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Household and similar electrical appliances – Safety –

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



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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –
SAFETY –****Part 2-24: Particular requirements for refrigerating appliances,
ice-cream appliances and ice-makers**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This part of International Standard IEC 60335 has been prepared by subcommittee 61C: Household appliances for refrigeration, of IEC technical committee 61: Safety of household and similar electrical appliances.

This consolidated version of IEC 60335-2-24 is based on the sixth edition (2002) [documents 61C/213/FDIS and 61C/216/RVD] and its amendment 1 (2005) [documents 61C/291/FDIS and 61C/302/RVD].

It bears the edition number 6.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fourth edition (2001) of that standard.

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

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

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

NOTE 2 The following numbering system is used:

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

NOTE 3 The following print types are used:

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

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

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

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

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.

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.

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

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

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

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

1 Scope

This clause of Part 1 is replaced by the following.

This International 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 that are encountered by all persons in and around the home. However, in general, it does not 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 the 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 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60079 (all parts), *Electrical apparatus for explosive gas atmospheres*

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

IEC 60079-15, *Electrical apparatus for explosive gas atmospheres – Part 15: Construction, test and marking of type of protection, non-sparking "n" electrical apparatus*¹

IEC 60079-20:1996, *Electrical apparatus for explosive gas atmospheres – Part 20: Data for flammable gases and vapours, relating to the use of electrical apparatus*

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

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

ISO 817:1974, *Organic refrigerants – Number designation*

ISO 3864:1984, *Safety colours and safety signs*

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

3 Definitions

This clause of Part 1 is applicable except as follows.

3.1.9 Replacement:

normal operation

operation of the appliance under the following conditions

3.2.9.101

normal operation of a refrigerating appliance

operation at an ambient temperature in accordance with 5.7, 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

¹ This future third edition of IEC 60079-15 is currently circulating as an FDIS to the National Committees.

3.2.9.102**normal operation of an ice-maker**

operation at an ambient temperature in accordance with 5.7, with the supply water at a temperature of $15\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$

3.2.9.103**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 $15\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$

3.2.9.104**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 $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$

3.101**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

3.102**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**)

3.103**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

3.104**incorporated ice-maker**

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

3.105**heating system**

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

3.106**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**)

3.107**condenser**

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

3.108

evaporator

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

3.109

flammable refrigerant

refrigerant with a flammability classification of group 2 or 3 in accordance with 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.

3.110

ice-cream appliance

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

3.111

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

4 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.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.2 *Addition:*

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

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

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

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

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

5.3 *Addition:*

Before starting the tests

- **ice-cream appliances** are operated empty at **rated voltage** for 1 h, or for 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.

5.4 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.

5.7 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

$32\text{ °C} \pm 1\text{ °C}$ on appliances of extended temperate (SN) and temperate (N) classes;

$38\text{ °C} \pm 1\text{ °C}$ on appliances of subtropical (ST) class;

$43\text{ °C} \pm 1\text{ °C}$ 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 $20\text{ °C} \pm 5\text{ °C}$.

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.

5.8.1 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.

5.9 Addition:

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

5.10 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 101 Commonly available fixing hardware, such as screws and bolts, need not be delivered with a fixed appliance.

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

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

5.103 **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.

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 in accordance with 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 conforming to 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, and
 - windings of motor-compressors
- shall not exceed the values given in Table 101.

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

- enclosures, other than those with an enclosure for which the temperature rise is specified in Table 3, and
 - 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

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

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 refrigerating appliances** the values specified for the various types of stationary **class I appliances**;
- for other **class I appliances** 1,5 mA.

13.3 Addition:

*The test voltage specified in Table 4 for **reinforced insulation** is applied between separate circuits for battery operation and mains supply operation.*

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:

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 and 0,6 % of acid rinsing agent, as specified in Annex AA of IEC 60335-2-5, 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 **clearances** and **creepage distances** below the values specified in Clause 29.

Furthermore, if the inspection shows that water is in contact with the defrost heating element or its insulation, 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 and 0,6 % of acid rinsing agent, as specified in Annex AA of IEC 60335-2-5, 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 **clearances** and **creepage distances** below the values specified in Clause 29.

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 **clearances** and **creepage distances** below the values specified in Clause 29.

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 **clearances** and **creepage distances** below the values specified in Clause 29.

Furthermore, if the inspection shows that water is in contact with the defrost heating element or its insulation, 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 refrigerating appliances** the values specified for the various types of stationary **class I appliances**;
- for other **class I appliances** 1,5 mA.

16.3 Addition:

*The test voltage specified in Table 7 for **reinforced insulation** is applied between separate circuits for battery operation and mains supply operation.*

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**.*

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

NOTE 101 For any given type of fan motor and thermal motor-protection combination, this test is performed only once.

Motor compressors not conforming to IEC 60335-2-34 are subjected to the tests specified in IEC 60335-2-34, 19.101 and 19.102, and shall also conform to 19.104 of that standard.

