INTERNATIONAL STANDARD

IEC 60335-2-40

Fourth edition
2002-12

Household and similar electrical appliances – Safety –

Part 2-40: Particular requirements for electrical heat pumps, air conditioners and dehumidifiers

Appareils électrodomestiques et analogues – Sécurité –

Partie 2-40: Règles particulières pour les pompes à chaleur électriques, les climatiseurs et les déshumidificateurs

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers

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.
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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.

This part of International Standard IEC 60335 has been prepared by subcommittee 61D: Appliances for air-conditioning for household and similar purposes, of IEC technical committee 61: Safety of household and similar electrical appliances.

This fourth edition cancels and replaces the third edition published in 1995 and its amendment 1 (2000). It constitutes a technical revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
61D/116/FDIS	61D/121/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.

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 electrical heat pumps, air-conditioners and dehumidifiers.

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 small roman type.

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

The committee has decided that the contents of this publication will remain unchanged until 2003. At this date, the publication will be

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- withdrawn;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

The following differences exist in the countries indicated below.

– 6.1: Class 0I appliances are allowed (Japan).

– 11.8: The temperature of the wooden walls in the test casing is limited to 85 °C (Sweden).

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

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.

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 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of electric **heat pumps**, including **sanitary hot water heat pumps**, **air-conditioners**, and **dehumidifiers** incorporating sealed motor-compressors, their maximum **rated voltages** being not more than 250 V for single phase appliances and 600 V for all other appliances.

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.

The appliances referenced above may consist of one or more factory made assemblies. If provided in more than one assembly, the separate assemblies are to be used together, and the requirements are based on the use of matched assemblies.

NOTE 101 A definition of "sealed motor-compressor" is given in IEC 60335-2-34.

NOTE 102 Requirements for refrigeration safety are covered by ISO 5149, and requirements for containers intended for storage of the heated water included in **sanitary hot water heat pumps** are, in addition, covered by IEC 60335-2-21.

NOTE 103 For appliances using flammable refrigerants, additional requirements are under consideration.

Supplementary heaters, or a provision for their separate installation, are within the scope of this standard, but only heaters which are designed as a part of the appliance package, the controls being incorporated in the appliance.

NOTE 104 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;

– for appliances subjected to pressure, 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, the national water supply authorities and similar authorities. In the case of appliances for permanent connection to the water supply system, all relevant requirements need to be observed.

NOTE 105 This standard does not apply to

– humidifiers intended for use with heating and cooling equipment (IEC 60335-2-88);

– appliances designed exclusively for industrial processing;

– 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).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60068-2-52:1996, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

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

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

3 Definitions

This clause of Part 1 is applicable except as follows.

3.1.4 *Addition:*

NOTE 101 If the appliance comprises electrical accessories, including fans, the **rated power input** is based upon the total maximum **electrical power input** with all accessories energized, when operating continuously under the appropriate environmental conditions. If the **heat pump** can be operated in the heating or cooling mode, the **rated power input** is based upon the input in the heating or in the cooling mode, whichever is the greater.

3.1.9 *Replacement:*
normal operation
conditions that apply when the appliance is mounted as in normal use and is operating under the most severe operating conditions specified by the manufacturer

3.101
heat pump
appliance which takes up heat at a certain temperature and releases heat at a higher temperature

NOTE When operated to provide heat (e.g., for space heating or water heating), the appliance is said to operate in the heating mode; when operated to remove heat (for example, for space cooling), it is said to operate in the cooling mode.

3.102
sanitary hot water heat pump
heat pump intended to transfer heat to water suitable for human consumption

3.103
air conditioner
encased assembly or assemblies designed as an appliance to provide delivery of conditioned air to an enclosed space, room or zone. It includes an electrically operated refrigeration system for cooling and possibly dehumidifying the air. It may have means for heating, circulating, cleaning and humidifying the air

3.104
dehumidifier
encased assembly designed to remove moisture from its surrounding atmosphere. It includes an electrically operated refrigeration system and the means to circulate air. It also includes a drain arrangement for collecting and storing and/or disposing of the condensate

3.105
dehumidification – comfort
dehumidification to reduce the humidity within a space to a level to satisfy the requirements of the occupants

3.106
dehumidification – process
dehumidification to reduce the humidity within a space to a level necessary for the process or the storage of goods and/or materials or the drying out of the building fabric

3.107
dehumidification – heat recovery
dehumidification where the latent and sensitive heat removed from the space together with the compressor heat is reused in another application rather than rejected outside to waste

3.108
wet-bulb temperature (WB)
temperature indicated when the temperature-sensitive element in a wetted wick has reached a state of constant temperature (evaporative equilibrium)

3.109
dry-bulb temperature (DB)
temperature indicated by a dry, temperature-sensitive element shielded from the effects of radiation

3.110
evaporator
heat exchanger in which refrigerant liquid is vaporized by absorption of heat

3.111
heat exchanger
device specifically designed to transfer heat between two physically separated fluids

3.112
indoor heat exchanger
heat exchanger designed to transfer heat to the indoor parts of the building or to the indoor hot water supplies (e.g. sanitary water) or to remove heat therefrom

3.113
outdoor heat exchanger
heat exchanger designed to remove or release heat from the heat source (for example, ground water, outdoor air, exhaust air, water or brine)

3.114
supplementary heater
electric heater provided as part of the appliance to supplement or replace the output of the refrigerant circuit of the appliance by operation in conjunction with, or instead of, the refrigeration circuit

3.115
pressure-limiting device
mechanism that automatically responds to a predetermined pressure by stopping the operation of the pressure-imposing element

3.116
pressure-relief device
pressure actuated valve or rupture member which functions to relieve excessive pressure automatically

3.117
self-contained unit
complete appliance, in suitable frames or enclosures, that is fabricated and shipped in one or more sections, and has no refrigerant containing parts connected in the field other than by companion or block valves

NOTE 1 A **self-contained unit** in a single frame or enclosure is called a single package unit.

NOTE 2 A **self-contained unit** in more than one frame enclosure is called a split package unit.

3.118
appliances accessible to the general public
appliances intended to be located in residential buildings or in commercial buildings

3.119
appliances not accessible to the general public
appliances which are intended to be maintained by qualified service personnel and located either in machine rooms and the like or at a level not less than 2,5 m or in secured rooftop areas

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.6 *Addition:*

Any controls which regulate the temperature or humidity of the conditioned space are rendered inoperative during the test.

5.7 *Replacement:*

The tests and test conditions of Clauses 10 and 11 are carried out under the most severe operating conditions within the operating temperature range specified by the manufacturer. Annex AA provides examples of such temperature conditions.

5.10 *Addition:*

For split-package units, the refrigerant lines shall be installed in accordance with the installation instructions. The refrigerant line length shall be the maximum length stated in the installation instructions or 7,5 m, whichever is the shorter. The thermal insulation of the refrigerant lines shall be applied in accordance with the installation instructions.

5.101 *Motor-compressors are also subjected to the relevant test of Clause 19 of IEC 60335-2-34, unless the motor-compressor complies with that standard, in which case it is not necessary to repeat these tests.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Modification:*

Appliance shall be of **class I**, **class II** or **class III**.

6.2 *Addition:*

Appliances shall be classified according to degree of protection against harmfull ingress of water in accordance with IEC 60529:

– appliances or parts of appliances intended for outdoor use shall be at least IPX4;
– appliances intended only for indoor use (excluding laundry rooms) may be IPX0;
– appliances intended to be used in laundry rooms shall be at least IPX1.

