dropping and vibration.

Compliance is checked by the following test:

The appliance is placed on a horizontal wooden panel which is dropped 50 times from a height of 50 mm onto a solid base of wood.

The appliance is then fastened in its normal position of use to a vibration-generator by means of straps around the enclosure. The type of vibration is sinusoidal, the direction is vertical and the severity is as follows:

- duration 30 min
- amplitude 0,35 mm
- sweep frequency range 10 Hz, 55 Hz, 10 Hz
- sweep rate approximately one octave per minute

After the test, the appliance shall show no damage affecting safety; in particular, no connections or parts the loosening of which may impair safety, shall have loosened.

21.102 Lamps shall be protected against mechanical shocks.

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

The sphere shall not touch the lamp.

22 Construction

This clause of part 1 is applicable except as follows:

22.6 Addition:

Thermostats, with the exception of their thermosensitive parts, shall not be in contact with the **evaporator** unless they are adequately protected against condensation on cold surfaces and against the effect of water formed during the defrosting process.

NOTE Attention is drawn to the fact that fluids may flow along parts such as stems and tubes of thermostats.

22.7 Replacement:

Compression-type appliances, including protective enclosures of a protected cooling system, using **flammable refrigerants** shall withstand

- a pressure of 3,5 times the saturated vapour pressure of the refrigerant at 70 °C for parts exposed to the high-side pressure during normal operation;
- a pressure of 5 times the saturated vapour pressure of the refrigerant at 20 °C for parts exposed only to low-side pressure during normal operation.

NOTE 1 Specific constructional requirements of appliances with a protected cooling system are given in 22.107.

NOTE 2 All pressures are gauge pressures.

Compliance is checked by the following test:

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

NOTE 3 The test is not carried out on motor-compressors complying with IEC 60335-2-34.

22.17 The requirement is not applicable to **refrigerating appliances** and **ice-makers**.

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 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 lamps.

Compliance is checked by inspection and, if necessary, by subjecting the lampholders to a torque of 0,15 Nm for E14 and B15 lampholders, and 0,25 Nm for E27 and B22 lampholders. The lampholders shall then withstand a push force and then a pull force of 10 N ± 1 N, each applied for 1 min in the direction of the axis of the lampholder.

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

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

During the test, no breakdown shall occur.

NOTE Connections to electrical terminals are not considered as joints.

22.103 Ice-makers and appliances incorporating **ice-makers** shall withstand the water pressure to which they may be subjected in normal use.

*Compliance is checked by subjecting those parts of the **ice-maker** and of the appliance incorporating an **ice-maker**, which are under pressure from the water supply mains, for 5 min, to a static pressure equal to twice the maximum permissible inlet water pressure or 1,2 MPa (12 bar), whichever is the greater.*

During the test, there shall be no leakage from any part including the inlet water hose.

22.104 Appliances with two or more temperature control devices which control the same motor-compressor shall not cause undue operation of the thermal motor-protector of the motor-compressor.

Compliance is checked by the following test:

*The appliance is operated at **rated voltage** under **normal operation** except that user adjustable temperature control devices are set to give cyclic operation.*

When steady conditions are established, and immediately after a breaking of the first control device the second control device is activated. The thermal motor-protector of the motor-compressor shall not operate.

In the case of appliances where more than two control devices may act on a motor-compressor, the test is carried out separately with each combination of control devices.

22.105 For mains-operated appliances which can also be battery operated, the battery circuit shall be insulated from **live parts** by **double insulation** or **reinforced insulation**.

Moreover, it shall not be possible to touch **live parts** when making the connections to the battery. This applies even if covers, or other parts, which have to be removed to make the connections are **non-detachable parts**.

*Compliance is checked by inspection and by the tests specified for **double insulation** or **reinforced insulation**.*

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

Compliance is checked by inspection.

22.107 Compression-type appliances with a protected cooling system and which use **flammable refrigerants** shall be constructed 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 liable to cause a fire or explosion hazard in the event of a leakage from the component itself.