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

*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 and ice-cream 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 **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 8.*

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, for which the appliance is empty, the refrigerating system 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 12.5.1 of IEC 60598-1, the appliance being supplied at **rated voltage**.*

During the test, surrounding plastic parts shall not show any distortion which may affect safety in the sense of this standard.

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

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 in accordance with 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.

As many weights as possible are placed horizontally on the door shelves starting as far as possible from the hinge and touching each other along the shelf, even if extended beyond the edge of the shelf, except for a space less than 80 mm wide at the end of the shelf.

Three of these weights are placed in each position on those shelves where the free height above the shelf is 340 mm or higher, two weights in each position on those shelves where the free height above the shelf is between 170 mm and 340 mm and one weight in each position where the free height above the shelf is less than 170 mm. Shelves that can be adjusted to different positions by the user are placed in the position which will give the most unfavourable results.

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 in accordance with 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 101 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 101 Specific constructional requirements of appliances with a protected cooling system are given in 22.107.

NOTE 102 All pressures are gauge pressures.

Compliance is checked by the following test.

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

NOTE 103 The test is not 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 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 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.

After the tests, lampholders shall not have worked loose.

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 in accordance with 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 mm $\pm$ 0,05 mm and a length between 2 m and 3 m.

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

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

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

The quantity of refrigerant of the type indicated by the manufacturer to be injected is equal to 80 % of the nominal charge of the refrigerant $\pm$ 1,5 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

- 32 °C $\pm$ 1 °C for leakage simulation on low-side pressure circuits;*
- 70 °C $\pm$ 1 °C for leakage simulation on high-side pressure circuits.*

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

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

The concentration is not measured close to

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

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 N ± 3 N;
- *force parallel to the surface to be tested* not exceeding 250 N.

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

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

The scratches shall not cross each other.

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

22.108 For **compression-type appliances** with unprotected cooling systems and which use **flammable refrigerants**, any electrical component located inside the food storage compartment, which during **normal operation** or abnormal operation produces sparks or arcs and luminaires, shall be tested and found at least to comply with the requirements in Annex CC 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, even if they produce arcs or sparks during operation; nor to
- intentionally weak parts that become permanently open-circuited during the tests of Clause 19, even if they produce arcs or sparks during operation.

Refrigerant leakage into food storage compartments shall not result in an explosive atmosphere outside the food storage compartments in areas where electrical components that produce arcs and sparks during **normal operation** or abnormal operation or luminaires are mounted, when doors or lids remain closed or when opening or closing doors or lids, unless these components have been tested and found at least to comply with the requirements in Annex CC, 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, even if they produce arcs or sparks during operation; 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 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 Changing of a lamp is not considered a potential explosion hazard, because the door or lid is open during this operation.

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

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

NOTE 6 Irrespective of the requirement given in 5.4 of IEC 60079-15 Ed.3., 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 is measured at least 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 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.*

The concentration values are recorded for a period of 15 min after a sustained decrease is observed.

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 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 tests of Clause 19

are mounted, 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 liable to cause a fire or explosion hazard in the event of a leakage of the component itself.

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

NOTE 2 Irrespective of the requirement given in 5.4 of IEC 60079-15, Ed.3, 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.

*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, or
- the gasket of semi-hermetic motor-compressors

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

NOTE 4 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 component is measured at least every 30 s from the beginning of the test until 15 min after a sustained decrease is observed.

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 specified in Clauses 11 and 19.

Temperatures of

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

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

Table 102 – Refrigerant flammability parameters

Refrigerant number	Refrigerant name	Refrigerant formula	Refrigerant 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.

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 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:

– 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

24.3 Addition:

Voltage selection switches used in appliances for camping or similar use shall have a contact separation in all poles that provide full disconnection from the supply under overvoltage category III conditions.

24.5 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**.*

24.101 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 cords used to connect an appliance to a SELV power supply.

25.13 Addition:

This subclause does not apply to flexible leads or cords used to connect an appliance to a SELV power supply.

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 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 conforms to IEC 60335-2-34. For motor-compressors not conforming to Part 2-34, the additions and modifications specified in Part 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 **refrigeration appliances** and **ice-makers** is in pollution degree 3 and shall have a CTI value of not less than 250.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.1 Addition:

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

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

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

Modification:

*For **accessible parts** of non-metallic material within the storage compartment, the temperature of $75^{\circ}\text{C} \pm 2^{\circ}\text{C}$ is replaced by $65^{\circ}\text{C} \pm 2^{\circ}\text{C}$.*

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.