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

Compliance is checked by inspection and the relevant tests.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Modification:*

Replace the second dash by:

– symbol for nature of supply including number of phases, unless for single phase operation.

Addition:

– rated frequency;
– the mass of the refrigerant, or of each refrigerant in a blend other than those of the azeotropic type;
– the refrigerant identification:
  - for a single component refrigerant, one of the following:
    - the chemical formula;
    - the refrigerant number;
  - for a blended refrigerant, one of the following:
    - the chemical name of each of the components;
    - the chemical formula for each of the components;
    - the refrigerant numbers of each of the components;
    - the refrigerant number of the refrigerant blend;
– permissible excessive operating pressure for the storage tank (for **sanitary hot water heat pumps**);
– for the refrigerant circuit; should the permissible excessive operating pressure for the suction and discharge side differ, a separate indication is required;
– IP number according to degree of protection against ingress of water, other than IPX0.

Appliances shall be marked with all of the designations and the rated inputs of the **supplementary heaters** for which they are intended to be used, and shall have provision for identifying the actual heater that is field installed.

Unless it is evident from the design, the enclosure of the appliance shall be marked, by words or by symbols, with the direction of the fluid flow.

7.12 *Addition:*

For **appliances not accessible to the general public**, the classification according to 6.101 shall be included.

7.12.1 *Addition:*

In particular, the following information shall be supplied:

– that the appliance shall be installed in accordance with national wiring regulations;
– the dimensions of the space necessary for correct installation of the appliance including the minimum permissible distances to adjacent structures;
– for appliances with **supplementary heaters**, the minimum clearance from the appliance to combustible surfaces;
– a wiring diagram with a clear indication of the connections and wiring to external control devices and **supply cord**;
– the range of external static pressures at which the appliance was tested (add-on **heat pumps**, and appliances with **supplementary heaters,** only);
– the method of connection of the appliance to the electrical supply and interconnection of separate components;
– indication of which parts of the appliance are suitable for outdoor use, if applicable;
– details of type and rating of fuses;
– details of supplementary heating elements that may be used in conjunction with the appliance, including fitting instructions either with the appliance or with the **supplementary heater**;
– maximum and minimum water or brine operating temperatures;
– maximum and minimum water or brine operating pressures.

Open storage tanks of **heat pumps** for water heating shall be accompanied by an instruction sheet which shall state that the vent shall not be obstructed.

7.15 *Addition:*

A marking may be located on a panel that can be removed for installation or service, providing that the panel shall be in place for the intended operation of the appliance.

7.101 A marking shall be provided for a replaceable fuse or a replaceable overload **protective device** provided as a part of a product or remote control assembly. It shall be visible when the cover or door of the compartment is open. This marking shall specify

– the rating of the fuse in amperes, the type and voltage rating, or
– the manufacturer and model designation of the replaceable overload **protective device**.

Compliance is checked by inspection.

7.102 If the product is intended for permanent connection to fixed wiring with aluminium wires, the marking shall so state.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable.

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.

11 Heating

This clause of Part 1 is replaced by the following.

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

Compliance is checked by determining the temperatures of the various parts under the conditions specified in 11.2 to 11.7. Nevertheless, if the temperature of the motor winding exceeds the value specified in Table 3 or if there is doubt with regard to the classification of the insulation system employed in a motor, compliance is checked by the tests of Annex C.

11.2 *Appliances are installed in a test room in accordance with the manufacturer's installation instructions. In particular*

- *clearances to adjacent surfaces specified by the manufacturer shall be maintained;*
- *flow rates for liquid source or sink equipment shall be the minimum specified in the manufacturer's instructions;*
- *the outlet duct connected to the appliance shall be subjected to the maximum static pressure given in the manufacturer's instructions;*
- *for appliances provided with means of adjusting the flow, the flow for the tests shall be the minimum obtainable;*
- *adjustable limit controls are set at the maximum cutout setting and the minimum differential permitted by the control adjusting means.*

*For appliances provided with **supplementary heaters**, an additional test casing as described in 11.9 is used.*

11.2.1 *For heating tests of appliances with **supplementary heaters**, an inlet duct is connected to the inlet air opening of the appliance (assuming that the appliance is intended to be so applied). The duct shall be the same size as the flanges, if flanges are provided. If flanges are not provided, the duct is the same size as the inlet opening.*

The inlet duct is provided with an adjustable restricting means by which the airflow can be reduced.

The restriction should be uniform across the duct's cross sectional area, so that the full heating coil surface will be exposed to the airflow except when the restriction is closed.

11.2.2 *An appliance which does not include **supplementary heaters** is fitted with an outlet duct sized to fit the casing flanges, or opening without flanges, or locations marked for flanges, and arranged to discharge away from the return air inlet.*

*An appliance that includes or has provision for **supplementary heater** is fitted with a metal outlet duct in accordance with Figure 101a) or Figure 101b), depending on the direction of the airflow.*

The outlet duct is provided with a restricting means to obtain the maximum static pressure given in the manufacturer's instructions.

11.3 *Temperatures other than those of windings are determined by means of fine-wire thermocouples so chosen and positioned that they have the minimum effect on the temperature of the part under test.*

NOTE 101 Thermocouples having wires with a diameter not exceeding 0,3 mm are considered to be fine-wire thermocouples.

Thermocouples used for determining the temperatures of the surface of walls, ceiling and floor are embedded in the surface or attached to the back of small blackened disks of copper or brass, 15 mm in diameter and 1 mm thick, which are flush with the surface.

So far as is possible, the appliance is positioned so that parts likely to attain the highest temperatures touch the disks.

In determining the temperatures of handles, knobs, grips and the like, consideration is given to all parts which are gripped in normal use and, if of insulating material, to parts in contact with hot metal.

The temperature of electrical insulation, other than that of windings, is determined on the surface of the insulation, at places where failure could cause a short circuit, contact between ***live parts*** *and* ***accessible*** *metal* ***parts****, bridging of insulation or reduction of* ***clearances and creepage distances*** *below the values specified in Clause 29.*

Temperatures of windings are determined by the resistance method unless the windings are non-uniform or severe complications are involved in order to make the necessary connections, in which case the temperatures are determined by means of thermocouples.

The temperatures in the duct are to be measured by means of a thermocouple grid consisting of nine thermocouples of identical length, wired in parallel to form a grid with a thermocouple located centrally in each of nine equal duct areas in a plane perpendicular to the axis of the airflow.

11.4 *Appliances are operated under* ***normal operation*** *at a supply voltage between 0,94 times the lowest* ***rated voltage*** *and 1,06 times the highest* ***rated voltage,*** *the voltage chosen being that which gives the most unfavourable result. Heating elements shall be energized at a voltage which gives an electrical input of 1,15 times the maximum* ***rated power input.***

11.5 *Where appliance can be operated in the cooling mode as well as the heating mode, a test is conducted in each mode.*

For appliances with ***supplementary heaters*** *or provision for* ***supplementary heaters****, in additional test is conducted with all the heating elements operative by short circuiting* ***thermostats*** *or by reducing, if necessary, the air temperature to a value which causes all the elements to switch on.*

11.6 *Appliances with defrost facilities, are additionally submitted for a defrost test in the most unfavourable conditions.*

11.7 *All appliances are operated continuously until steady conditions are achieved except for defrost tests.*

11.8 *During the test the temperatures are monitored continuously and shall not exceed the values shown in Table 3,* ***protective devices*** *shall not operate and sealing compound shall not flow out.*

The temperature of the air in the outlet duct shall not exceed 90 °C.

