

INTERNATIONAL STANDARD



**Household and similar electrical appliances – Safety –
Part 2-11: Particular requirements for tumble dryers**



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INTERNATIONAL STANDARD



**Household and similar electrical appliances – Safety –
Part 2-11: Particular requirements for tumble dryers**

INTERNATIONAL
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COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-11: Particular requirements for tumble dryers

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 redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60335-2-11 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances.

This eighth edition cancels and replaces the seventh edition published in 2008, Amendment 1:2012 and Amendment 2:2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the seventh edition:

- aligns the text with IEC 60335-1, Ed 5, and its Amendments 1 and 2;
- some notes have been converted to normative text (7.12, 7.12.1, 11.3, 19.101, AA.5.2);
- more detailed test specifications have been given in 11.3 and 15.2;
- specific requirements have been added in 3.1.9, 3.6.101, 7.12, 11.7, 19.1, and Clause 22 to cover appliances with steam generators;
- specific requirements have been added in 22.108 to cover programmable electronic circuits;
- Annex AA has been deleted, because it is covered by Part 1 and the remaining annexes have been renumbered.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
61/5786/FDIS	61/5803/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety*, can be found on the IEC website.

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 fifth edition (2010) 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 tumble dryers.

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 the associated noun are also in bold.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

The following differences exist in the countries indicated below.

- 3.1.9: The textile material has different dimensions (USA).
- 6.2: Tumble dryers are not required to be IPX4 (USA).
- 7.12: Actual articles of clothing can be specified instead and warnings are required to be marked on the appliance regarding the use of chemicals for cleaning (USA).
- 11.2: The test condition is different (USA).
- 11.7: This test is continued until steady conditions are established and different criteria are used to determine when steady conditions are reached (USA).
- 19.4: The test is different (USA).
- 19.9: A running overload test is carried out on automatically controlled tumble dryers (USA).
- 20.102: When considering accessibility to rotating drums, the maximum drum volume is 60 dm³ and the maximum door opening is 200 mm (USA).
- 20.103: This test is different (USA).
- 22.104: The test is different (USA).
- 27.1: Earthing terminals and contacts are allowed to be electrically connected to the neutral conductor of a tumble dryer (USA).

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another part 2 of IEC 60335, the relevant part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

NOTE 2 Horizontal and generic standards covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards. For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 standards.

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

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

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-11: Particular requirements for tumble dryers

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of electric **tumble dryers** intended for household and similar purposes, their **rated voltage** being not more than 250 V for single-phase appliances and 480 V for other appliances.

NOTE 101 This standard applies to the drying function of washing machines having a drying cycle.

This standard also deals with the safety of **tumble dryers** that use a refrigerating system, incorporating sealed motor-compressors, for drying textile material. These appliances may use **flammable refrigerants**. Additional requirements for these appliances are given in Annex ~~BB~~ AA.

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.

NOTE 102 Examples of such appliances are **tumble dryers** for communal use in blocks of flats or in launderettes.

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

- persons (including children) whose
 - physical, sensory or mental capabilities; or
 - lack of experience and knowledgeprevents them from using the appliance safely without supervision or instruction;
- children playing with the appliance.

NOTE 103 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, the national water supply authorities, ~~the national authorities responsible for transportation and the national authorities for buildings~~.

NOTE 104 This standard does not apply to

- appliances intended 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 steam generating devices in which steam is produced at a pressure exceeding 50 kPa.~~

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

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

IEC 60584-1, Thermocouples – Part 1: EMF specifications and tolerances

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

Replacement:

3.1.9

normal operation

operation of the appliance under the following conditions:

The appliance is operated filled with textile material having a mass in the dry condition equal to the maximum load stated in the instructions.

The textile material consists of pre-washed double-hemmed cotton sheets having dimensions approximately 70 cm × 70 cm and a specific mass between 140 g/m² and 175 g/m² in the dry condition. The textile material is soaked with water having a temperature of 25 °C ± 5 °C and a mass equal to that of the textile material.

If the drying function can automatically follow the washing function in a washing machine, the appliance is not separately loaded. The appliance is operated with the maximum quantity of textile material stated in the instructions for the combined washing-drying cycle.

Note 101 to entry: Cotton having a water content not exceeding 10 % is considered to be in the dry condition. Cotton conditioned for 24 h in still air, having a temperature of 20 °C ± 2 °C, a relative humidity between 60 % and 70 % and a pressure between 860 mbar and 1 060 mbar, will contain approximately 7 % water.

A **steam generator** intended to be filled by hand is filled according to the instructions, water being added to maintain the steam generation.