NOTE 2 Appliances with a protected cooling system are those

- without any part of the cooling system inside a food storage compartment;
- where any part of the cooling system which is located inside a food storage compartment is constructed so that the refrigerant is contained within an enclosure with at least two layers of metallic materials separating the refrigerant from the food storage compartment. Each layer shall have a thickness of at least 0,1 mm. The enclosure has no joints other than the bonded seams of the evaporator where the bonded seam has a width of at least 6 mm;
- where any part of the cooling system which is located inside a food storage compartment has the refrigerant contained in an enclosure which itself is contained within a separate protective enclosure. If leakage from the containing enclosure occurs, the leaked refrigerant is contained within the protective enclosure and the appliance will not function as in normal use. The protective enclosure shall also withstand the test of 22.7. No critical point in the protective enclosure shall be located within the food storage compartment.

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

Compliance is checked by inspection and by the tests of 22.107.1 and 22.107.2.

NOTE 4 An appliance with a protected cooling system which, when tested, is found not to comply with the requirements specified for a protected cooling system, may be considered as having an unprotected cooling system if it is tested according to 22.108 and found to comply with the requirements for an unprotected cooling system.

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

NOTE 1 Critical points are only interconnecting joints between parts of the refrigerant circuit including the gasket of a semi-hermetic motor compressor. Welded telescopic joints of the motor-compressor housing, the welding of the pipes through the motor-compressor housing and the welding of the fusite are not considered to be pipework joints. To find the most critical point of the cooling system, it may be necessary to carry out 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 $0,7 \text{ mm} \pm 0,05 \text{ mm}$ and a length between 2 m and 3 m.

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

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

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

The quantity of refrigerant of the type indicated by the manufacturer to be injected is equal to 80 % of the nominal charge of the refrigerant $\pm 1,5 \text{ g}$ or the maximum which can be injected in one hour, 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 carried out using the fraction that has the smallest value of the lower explosive limit.

The gas bottle is kept at a temperature of

- a) $32 \text{ }^{\circ}\text{C} \pm 1 \text{ }^{\circ}\text{C}$ for leakage simulation on low-side pressure circuits;
- b) $70 \text{ }^{\circ}\text{C} \pm 1 \text{ }^{\circ}\text{C}$ for leakage simulation on high-side pressure circuits.

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

*The concentration of leaked refrigerant inside the food storage compartments and inside any internal or external electrical component compartment except those which contain only **non-self-resetting protective devices** necessary for compliance with clause 19, is measured continuously from the beginning of the test and for at least 1 h after the injection of the gas has stopped.*

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

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

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

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

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

22.107.2 All accessible surfaces of protected cooling system components, including accessible surfaces in intimate contact with protected cooling systems, are scratched using the tool whose tip 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 %.

22.108 For **compression-type appliances** with unprotected cooling systems and which use **flammable refrigerants**, any electrical apparatus other than **non-self-resetting protective devices**, necessary for compliance with clause 19, located inside the food storage compartments shall be tested and found to comply with at least section 3 clauses 16 and 17, and section 4 of IEC 60079-15 for group IIA gases or the refrigerant used.

Refrigerant leakage into food storage compartments shall not result in an explosive atmosphere outside the food storage compartment in areas where electrical apparatus are mounted, except in those areas which contain only **non-self-resetting protective devices** necessary for compliance with clause 19, when doors or lids remain closed or when opening or closing doors or lids unless these apparatus have been tested and found to comply at least with section 3, clauses 16 and 17 and section 4 of IEC 60079-15 for group IIA gases or the refrigerant used.

NOTE 1 Separate components such as **thermostats** which contain less than 0,5 g of flammable gas are not considered liable 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 22.107.

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

NOTE 4 For the purposes of this standard, the term apparatus includes electrical and **electronic components**, related circuits and associated constructions, but does not include **non-self-resetting protective devices** necessary for compliance with clause 19.

NOTE 5 Changing of a lamp is not considered a potential explosion hazard, because the door or lid is open during this operation.

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

NOTE 6 The tests in section 4 of IEC 60079-15 may be carried out using the stoichiometric concentration of the refrigerant used. However, apparatus which has been independently tested and found to comply with section 4 of IEC 60079-15 using the gas specified for group IIA need not be tested.

NOTE 7 Irrespective of the requirement given in 4.3 of IEC 60079-15, surface temperature limits are specified in 22.110.

*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 carried out twice and is repeated a third time if one of the first tests gives more than 40 % of the lower explosive limit.