NOTE 101 The value of the temperature of a winding is calculated from the formula:

$$T = \frac{R_2}{R_1}(k + T_1) - k$$

where:

T is the temperature of the copper winding at the end of the test

R_1 is the resistance at the beginning of the test

R_2 is the resistance at the end of the test

T_1 is the ambient temperature at the beginning of the test

k is equal to 234,5 for copper windings and 225 for aluminium windings.

At the beginning of the test, the windings shall be at ambient temperature.

It is recommended that the resistance of windings at the end of the test be determined by taking resistance measurements as soon as possible after switching off, and then at short intervals so that a curve of resistance against time can be plotted for ascertaining the resistance at the instant of switching off.

Table 3 – Temperature limits

Parts	*Temperature* °C
Windings of sealed motor-compressors [a]	
– *with synthetic insulation*	*140*
– *with other insulation*	*130*
External enclosures of sealed motor-compressors or of any other motor	*150*
Windings [b] *if the winding insulation is (other than motor-compressors):*	
– *of class A material* [c]	*100 (90)*
– *of class E material* [c]	*115 (105)*
– *of class B material* [c]	*120 (110)*
– *of class F material* [c]	*140*
– *of class H material* [c]	*165*
– *of class 200 material* [c]	*185*
– *of class 220 material* [c]	*205*
– *of class 250 material* [c]	*235*
Terminals, including earthing terminals, for external conductors of ***stationary appliances****, unless they are provided with a* ***supply cord***	*85*
Ambient of switches, and ***thermostats*** *and* ***temperature limiters*** [d]	
– *without T marking*	*55*
– *with T marking*	*T*
Rubber or polyvinyl chloride insulation of internal and external wiring, including ***supply cord****:*	
– *without temperature rating* [e]	*75*
– *with temperature rating (T)*	*T*
Cord sheaths used as ***supplementary insulation***	*60*
Rubber, other than synthetic, used for gaskets or other parts, the deterioration of which could affect safety:	
– *when used as* ***supplementary insulation*** *or* ***reinforced insulation***	*65*
– *in other cases*	*75*
Lampholders with T-marking [j]	
– *B15 and B22 marked T1*	*165*
– *B15 and B22 marked T2*	*210*
– *other lampholders*	*T*
Lampholders without T-marking [j]	
– *E14 and B15*	*135*
– *B22, E26 NS E27*	*165*
– *other lampholders and starter holders for fluorescent lamps*	*80*
Material used as insulation other than that specified for wires and windings:	
– *impregnated or varnished textile, paper or press board*	*95*
– *laminated bonded with:*	
• *melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins*	*110*
• *urea-formaldehyde resin*	*90*
– *printed circuit boards bonded with epoxy resin*	*145*
– *moulding of:*	
• *phenol-formaldehyde with cellulose fillers*	*110*
• *phenol-formaldehyde with mineral fillers*	*90*
• *melamine-formaldehyde*	*110*
• *urea-formaldehyde*	*90*

* See notes next page

Table 3 *(continued)*

Parts	*Temperature* °C
– *polyester with glass-fibre reinforcement*	135
– *silicone rubber*	170
– *polytetrafluoroethylene*	290
– *pure mica and tightly sintered ceramic material, when such materials are used as* ***supplementary insulation*** *or* ***reinforced insulation***	425
– *thermoplastic material* [f]	–
Wood, in general [g]	90
Wooden walls of the test casing	90
Outer surfaces of capacitors [h]*:*	
– *with marking of maximum operating temperature (T)* [i]	T
– *without marking of maximum operating temperature:*	
• *small ceramic capacitors for radio and television interference suppression*	75
• *capacitors complying with IEC 60384-14*	75
• *other capacitors*	45
External enclosure of appliances without ***supplementary heater***	85
Handles, knobs, grips and the like and all parts which are gripped in normal use:	
– *of metal*	60
– *of porcelain or vitreous material*	70
– *of moulded material, rubber or wood*	85
Parts in contact with oil having a flash-point of t °C	t – 25
Any point where the insulation of wires can come into contact with parts of a terminal block or compartment for fixed wiring of a ***stationary appliance*** *not provided with a* ***supply cord****:*	
– *if the instructions require the use of supply wires with temperature rating (T)*	T
– *in other cases*	75

[a] *Not required for motor-compressors that comply with IEC 60335-2-34.*

[b] *The temperatures within parentheses apply when thermocouples are used.*
The figures without parentheses apply when the resistance method is used.

[c] *The classification is in accordance with IEC 60085.*
Examples of Class A material are:
– impregnated cotton, silk, artificial silk and paper;
– enamels based on oleo or polyamide resins.

Examples of Class B materials are:
– glass fibre, melamine-formaldehyde and phenol-formaldehyde resins.

Example of Class E material are:
– mouldings with cellulose fillers, cotton fabric laminates and paper laminates, materials bonded with melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins;
– cross-linked polyester resins, cellulose triacetate films, polyethylene terephthalate films;
– varnished polyethylene terephthalate textile bonded with oil-modified alkyd resin varnish;
– enamels based on polyvinyl formalin, polyurethane or epoxy resins.

For totally enclosed motors, the temperature limits for class A, class E and class B materials may be increased by 5 °C (5 K).

A totally enclosed motor is a motor so constructed that the circulation of the air between the inside and the outside of the case is prevented, but which is not necessarily sufficiently enclosed to be called airtight.

Table 3 – *(continued)*

[d] *T means the maximum operating temperature.* *The ambient of switches and **thermostats** is the temperature of the air at the hottest point at a distance of 5 mm from the surface of the switch and **thermostat** concerned.* *For the purpose of this test, switches and **thermostats** marked with the individual ratings may be considered as having no marking for the maximum operating temperature, if this is requested by the manufacturer of the appliance. However, if a thermostat or other temperature limiter is mounted on a heat-conducting part, the declared temperature limit of the mounting surface (Ts) is also applicable. Therefore, the temperature of the mounting surface has to be measured.*
[e] *This limit applies to cables, cords and wires complying with the relevant IEC standards; for others it may be different.*
[f] *There is no specific limit for thermoplastic material, which must withstand the tests of 30.1 of IEC 60335-1, for which purpose the temperature shall be measured.*
[g] *The limit specified concerns the deterioration of wood and it does not take into account deterioration of surface finishes.*
[h] *There is no limit for the temperature rise of capacitors which are short-circuited in 19.11.*
[i] *Temperature marking for capacitors mounted on printed circuit boards may be given in the technical sheet.*
[j] *Locations for measuring the temperatures are specified in Table 12.1 of IEC 60598-1.*
If these or other materials are used, they shall not be subjected to temperatures in excess of the thermal capabilities as determined by aging tests made on the materials themselves.

NOTE 102 The temperature limit for metal applies to parts having a metal coating at least 0,1 mm thick and to metal parts having a plastic coating less than 0,3 mm thick.

NOTE 103 The temperature of the terminal's switches is measured if the switch is tested in accordance with Annex H.

11.9 Test casing

The test casing consists of plywood walls having a thickness of about 20 mm, with dull black painted inside surfaces and all joints sealed. The distances between the casing and the surfaces of the appliance and the outlet duct, if any, are equal to the minimum clearances specified by the manufacturer.