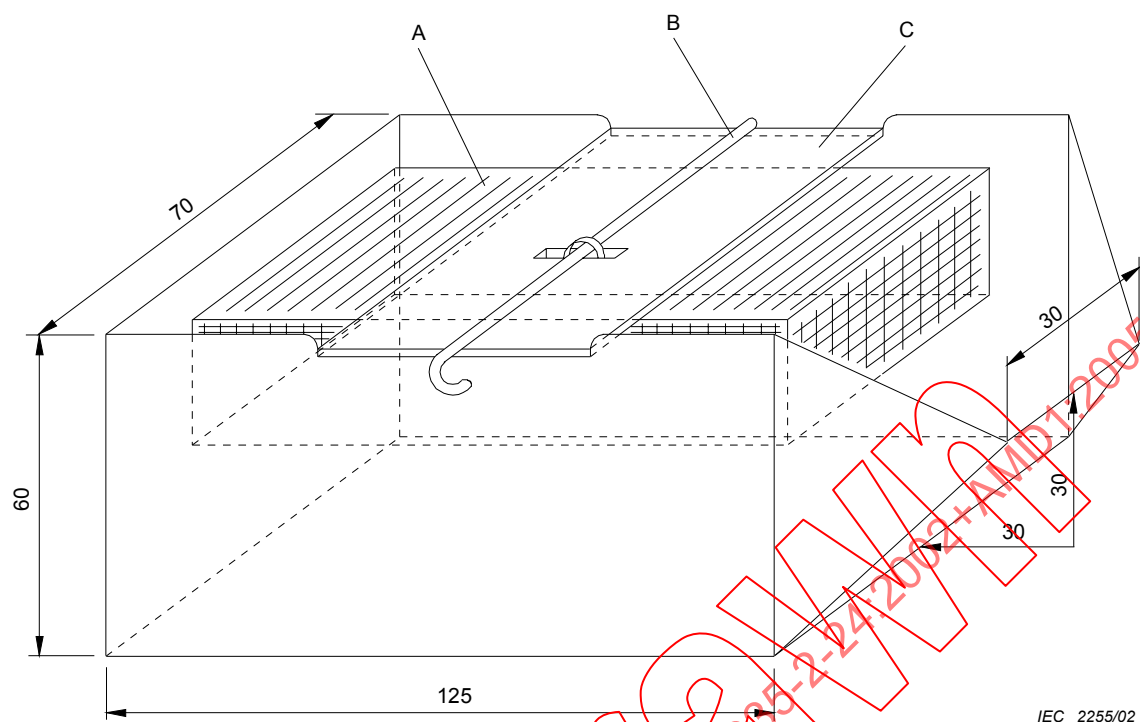
30.2.2 Not applicable.

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.



IEC 2255/02

Dimensions in millimetres

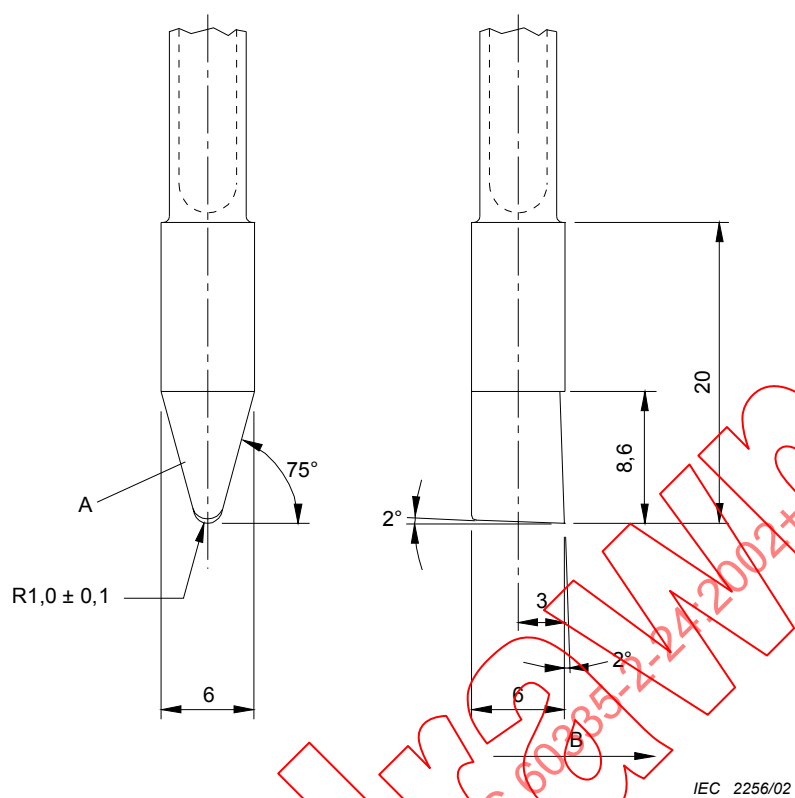
Key

- A Displacement block
- B Release pin
- C Removable bridge support

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



Dimensions in millimetres

Key

- A Hard-soldered carbide tip K10
- B Direction of movement

Figure 102 – Detail of scratching tool tip