Through an appropriate orifice, 80 % of the nominal refrigerant charge $\pm 1,5$ 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 for opening the lids or doors is used.

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

*The concentration of leaked refrigerant as close as possible to the electrical apparatus, other than **non-self-resetting protective devices** necessary for compliance with clause 19, is measured continuously from the beginning of the test.*

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

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

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

22.109 Compression-type appliances which use **flammable refrigerants** shall be constructed so that leaked refrigerant will not stagnate so as to cause a fire or explosion hazard in areas outside the food storage compartments where the appliance's electrical components, other than **non-self-resetting protective devices** necessary for compliance with clause 19, are fitted.

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

Unless the electrical apparatus under consideration has been tested and found to comply at least with section 3, clauses 16 and 17, and section 4 of IEC 60079-15 for group IIA gases or the refrigerant used, compliance is checked by the following test.

NOTE 2 Irrespective of the requirement given in 4.3 of IEC 60079-15, surface temperature limits are specified in 22.110.

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

NOTE 4 For the purposes of this standard, the term apparatus includes electrical and **electronic components**, related circuits and associated constructions, but does not include **non-self-resetting protective devices** necessary for compliance with clause 19.

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

- pipework joints in external parts of the cooling circuit;
- the gasket of semi-hermetic motor-compressors;

to the electrical apparatus under consideration, any direct injection shall be avoided.

NOTE 5 Welding telescopic joints of the motor-compressor housing, the welding of the pipes through the motor-compressor housing and the welding of the fusite are not considered to be pipework joints.

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

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

22.110 Temperatures on surfaces that may be exposed to leakage of **flammable refrigerants** shall not exceed the 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 of clause 11 and the tests of clause 19, except those tests which are terminated by a **non-self-resetting protective device** operating or by an intentionally weak part becoming permanently open-circuited.

Table 102 – Refrigerant flammability parameters

Refrigerant number	Refrigerant name	Refrigerant formula	Refrigerant ignition temperature ^{a c} °C	Refrigerant lower explosive limit ^{b c d} %V/V
R50	Methane	CH ₄	537	4,4
R290	Propane	CH ₃ CH ₂ CH ₃	470	1,7
R600	n-Butane	CH ₃ CH ₂ CH ₂ CH ₃	372	1,4
R600a	Isobutane	CH(CH ₃) ₃	494	1,8

^a Values for other **flammable refrigerants** can be obtained from IEC 60079-4A and IEC 60079-20.

^b Values for other **flammable refrigerants** can be obtained from IEC 60079-20 and ISO 5149.

^c IEC 60079-20 is the reference standard. ISO 5149 may be used if the required data is not contained in IEC 60079-20.

^d Concentration of refrigerant in dry air.

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

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 farthest from the hinge axis in the direction perpendicular to the plane of the lid or door.

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

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

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

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

Compliance is checked by inspection and measurement.

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

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

Compliance is checked by inspection, measurement and by the following test which is carried out 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 for installation, 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.

A 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 and the drawer shall open before the force exceeds 70 N.

22.114 In appliances intended for household use and which contain compartments with a **free space**, any door or drawer giving access to these compartments shall not be fitted with a self-latching lock.

Key operated locks shall require two independent movements to actuate the lock or be of a type that automatically ejects the key when unlocked.

NOTE Push and turn is considered to be an example of two independent movements.

Compliance is checked by inspection and test.

22.115 The fixing means for **fixed appliances** shall have adequate mechanical strength.

Compliance is checked by the following test which is carried out with the appliance empty and installed in accordance with the instructions for installation.

NOTE Appliances normally mounted on a wall or fixed to a ceiling are not tested.

A 500 N force is applied horizontally at specified points, one at a time. The force shall be maintained for 5 min.

The points of application and direction of the force are a forward force at the highest point in the centre of the rear of the appliance and a sideways force at the highest point in the centre of each side of the appliance. The force is applied over a surface area of at least 30 mm by 30 mm that does not project above the top surface of the appliance.

The fixing means shall remain intact and the appliance shall not tip by more than 2°.

23 Internal wiring

This clause of part 1 is applicable except as follows.

23.3 Addition:

NOTE 101 The requirement concerning open-coil springs does not apply to external conductors.