For appliances not specified for installation with minimum clearances, as an alternative to the plywood test casing in direct contact with the appliance, glass fibre insulating material having a thickness of at least 25 mm and a density of at least 16 kg/m³ may be wrapped closely around the appliance and the outlet duct, provided this is agreed with the manufacturer.

In that case, thermocouples are directly placed in contact with the enclosure.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable except as follows.

13.2 *Modification:*

*For **stationary class I appliances**, the leakage current shall not exceed 2 mA per kilowatt **rated power input** with a maximum value of 10 mA for **appliances accessible to the general public**, and a maximum value of 30 mA for **appliances not accessible to the general public**.*

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is replaced by the following.

15.1 Electrical components of appliances shall be protected against the ingress of water which may be present in the appliance as a result of rain, overflow from the drain pan, or defrosting.

Compliance is checked by the tests of 15.2, followed immediately by the overflow test of 15.3; and this is followed by the defrost test of 11.6, and the tests of Clause 16.

Following these tests an inspection is made within the enclosures. The water which may have entered the enclosure shall not have reduced ***clearances and creepage distances*** *below the minimum values specified in Clause 29.*

NOTE Appliances designed to be installed completely inside a building and which have no outdoor parts, are not subjected to the test of 15.2.

If ducts leading to the outside of a building are used, the test of 15.2 is carried out on the terminations of such ducts in an arrangement simulating the actual installation, according to the manufacturer's instructions.

For appliances intended to be mounted through a wall or a window, or for a split package unit, the test of 15.2 is carried out on that part or unit which, according to the manufacturer's instructions, is intended to be mounted outside the building.

The motor-compressor is not operated during the tests of 15.2 and 15.3.

15.2 *Appliances other than IPX0 are subjected to the tests of IEC 60529 as follows:*

– *IPX1 appliances as described in 14.2.1;*
– *IPX2 appliances as described in 14.2.2;*
– *IPX3 appliances as described in 14.2.3;*
– *IPX4 appliances as described in 14.2.4;*
– *IPX5 appliances as described in 14.2.5;*
– *IPX6 appliances as described in 14.2.6;*
– *IPX7 appliances as described in 14.2.7.*

For this test the appliance is immersed in water containing 1 % NaCl.

15.3 *The appliance is installed in its position of normal use. The drain pan discharge pipe is blocked, and the pan carefully filled to the brim without splashing. The drain pan is then subjected to a continuous overflow, the rate of which is adjusted to approximately 17 cm³/s per 1 m³/s airflow, and the fan(s) switched on. The test is continued for a period of 30 min, or until water drains from the appliance.*

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.2 *Modification:*

For ***stationary class I appliances,*** *the leakage current shall not exceed 2 mA per kilowatt* ***rated power input*** *with a maximum value of 10 mA for* ***appliances accessible to***

***the general public**, and a maximum value of 30 mA for **appliances not accessible to the general public**.*

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 replaced by the following.

19.1 Appliances shall be so constructed that the risk of fire, or of mechanical damage impairing safety or protection against electric shock, as a result of abnormal or careless operation is obviated, as far as practicable. Failure of the transfer medium flow, or of any control devices, shall not result in a hazard.

Electronic circuits shall be designed and applied so that a fault condition will not render the appliance unsafe with regard to electric shock, fire hazard, mechanical hazard or dangerous malfunction.

Appliances are subjected to the tests specified in 19.2 to 19.10.

*Appliances incorporating **PTC heating elements** are also subjected to the test of 19.13.*

*Appliances incorporating **electronic circuits** are also subjected to the test of 19.11 and 19.12 as applicable.*

During and after the test the appliance shall comply with the requirement of 19.14.

19.2 *The motors, other than motor-compressors, are mounted on a support of wood or similar material. The motor rotors are locked; fan blades and brackets are not removed.*

*The motors are supplied at their supplied voltage when the appliance is supplied at **rated voltage** or at the upper limit of the **rated voltage range**, in a circuit as shown in Figure 102.*

*Under these conditions, the assembly is operated for 15 days (360 h) or until a **protection device** permanently opens the circuit, whichever is the shorter period.*

During the test, the ambient temperature is maintained at 23 °C ± 5 °C.

If the temperature of the motor windings does not exceed 90 °C when steady conditions are established, the test is considered to be ended.

During the test, the temperature of the enclosure shall not exceed 150 °C and the temperature of the windings shall not exceed the values shown in the following table.

Table 6 – Maximum winding temperature

Type of appliance	*Class of insulating material and limiting temperature* °C							
	A	***E***	***B***	***F***	***H***	***200***	***220***	***250***
– If impedance protected.....	*150*	*165*	*175*	*190*	*210*	*230*	*250*	*280*
– If protected by protective devices which operate during the first hour, maximum value.....	*200*	*215*	*225*	*240*	*260*	*280*	*300*	*330*
•after first hour, maximum value.....	*175*	*190*	*200*	*215*	*235*	*255*	*275*	*305*
•after first hour, arithmetic average	*150*	*165*	*175*	*190*	*210*	*230*	*250*	*280*

Three days (72 h) after the beginning of the test, the motor shall withstand an electric strength test as specified in 16.3.

During the test, a 30 mA residual current device shall not open.

At the end of the test, the leakage current between the windings and the enclosure is measured and shall not exceed 2 mA, the motor being supplied at twice the ***rated voltage****.*

19.3 *If the motor-compressor has not been type-tested against the requirements of IEC 60335-2-34, a sample shall be provided with the rotor locked and being filled with oil and refrigerant as intended.*

The sample shall then be subjected to the test specified in 19.101 of IEC 60335-2-34 and shall comply with the requirements in 19.104 of that standard.

19.4 *Appliances incorporating three-phase motors are operated under the conditions of Clause 11 at* ***rated voltage*** *or at the upper limit of the* ***rated voltage range*** *with one phase disconnected, until steady conditions are obtained or the* ***protective device*** *operates.*

19.5 *The appliance is operated under the conditions in Clause 11 at* ***rated voltage*** *or at the upper limit of the* ***rated voltage range****, at an ambient temperature of 23 °C ± 5 °C. When steady conditions are attained, the heat transfer medium flow of the* ***outdoor heat exchanger*** *is restricted or shut off, whichever is the most unfavourable without the appliance being non-operative.*

After this test, ***protective devices*** *that may have operated are reset, and the test is repeated, with the heat transfer medium flow, fluid or air, of the* ***indoor heat exchanger****, restricted or shut off, whichever is the most unfavourable without the appliance being non-operative. In the case of appliances with defrosting systems, the heat transfer medium flow rate is additionally shut off at the beginning of the defrosting phase.*

Appliances incorporating a motor common to both the ***indoor*** *and* ***outdoor heat exchangers*** *are subjected to the above test, the motor being disconnected once steady conditions are attained.*

19.6 *The* ***indoor heat exchanger*** *of appliances using water as a heat transfer medium is subjected to the following test.*

The appliance is operated under the conditions specified for Clause 10 at ***rated voltage*** *or at the upper limit of the* ***rated voltage range*** *at the maximum water temperature specified by the manufacturer. The indoor water temperature shall be raised 15 K with a rate of 2 K/min and*

this temperature maintained for 30 min, after which the water temperature is lowered to its original value at the same velocity.