A **steam generator** intended to be filled automatically is connected to the water mains.

3.5 Definitions relating to types of appliances

3.5.101

tumble dryer

appliance in which textile material is dried by tumbling in a rotating drum through which heated air is blown

3.5.102

condensation-type tumble dryer

tumble dryer in which the air used for the drying process is dehumidified by cooling

3.6 Definitions relating to parts of an appliance

3.6.101

steam generator

device in which steam is produced at a pressure not exceeding 50 kPa and in which the pressure drops to atmospheric pressure when the steam is not supplied

3.8 Definitions relating to miscellaneous matters

3.8.101

cool down period

final part of the **tumble dryer** cycle where the drum is continuously rotated with reduced power to the heating element and with air circulation in order to reduce the possibility of spontaneous combustion of the clothes load

Note 1 to entry: Continuous rotation does not mean rotation in same direction if the intended operation is to reverse direction in normal use.

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable.

6 Classification

This clause of Part 1 is applicable except as follows.

6.2 Addition:

Appliances shall be at least IPX4.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 Addition:

The appliance shall be marked with symbol ISO 7000-0790 (2004-01) or with the substance of the following:

Read the instructions

~~7.6 Addition:~~



~~[symbol IEC 60417-5041 (2002-10)] — caution, hot surface~~

7.10 Addition:

If the **off position** is only indicated by letters, the word "off" shall be used.

7.12 Addition:

The instructions ~~for use~~ shall state

- the maximum mass of dry textile material in kilograms to be used in the appliance;
- that the tumble dryer is not to be used if industrial chemicals have been used for cleaning;
- that the lint trap has to be cleaned frequently, if applicable;

- that lint must not to be allowed to accumulate around the tumble dryer (not applicable for appliances intended to be vented to the exterior of the building);
- that adequate ventilation has to be provided to avoid the back flow of gases into the room from appliances burning other fuels, including open fires

~~NOTE 101~~ (this instruction is not required if the **tumble dryer** discharges the air into the room).

If ~~symbols IEC 60417-5041 (2002-10)~~ or symbol ISO 7000-0790 (2004-01) ~~are~~ is used, ~~their~~ its meaning shall be explained.

The instructions shall include the substance of the following.

- Do not dry unwashed items in the tumble dryer.
- Items that have been soiled with substances such as cooking oil, acetone, alcohol, petrol, kerosene, spot removers, turpentine, waxes and wax removers should be washed in hot water with an extra amount of detergent before being dried in the tumble dryer.
- Items such as foam rubber (latex foam), shower caps, waterproof textiles, rubber backed articles and clothes or pillows fitted with foam rubber pads should not be dried in the tumble dryer.
- Fabric softeners, or similar products, should be used as specified by the fabric softener instructions.
- ~~– The final part of a tumble dryer cycle occurs without heat (cool down cycle) to ensure that the items are left at a temperature that ensures that the items will not be damaged.~~
- Remove all objects from pockets such as lighters and matches.
- Fill steam generators only with liquids specified by the manufacturer.

The instructions shall include the substance of the following warning:

WARNING: Never stop a tumble dryer before the end of the drying cycle unless all items are quickly removed and spread out so that the heat is dissipated.

The instructions for appliances for which the air temperature exceeds 55 °C during the drying cycle, shall include the substance of the following warning:

WARNING: The appliance must not be supplied through an external switching device, such as a timer, or connected to a circuit that is regularly switched on and off by a utility.

7.12.1 Addition:

The ~~installation~~ instructions shall state that

- for appliances with ventilation openings in the base, a carpet must not obstruct the openings;
- exhaust air must not be discharged into a flue that is used for exhausting fumes from appliances burning gas or other fuels

~~NOTE 101~~ (this instruction is not required if the **tumble dryer** discharges the air into the room);

- the appliance must not be installed behind a lockable door, a sliding door or a door with a hinge on the opposite side to that of the tumble dryer, in such a way that a full opening of the tumble dryer door is restricted.

If the ~~installation~~ instructions state that the **tumble dryer** can be placed on top of a washing machine, they shall state which washing machines are suitable. Instructions shall be given for the assembly of the **tumble dryer** and washing machine. The instructions shall state how to obtain any fixing attachments required, unless they are supplied with the appliance.

7.14 Addition:

The height of ~~symbols IEC 60417-5041 (2002-10)~~ and symbol ISO 7000-0790 (2004-01) shall be at least 15 mm.

~~Compliance is checked by measurement.~~

7.15 Addition:

Symbol ISO 7000-0790 (2004-01), or the marking “Read the instructions”, shall be readily visible when the appliance is installed as in normal use.