24 Components

This clause of part 1 is applicable except as follows:

24.1 Addition:

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

24.1.2 Addition:

- | | |
|---|--|
| – self-resetting thermal cut-outs which may influence the test results of 19.101 and which are not short-circuited during the test of 19.101 | 100 000 |
| – thermostats which control the motor-compressor | 100 000 |
| – motor-compressor starting relays | 100 000 |
| – automatic thermal motor-protectors for motor-compressors of the hermetic and semi-hermetic type | minimum 2 000, but not less than the number of operations during the locked-rotor test |
| – manual reset thermal motor-protectors for motor-compressors of the hermetic and semi-hermetic type | 50 |
| – other automatic thermal motor-protectors | 2 000 |
| – other manual reset thermal motor protectors | 30 |

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

24.1.5 Addition:

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

24.3 Addition:

Voltage selection switches used in appliances for camping or similar use shall ensure all-pole disconnection from the supply and shall have a contact separation of at least 3 mm.

24.101 Lampholders shall be of the insulated type.

Compliance is checked by inspection.

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**, 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.

Appliances which can be both mains and battery operated shall be provided with a separate means for the connection of the mains and of the battery.

25.7 Modification:

Replace the fourth and fifth dashed items by the following:

- light polyvinyl chloride sheathed flexible cord (code designation 60227 IEC 52).

Addition:

This subclause does not apply to flexible leads or a flexible cord used to connect an external battery or battery box to an appliance.

25.13.2 *Addition:*

This subclause does not apply to flexible leads or a flexible cord used to connect an external battery or battery box to an appliance.

25.23 *Addition:*

For appliances which can be battery operated, if the battery is placed in a separate box, the flexible lead or flexible cord used to connect the box to the appliance is considered to be an **interconnection cord**.

25.101 Appliances which can be battery operated shall have suitable means for connection of the battery.

Appliances shall be provided with terminals or flexible leads, or a flexible cord which, for connection to the battery terminals, may be fitted with clamps or other devices suitable for use with the type of battery marked on the appliance.

Compliance is checked by inspection.

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.

26.11 *Addition:*

Terminal devices in an appliance for the connection of the flexible leads or cord with **type X attachment** connecting an external battery or battery box shall be so located or shielded that there is no risk of accidental connection between battery supply terminals.

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 Creepage distances, clearances and distances through 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.

29.1 Addition:

Add the following item to table 13:

Between separate circuits for battery operation and mains supply operation	–	–	8	8	8	8	–	–
--	---	---	---	---	---	---	---	---

30 Resistance to heat, fire and tracking

This clause of part 1 is applicable except as follows:

30.1 Addition:

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

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

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

Modification:

For **accessible parts** of non-metallic material within the 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.

30.2.1 Addition:

The door or lid shall be open during the glow-wire test. If a self-sustaining flame exists, the door or lid is closed after the 30 s application of the glow-wire tip, and the test is continued.

30.2.2 Not applicable.

30.2.3 *Addition:*

The door or lid shall be open during the glow-wire test and when applicable, the needle flame test. If a self-sustaining flame exists, the door or lid is closed after the 30 s application of the glow-wire tip or the application time of the needle flame, and the test is continued.