19.7 *Air to air appliances are operated under the conditions specified in Clause 11.*

*The **dry-bulb temperature** is then reduced to a value 5 K below the minimum value specified by the manufacturer.*

*The test is repeated except that the **dry-bulb temperature** is increased to a value 10 K above the maximum temperature specified by the manufacturer.*

*The appliances are operated at **rated voltage** or at the upper limit of the **rated voltage range**.*

19.8 *All appliances provided with **supplementary heaters** are subjected to the following test under the conditions specified in Clause 11:*

*After the airflow conditions specified are established, the indoor airflow is restricted to such an extent that the temperature of the air in the outlet, measured by means of the thermocouple grid (see 11.3), is 3 K below the temperature obtained after a temperature limiting control, a motor **protective device**, a pressure switch or similar device operates for the first time as a result of slowly restricting the free area of the inlet.*

This is achieved if the temperature rise is approximately 1 K per min.

*It is necessary to restrict the free area of the inlet until the first of the **protective devices** operates and then operation is resumed with sufficient restriction so that the temperature of the discharge air is 3 K below the temperature at the moment of cut-off.*

*Appliances are operated at **rated voltage** or at the upper limit of the **rated voltage range.***

NOTE 101 To facilitate this test, the **protective device** which has operated may be short-circuited once the temperature at which it operates has been determined.

19.9 *If all electric heating elements are not energized under the conditions specified in 19.8 for the air entering the **evaporator**, an additional test is carried out at a lower temperature of the inlet air, this temperature being the highest that will permit all electric heating elements to be energized.*

*It is the intention that the operating point be just below the point of maximum restriction of the air entering the indoor coil assembly thus permitting continuous operation of both the motor-compressor and the electric heating elements. If the temperature of the air entering the **evaporator** required to permit all electric heating elements to be energized is less than the values specified, this lower temperature may be simulated by reducing the airflow through the **evaporator,** by blocking a part of the **evaporator,** or by similar means in order to obtain the operating conditions which would occur at this lower temperature of the air entering the **evaporator.***

*Appliances are operated at **rated voltage** or at the upper limit of the **rated voltage range**.*

19.10 *The appliance is operated under conditions in Clause 11 and at **rated voltage**, with any form of operation or any defect that may be expected during normal use. Only one fault condition is reproduced at a time, the tests being made consecutively.*

Examples of fault conditions are

– *the programme controller, if any, stopping in any position;*

– *disconnection and reconnection of one or more phases of the supply;*

– *open-circuiting or short-circuiting of components.*

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

Locking in the "on" position of the main contacts of a contact intended for switching on and off the heating element(s) in normal use is considered to be a fault condition, unless the appliance is provided with at least two sets of contacts connected in series. This condition is, for example, achieved by providing two contactors operating independently of each other or by providing one contactor having two independent armatures operating two independent sets of main contacts.

19.11 *Compliance for* ***electronic circuits*** *is checked by evaluation of the fault conditions specified in 19.11.2 for all circuits or parts of circuits, unless they comply with the conditions specified in 19.11.1.*

If the safety of the appliance under any of the fault conditions depends on the operating of a miniature fuse-link complying with IEC 60127, the test of 19.12 is made.

During and after each test, the temperature of the windings shall not exceed values specified in Table 8. However, these limits do not apply to fail-safe transformers complying with subclause 15.5 of IEC 61558-1. The appliance shall comply with the conditions specified in 19.14. In particular, ***live parts*** *shall not be accessible to the test probe B and test probe 13 of IEC 61032, as specified in Clause 8. Any current flowing through* ***protective impedance*** *shall not exceed the limits specified in 8.1.4.*

If a conductor of a printed circuit becomes open-circuited, the appliance is considered to have withstood the particular test, provided all three of the following conditions are met:

– *the base material of the printed circuit board withstands the test of Annex E;*

– *any loose conductor does not reduce the* ***clearances*** *or* ***creepage distances*** *between* ***live parts*** *and* ***accessible metal parts*** *below the values specified in Clause 29:*

– *the appliance withstands the tests of 19.11.2 with the open-circuited conductor bridged.*

NOTE 101 Unless it is necessary to replace components after any of the tests, the electric strength test of 19.13 need only be carried out after the final test on the **electronic circuit.**

NOTE 102 In general, examination of the appliance and its circuit diagram will reveal the fault conditions which have to be simulated, so that testing can be limited to those cases which may be expected to give the most unfavourable results.

NOTE 103 In general, the tests take into account any failure which may arise from perturbations on the mains supply. However, where more than one component may be affected simultaneously, it may be necessary to carry out additional tests that are under consideration.

19.11.1 *Fault conditions a) to f) specified in 19.11.2 are not applied to circuits or parts of circuits where both of the following conditions are met:*

– *the* ***electronic circuit*** *is a low-power circuit as described below;*

– *the protection against electric shock, fire hazard, mechanical hazard or dangerous malfunction in other parts of the appliance does not rely on the correct functioning of the* ***electronic circuit****.*

A low-power circuit is determined as follows; an example is shown in Figure 7 (see Part 1).

The appliance is supplied at ***rated voltage*** *and a variable resistor adjusted to its maximum resistance is connected between the point to be investigated and the opposite pole of the supply source.*

The resistance is then decreased until the power consumed by the resistor reaches a maximum. Points closes to the supply at which the maximum power delivered to this resistor does not exceed 15 W at the end of 5 s are called low-power points. The part of the circuit farther from the supply source than a low-power point is considered to be a low-power circuit.

NOTE 101 The measurements are made from only one pole of the supply source, preferably the one that gives the fewest low-power points.

NOTE 102 When determining the low-power points, it is recommended to start with points close to the supply source.

NOTE 103 The power consumed by the variable resistor is measured by a wattmeter.

19.11.2 *The following fault conditions are considered and, if necessary, applied one at a time. Consequential faults are taken into consideration.*

*a) Short circuit of **functional insulation** if **clearances** or **creepage distances** are less than the values specified in Clause 29.*

b) Open circuit at the terminals of any component.

c) Short-circuit of capacitors, unless they comply with IEC 60384-14.

*d) Short circuit of any two terminals of an **electronic component,** other than integrated circuits. This fault condition is not applied between the two circuits of an optocoupler.*

e) Failure of triacs in the diode mode.

f) Failure of an integrated circuit. In this case the possible hazardous situations of the appliance are assessed to ensure that safety does not rely on the correct functioning of such a component.

All possible output signals are considered under fault conditions within the integrated circuit. If it can be shown that a particular output signal is unlikely to occur, then the relevant fault is not considered.

NOTE 101 Components such as thyristors and triacs are not subjected to fault condition f).

NOTE 102 Microprocessors are tested as integrated circuits.

In addition, each low-power circuit is short-circuited by connecting the low-power point to the pole of the supply from which the measurements were made.

*For simulation of the fault conditions, the appliance is operated under the conditions specified in Clause 11 but supplied at **rated voltage.***

When any of the fault conditions are simulated, the duration of the test is

– *as specified in 11.7 but only for one operating cycle and only if the fault cannot be recognized by the use, for example, change in temperature;*

– *as specified in 19.2, if the fault can be recognized by the user, for example, when the motor stops;*

– *until steady conditions are established, for circuits continuously connected to the supply main, for example, stand-by circuits.*

In each case, the test is ended if interruption of the supply occurs within the appliance.

*If the appliance incorporates an **electronic circuit** which operates to ensure compliance with Clause 19, the relevant test is repeated with a single fault simulated, as indicated in a) to f) above.*

Fault condition f) is applied to encapsulated and similar components if the circuit cannot be assessed by other methods.