~~7.101 The rear surface, other than that of fixed appliances, shall be marked with symbol IEC 60417-5041 (2002-10) if its temperature rise exceeds the limits specified in 11.8 for accessible front surfaces.~~

~~The layout of symbol IEC 60417-5041 (2002-10) shall be in accordance with the rules for a warning sign in ISO 3864-1.~~

~~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 applicable except as follows.

11.2 Addition:

Lint traps are cleaned and then 50 % of the area of the filter is blocked.

11.3 Addition:

~~Temperature rises of the accessible front surface are measured using the probe of Figure 101. Where the external accessible surfaces are suitably flat and access permits, then the test probe of Figure 101 is used to measure the temperature rises of external accessible surfaces specified in Table 101. The probe is applied with a force of $4\text{ N} \pm 1\text{ N}$ to the surface in such a way that the best possible contact between the probe and the surface is ensured. The measurement is performed after a contact period of 30 s.~~

~~NOTE 101 The probe may be held in place using a laboratory stand clamp or similar device. Any measuring instrument giving the same results as the probe may be used.~~

11.7 Replacement:

Appliances incorporating a timer, a humidity sensing control or other time-limiting control are operated in cycles. Each cycle comprises an operating period having a duration equal to the maximum time that can be provided by the control and a rest period of 4 min during which the appliance is reloaded.

The test may be ended if the temperature rise of any part does not exceed the value determined during the preceding cycle by more than 8 K.

Appliances having a combined washing-drying cycle are operated with the drying programme resulting in the highest temperature rise.

*Appliances with a **steam generator** are operated with that steam mode resulting in the highest temperature rise.*

Other appliances are operated continuously until steady conditions are established.

11.8 Addition:

~~*The temperature rises of the accessible front surface shall not exceed the following values:*~~

<i>— metal and painted metal parts</i>	<i>60 K</i>
<i>— vitreous-enamelled metal parts</i>	<i>65 K</i>
<i>— glass and ceramic parts</i>	<i>65 K</i>
<i>— plastic parts having a thickness exceeding 0,3 mm</i>	<i>80 K</i>

~~*The temperature rise limit of 80 K also applies to plastic material having a metal finish of thickness less than 0,1 mm. When the thickness of the plastic coating does not exceed 0,3 mm, the temperature rise limits of the supporting material apply.*~~

During the test, the temperature rises are monitored continuously and shall not exceed the values shown in Table 3 and Table 101.

Table 101 – Maximum temperature rises for accessible external surfaces under normal operating conditions with the door closed

Surface ^c	Temperature rise ^e K		
	Surfaces of appliances situated not more than 850 mm above the floor after installation		Surfaces situated more than 850 mm above the floor after installation ^d
	Front surfaces	Other surfaces ^d	
Bare metal	38	42	42
Coated metal ^a	42	49	49
Glass and ceramic	51	56	56
Plastic and plastic coating > 0,4 mm ^b	58	62	62
<p>^a Metal is considered coated when a coating having a minimum thickness of 90 µm made by enamel or non-substantially plastic coating is used.</p> <p>^b The temperature rise limit applies also for plastic material having a metal finish of thickness less than 0,1 mm.</p> <p>^c When the thickness of plastic coating does not exceed 0,4 mm, the temperature rise limits of coated metal or glass and ceramic apply.</p> <p>^d If these values are exceeded, the test is allowed to be repeated with the appliance moved away from the test corner side wall. The test is repeated for 1 cycle.</p> <p>^e Temperature rises are not measured on</p> <ul style="list-style-type: none"> – the underside of appliances intended to be used on a working surface or floor where these surfaces are inaccessible to a 75 mm diameter probe having a hemispherical end applied with a force not exceeding 1 N; – the rear surface of appliances where these surfaces are inaccessible to a 75 mm diameter probe having a hemispherical end applied with a force not exceeding 1 N. 			

The temperature rises are measured with the door closed.

The exhaust temperature of the air from the drum, measured at the first lint filter after the air passes the clothes load, shall be measured for the purposes of 22.105.

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 3,5 mA, or 1 mA/kW rated power input with a limit of 5 mA, whichever is higher.

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 Modification:

*The test is carried out with the drum filled with wet textile material as specified for **normal operation**, the mass of the water, however, being approximately 1,5 times the mass of the dry textile material.*

*Appliances intended to be connected to the water mains are operated with the outlet of the condensation circuit blocked. The inlet valve is held open and the filling continued for 1 min after first evidence of overflow or for 5 min after a **protective device** operates to stop the flow. Doors are opened but interlocks are not forced.*

For all appliances, 0,5 l of ~~water containing approximately 1 % NaCl and 0,6 % of rinsing agent, as specified in Annex AA,~~ the solution is rapidly poured over the top of the appliance, so that the spillage solution flows over the surfaces of the appliance that incorporate controls, the controls being placed in the on position. The controls are then operated through their working range, this operation being repeated after a period of 5 min.