31 Resistance to rusting

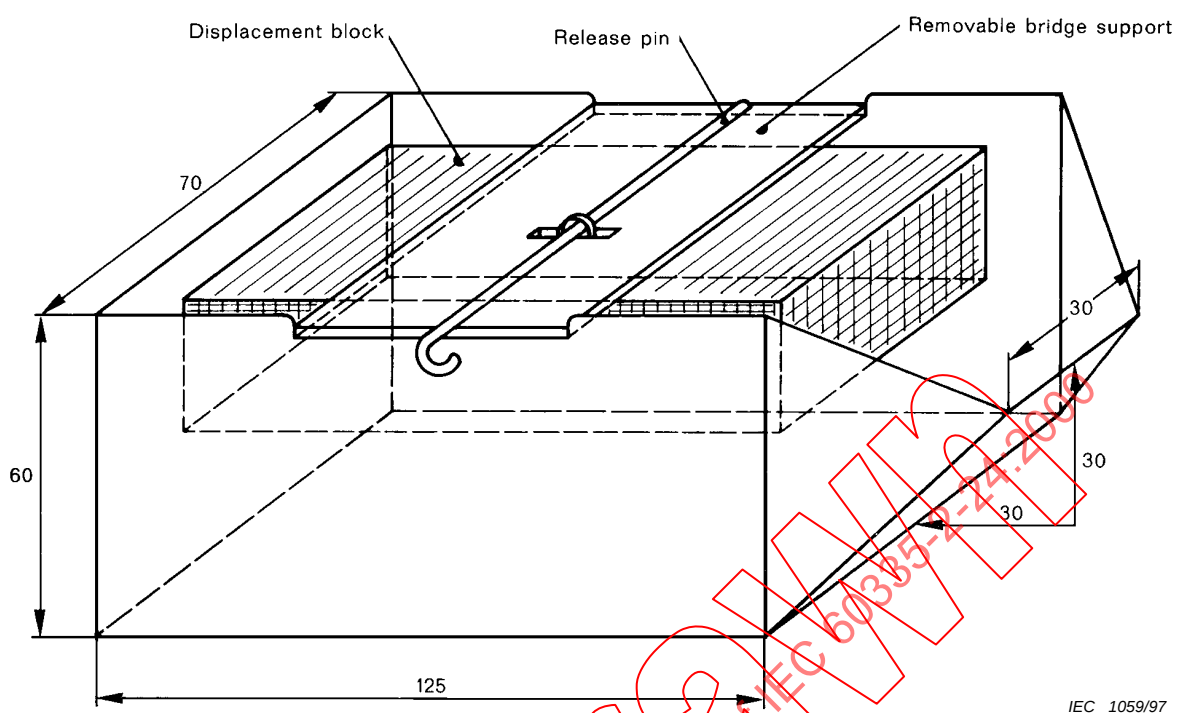
This clause of part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of part 1 is not applicable.

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Withd 2000



Dimensions in millimetres

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 inside dimensions and the tolerance is ± 2 .

Figure 101 – Apparatus for spillage test

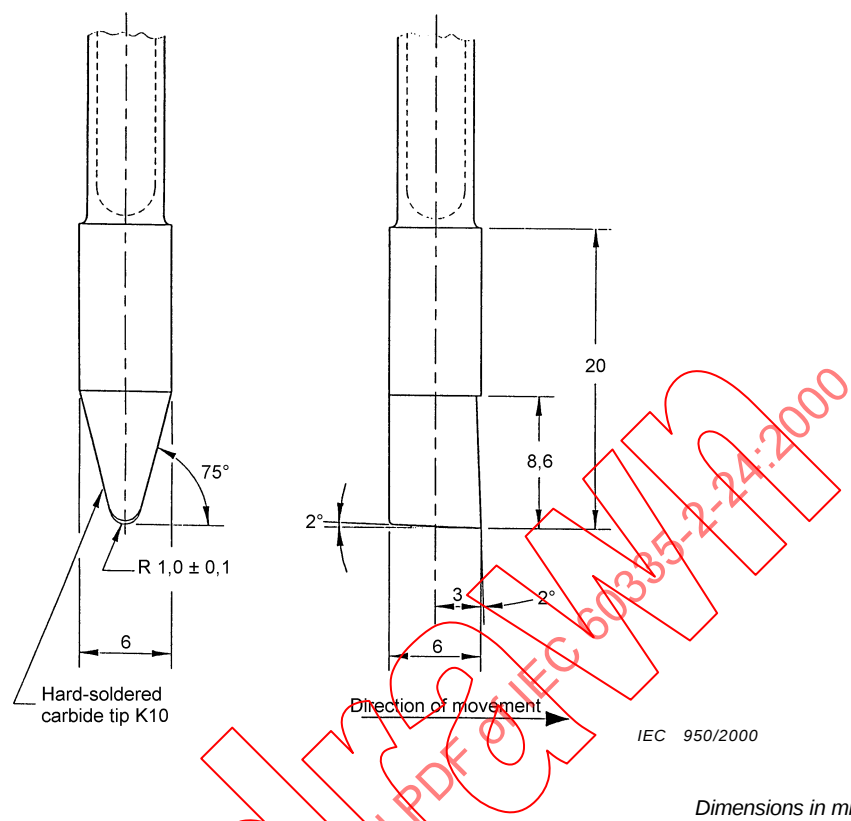


Figure 102 – Detail of scratching tool tip