Positive temperature coefficient resistors (PTC's), negative temperature coefficient resistors (NTC's) and voltage dependent resistors (VDR's) are not short-circuited if they are used within their manufacturer's declared specification.

19.12 *If, for any of the fault conditions specified in 19.11.2, the safety of the appliance depends on the operation of a miniature fuse-link complying with IEC 60127, the test is repeated but with the miniature fuse-link replaced by an ammeter.*

If the current measured does not exceed 2,1 times the rated current of the fuse-link, the circuit is not considered to be adequately protected and the test is carried out with the fuse-link short-circuited.

If the current measured is at least 2,75 times the rated current of the fuse-link, the circuit is considered to be adequately protected.

If the current measured exceeds 2,1 times the rated current of the fuse-link but does not exceed 2,75 times the rated current, the fuse-link is short-circuited and the test is carried out

– *for quick acting fuse-links, for the relevant period or for 30 min, whichever is the shorter;*

– *for time lag fuse-links, for the relevant period or for 2 min, whichever is the shorter.*

NOTE 101 In case of doubt, the maximum resistance of the fuse-link has to be taken into account when determining the current.

NOTE 102 The verification whether the fuse-link acts as a **protective device** is based on the fusing characteristics specified in IEC 60127, which also gives the information necessary to calculate the maximum resistance of the fuse-link.

19.13 *Appliances with **PTC heating elements** are supplied at **rated voltage** until steady conditions with regard to power input and temperature are established.*

*The **working voltage** is then increased by 5 % and the appliance is operated until steady conditions are again established. This test is repeated until 1,5 times **working voltage** is reached or until the heating element ruptures, whichever occurs first.*

19.14 *During the tests of 19.2 to 19.10 and 19.11, 19.12 and 19.13 if appropriate, the appliances shall not emit flames or molten metal, or poisonous or ignitable gas in hazardous amounts. Enclosures shall not deform to such an extent as will impair compliance with this standard and temperatures shall not exceed the values shown in the modified Table 9.*

Table 9 – Maximum abnormal temperature

Parts	***Temperature*** *°C*
Walls, ceiling and floor of the test casing	*175*
Insulation of the supply cable or [a]	*175*
Supplementary insulation *and* ***reinforced insulation*** *other than those of thermoplastic materials* [a]	*[1,5 × (T – 25)] + 25 where T is the value specified in Table 3*

[a] *There is no specific limit for **supplementary insulation** and **reinforced insulation** of thermoplastic material, which must withstand the tests of 30.1 of IEC 60335-1, for which purpose the temperature must be determined.*

*After the tests, the insulation other than that of **class III appliances**, when it has cooled down to approximately room temperature, shall withstand the electric strength test of 16.3, the test voltage however being as specified in Table 4.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

Addition:

Safety requirements specified in ISO 5149 shall apply.

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 *Addition:*

The electrical insulation shall not be affected by snow which might enter the appliance enclosure.

NOTE 101 This requirement may be met by the provision of suitable drain holes.

22.24 *Replacement:*

Bare heating elements shall be supported so that, in case of rupture or sagging, the heating conductor cannot come into contact with **accessible** metal **parts**. Bare heating elements shall be used with metal enclosures only. Wood or composite enclosures are not allowed.

Compliance is checked by inspection and, if necessary, by cutting the element in the most unfavourable place.

NOTE 101 No force is applied to the conductor after it has been cut.

NOTE 102 This test is made after the tests of Clause 29.

22.101 Appliances intended to be fixed shall be so designed that they can be securely fixed and maintained in position.

Compliance is checked by inspection and in case of doubt, after installation of the appliance in accordance with the manufacturer's installation instructions.

22.102 Appliances provided with **supplementary heaters** shall be provided with at least two cut-outs; the **thermal cut-out** intended to operate first may be a **self-resetting thermal cut-out**, the other **thermal cut-outs** shall be **non-self-resetting thermal cut-outs**.

Thermal cut-outs of the capillary type shall be so designed that the contacts open in the event of leakage from the capillary tube.

Thermal cut-outs, shall fulfill the requirements for switches in accordance with 24.3.

Thermal cut-outs which operate during the tests of Clause 19 in order to protect the heater against over-heating by heating elements shall be of the **non-self-resetting type**.

Compliance is checked by inspection and by the tests of Clause 19.

NOTE If, during the tests of Clause 19, a self-resetting control operates, it would be necessary to short out this control to determine if a **non-self-resetting thermal cut-out** then operates.

22.103 Non-self-resetting cut-outs shall be functionally independent of other control devices.

Compliance is checked by inspection.

22.104 Containers of **sanitary hot water heat pumps** shall withstand the water pressure occurring in normal use.

*Compliance is checked by subjecting the containers and **heat exchangers**, if any, to a water pressure which is raised to the value specified hereafter at a rate of 0,13 MPa per second and is maintained at that value for 5 min.*

The water pressure is

– *twice the permissible excessive operating pressure for closed containers;*
– *0,15 MPa for open containers.*

After the test, no water shall have leaked out and the containers shall not have ruptured.

NOTE If the container of **sanitary hot water heat pumps** incorporates a **heat exchanger**, the container and the **heat exchanger** are subjected to the pressure test in accordance with the relevant standard.

22.105 In the case of closed containers of **sanitary hot water heat pumps**, the formation of an air or vapour cushion of more than 2 % of the capacity, but not more than 10 % as a maximum, shall be provided.

Compliance is checked by inspection and, where necessary, by measurements.

22.106 Pressure relief devices, whether incorporated in the container of **sanitary hot water heat pumps** or supplied separately, shall prevent the pressure in the container from exceeding the permissible excessive operating pressure by more than 0,1 MPa.

Compliance is checked by subjecting the container to a slowly increasing water pressure and by observing the pressure at which the relief device operates.

22.107 The outlet system of open containers of **sanitary hot water heat pumps** shall be free from obstructions that could limit the water flow to such an extent that the pressure in the container would exceed the permissible excessive operating pressure.

Vented containers of **sanitary hot water heat pumps** shall be so constructed that the container is always open to the atmosphere through an aperture of at least 5 mm in diameter or 20 mm² in area, with a width of at least 3 mm.

Compliance is checked by inspection and measurement.

NOTE The first requirement is considered to be met if the area of the water outlet from the heated part of the container of **sanitary hot water heat pumps** is equal or greater than the area of the water inlet to the heated part.

22.108 Storage tanks of **sanitary hot water heat pumps** shall be resistant to vacuum pressure impulses which may occur in normal use.

Compliance is checked by subjecting containers which are not vented in accordance with 22.104 to a vacuum of 33 kPa for 15 min.

After the test, the container shall show no deformation which might result in a hazard.

NOTE Anti-vacuum valves, if any, are not rendered inoperative. This test may be carried out on separate containers.

22.109 Wiring connected to a **non-self-resetting thermal cut-out** designed to be replaced after its operation shall be so secured that replacement of the **thermal cut-out** itself or to a heating element assembly on which the **thermal cut-out** is mounted, will not damage other connections or internal wiring.

Compliance is checked by inspection and, if necessary, by manual test.

22.110 Non-self-resetting thermal cut-outs designed to be replaced after their operation shall open the circuit in the intended manner without short-circuiting **live parts** of different potential and without causing **live parts** to come into contact with the enclosure.

Compliance is checked by the following test.

*The appliance is operated five times, each time with a new **non-self-resetting thermal cut-out**, any other thermally operated control devices being short-circuited.*

*Each time, the **thermal cut-out** shall operate appropriately.*

During the test, the enclosure of the appliance is connected to earth through a 3 A fuse; this fuse shall not blow.

After this test, the supplementary heating elements shall withstand an electric strength test as specified in 16.3.

22.111 It shall not be necessary to manually reset any **thermostat** after power supply interruption during the operation of the appliance.

Compliance is checked by interrupting and then restoring the power supply. The appliance shall restart without any manual reset action.

23 Internal wiring

This clause of Part 1 is applicable.

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 all requirements of IEC 60335-2-34 if they meet all requirements of this standard.

24.1.4 *Modification:*

– ***self-resetting thermal cut-outs*** *3 000*

– ***non-self-resetting thermal cut-outs*** *300*

Addition:

– ***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 ..... min 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*

24.101 Thermal control devices incorporating replaceable parts shall be marked in such a way that the replaceable parts can be identified.

The replacement part shall be marked accordingly.

Compliance is checked by inspection of the marking.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 *Addition:*

The appliances may be provided with a supply cord fitted with a plug

– if they are for indoor use only,

– if they have a marked rating of 25 A or less and

– if they comply with the applicable code requirements for cord-connected appliances appropriate to the specific country in which they are to be used.

Modification:

Appliances shall not be provided with an appliance inlet.

25.7 *Addition:*

Supply cords of parts of appliances for outdoor use shall not be lighter than polychloroprene sheathed flexible cord (code designation 60245 IEC 57).

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable except as follows.

Addition:

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

29.2 *Addition:*

For insulation located in any airflow, the micro-environment is pollution degree 3 unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution due to normal use of the appliance.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2.2 Not applicable

31 Resistance to rusting

This clause of Part 1 is applicable except as follows.

Addition:

Compliance is checked by the salt mist test of IEC 60068-2-52, severity 2 being applicable.

Before the test, coatings are scratched by means of a hardened steel pin, the end of which has the form of a cone with an angle of 40°. Its tip is rounded with a radius of 0,25 mm ± 0,02 mm. The pin is loaded so that the force exerted along its axis is 10 N ± 0,5 N. The scratches are made by drawing the pin along the surface of the coating at a speed of approximately 20 mm/s. Five scratches are made at least 5 mm apart and at least 5 mm from the edges.

After the test, the appliance shall not have deteriorated to such an extent that compliance with this standard, in particular with Clauses 8 and 27, is impaired. The coating shall not be broken and shall not have loosened from the metal surface.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is not applicable.

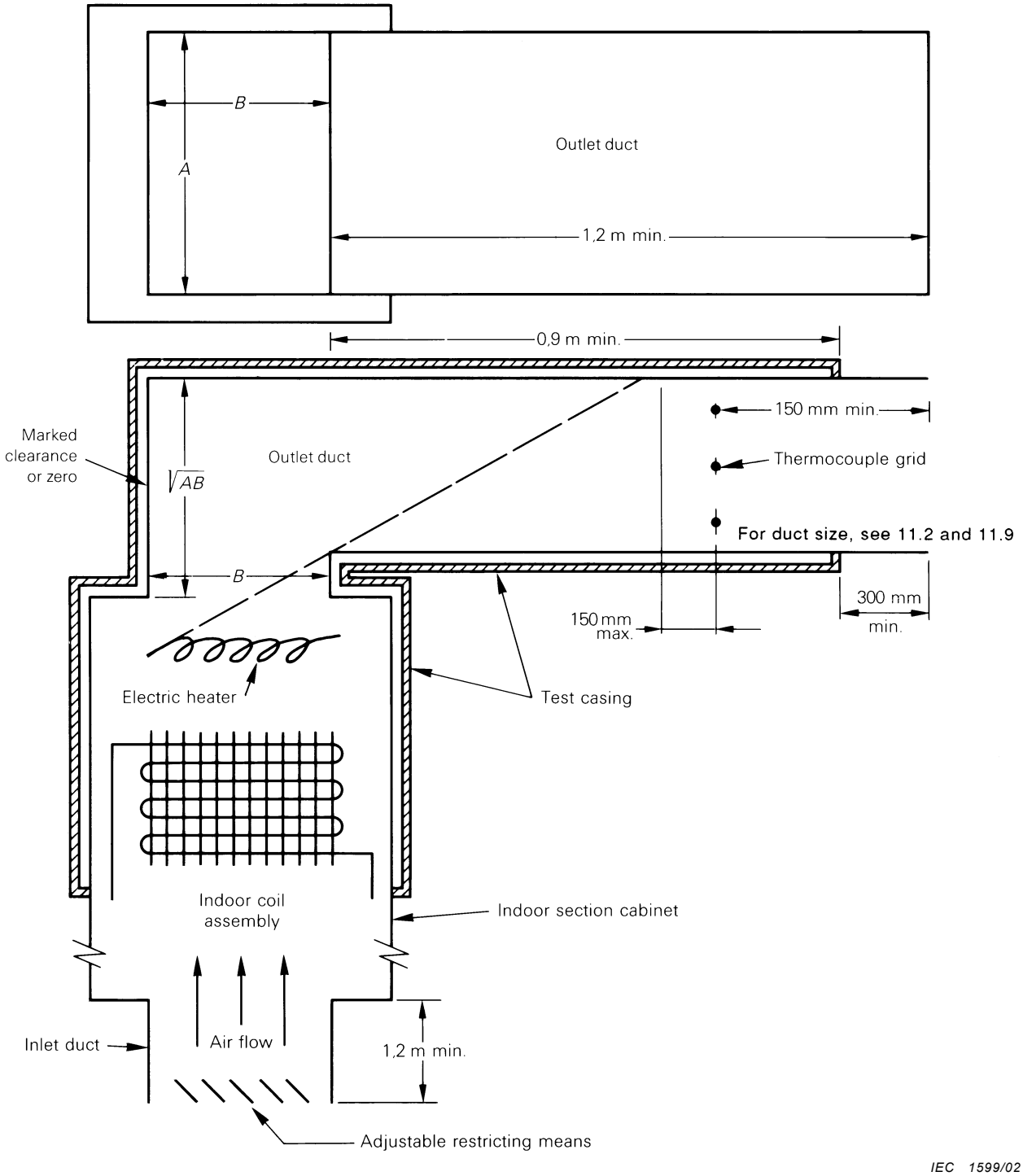


Figure 101a) – Arrangement for heating test of appliances with supplementary heater – upflow application

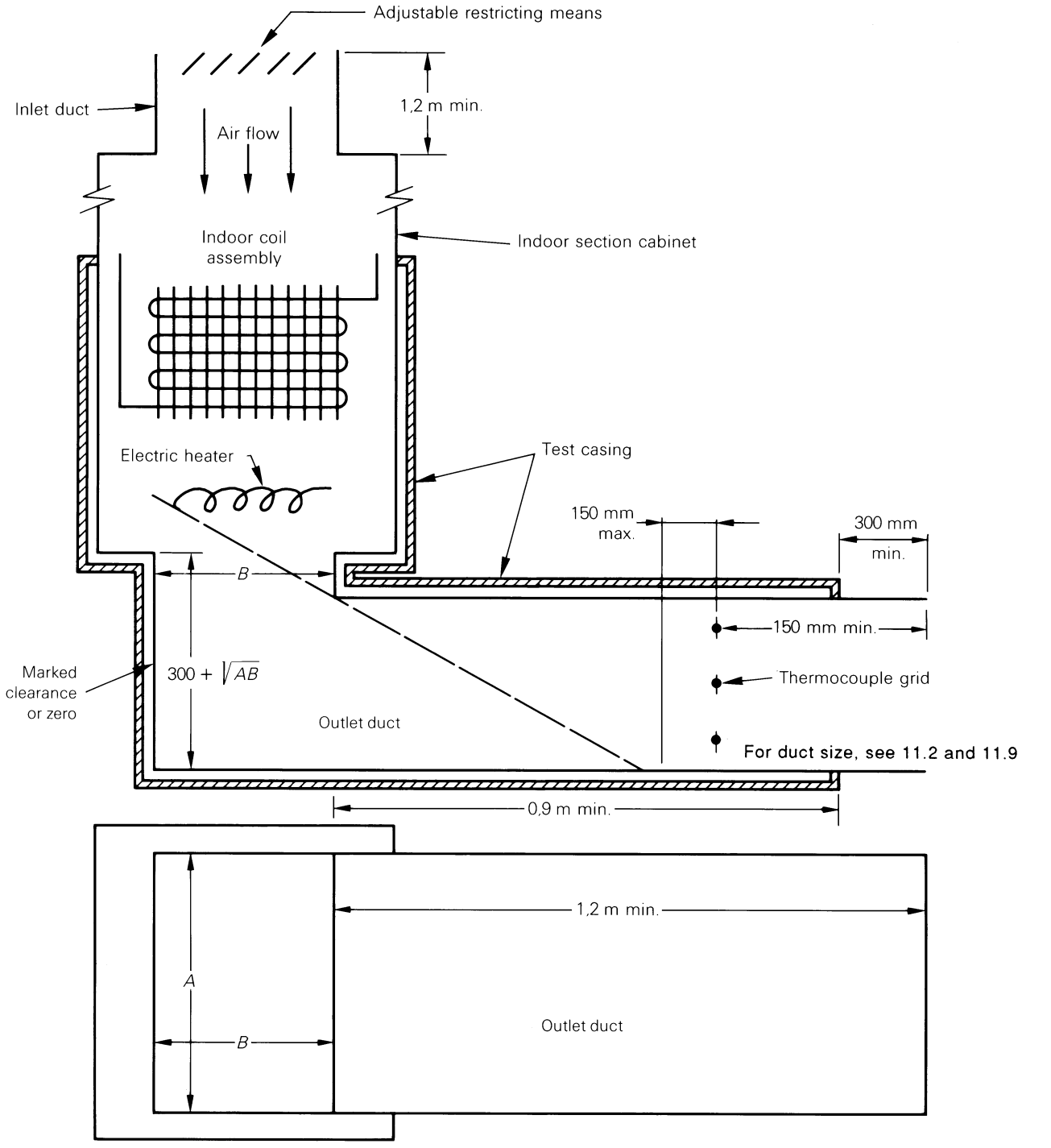
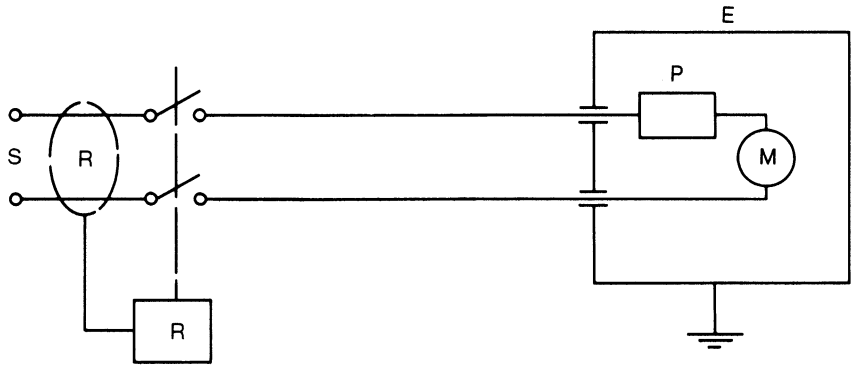


Figure 101b) – Arrangement for heating test of appliances with supplementary heater – downflow application



Key

S = Supply

E = Motor enclosure

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

P = Protective device (external or internal)

M = Motor

NOTE Care has to be taken to complete the earthing system to permit the correct operation of the RCCB/RCBO.

Figure 102 – Supply circuit for locked-rotor test of a motor of the single-phase type – Revise as needed for three-phase test

Annexes

The annexes of Part 1 are applicable except as follows.

Annex D
(normative)

Alternative requirements for protected motors

This annex of Part 1 is not applicable.

Annex I
(normative)

Motors having basic insulation that is inadequate for the rated voltage of the appliance

This annex of Part 1 is not applicable.

Annex AA
(informative)

Examples for operating temperatures of the appliance

Function of appliance	Classification		Heating				Cooling			
			Outdoor assembly °C (inlet)		Indoor assembly °C (outlet)		Outdoor assembly °C (inlet)		Indoor assembly °C (outlet)	
			DB [a]		WB [b]		DB [a]		WB [b]	
Outside air/ Recycled air	A7	A20	7	6	20	12	35	24	27	19
Exhaust air/ Recycled air	A20	A20	20	12	20	12	–	–	–	–
Exhaust air/ Fresh air	A20	A7	20	12	7	6	–	–	–	–
Outside air/Water	A7	W50	7	6	Water	50	35	24	Water	7
Exhaust air/Water	A20	W50	20	12	Water	50	–	–	–	–
Water/Water	W10	W50	Water	10	Water	50	Water	15	Water	7
Brine/Water	B0	W50	Brine	0	Water	50	Brine	15	Water	7
Brine/ Recycled air	B0	A20	Brine	0	20	12	–	–	–	–
Water/ Recycled air	W10	A20	Water	10	20	12	–	–	–	–
Water/ Recycled air	W20	A20	Water	20	20	12	–	–	–	–
Dehumidification	Comfort		–	–					27	21
	Process								12	9
	Heat recovery (air cooled)						27	21	27	21
	Heat recovery (water cooled)						Water	24	27	21
Sanitary hot water heat pump										
Outside air/Water	A7	W45	7	6	Water	45	–	–	–	–
Ambient air/Water	A15	W45	15	12	Water	45	–	–	–	–
Exhaust air/Water	A20	W45	20	12	Water	45	–	–	–	–
Brine/Water	B0	W45	Brine	0	Water	45	–	–	–	–

[a] DB: dry bulb

[b] WB: wet bulb

NOTE Appliance may be classified according to function and temperature application as noted below:

Source		Sink		Classification		
	Outside air		Recycled air		A –	A –*
	Exhaust air		Recycled air		A –	A –
	Exhaust air		Outside air		A –	A –
	Outside air		Water		A –	W –
	Exhaust air		Water		A –	W –
	Water		Water		W –	W –
	Water		Recycled air		W –	A –
	Brine		Recycled air		B –	A –
	Brine		Water		B –	W –

* For example, A7 A20 indicates appliance designed for an outside air operating temperature of 7 °C DB and an inside air operating temperature of 20 °C DB.

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60335-2-21, *Household and similar electrical appliances – Safety – Part 2-21: Particular requirements for storage water heaters*

IEC 60335-2-88, *Household and similar electrical appliances – Safety – Part 2-88: Particular requirements for humidifiers intended for use with heating, ventilation, or air-conditioning systems*

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