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

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.2 Modification:

*For **stationary class I combined appliances**, the leakage current shall not exceed 1 mA, or 1 mA/kW **rated power input** with a limit of 5 mA, whichever is higher.*

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 Modification:

Instead of being subjected to the tests of 19.2 and 19.3, appliances are subjected to the tests of 19.101 and 19.102, as applicable.

Addition:

If operation without water is a more unfavourable condition for appliances connected to the water mains, the tests are carried out with the water valve closed. This valve is not closed after the appliance has started to operate.

*The **steam generator** is operated without water.*

19.4 Replacement:

*The appliance is operated under the conditions specified in Clause 11 but with dry textile material. Controls that limit the temperature during the test of Clause 11 and all **self-resetting thermal cut-outs** that protect the heating elements are short-circuited simultaneously. The test is terminated at the end of the maximum period allowed by a timer.*

For condensation-type tumble dryers, the test is repeated, but with 75 % of the air outlet of the condenser blocked. The test is then carried out again with the air outlet fully blocked.

19.9 ~~Not applicable~~

Addition:

*The running overload test is carried out on appliances that have overload **protective devices** incorporating **electronic circuits** to protect the windings of the drum motor. However, the test is not carried out if the **protective device** senses the winding temperature directly.*

19.13 Addition:

The textile material shall not ignite and shall show no charring or glowing.

NOTE 101 Light-brown colouring of the textile material or slight emission of smoke is ignored.

19.101 *The appliance is operated under the conditions specified in Clause 11 but with dry textile material and the drum belt removed. The duration of the test is 90 min or for the maximum period allowed by a timer.*

If air circulation is likely to be prevented due to a fault condition, the test is repeated but with the drum belt in position and with the air circulation stopped.

NOTE ~~Care should~~ *shall* to be taken to ensure that the textile material is tumbling properly by reducing the load if necessary.

If both ~~of~~ these conditions are likely to occur simultaneously, the tests are combined.

19.102 *Appliances that permit test probe C of IEC 61032 to gain access to spaces containing **live parts** located below holes in the drum are tested for short circuit conditions. The short circuit is applied at the most unfavourable place between **live parts** and between **live parts** and other metal parts, if such a short circuit can be made by a pin having a diameter of approximately 1 mm and any length up to 50 mm. The appliance is operated as specified in Clause 11 but with dry textile material.*

19.103 *There shall be no risk of fire due to textile material coming into contact with a lamp cover.*

Compliance is checked by the following test.

*Ten layers of cheesecloth are placed over the lamp cover. The appliance is supplied at **rated voltage** with the door open until steady conditions are established. The temperature rise of the cover shall not exceed 150 K.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 Modification:

The test with the angle of inclination increased to 15 ° is not carried out.

20.101 It shall not be possible to open the door while the appliance is operating unless an interlock is provided that disconnects the motor before the door opening exceeds 75 mm. It shall not be possible to start the motor while the door opening exceeds 75 mm. ~~For appliances with a door opening having a dimension exceeding 200 mm and a drum having a volume exceeding 60 dm³, it shall not be possible to start the motor until a separate means which controls the movement of the drum is operated manually.~~

*Compliance is checked by inspection, by measurement and by manual test, the appliance being supplied at **rated voltage** and operating under **normal operation**.*

If means to prevent the door opening incorporates a coil or similar component to lock the door in the closed position, the component is energized and de-energized 6 000 times, six times a minute or at the rate imposed by the construction of the appliance if this is lower.

The locking means and its components shall be fit for further use.

NOTE The door is opened and closed during the test if this is necessary for the mechanical operation of the interlock.

20.102 For appliances with a door opening having a dimension exceeding 200 mm and a drum having a volume exceeding 60 dm³, it shall be possible to open the door from the inside with a force not exceeding 70 N.

~~This requirement does not apply to washing machines having a drying function.~~

Compliance is checked by inspection, by measurement and by applying a force of 70 N perpendicular to the plane of the door at a point furthest from the hinges.

If the appliance is supplied with a decorative door, the test is carried out with this door closed.

NOTE The force ~~may~~ can be applied to the outside of the door.

20.103 Appliances with horizontally hinged doors shall have adequate stability when the open door is subjected to a load. This requirement is not applicable to **built-in appliances** or **fixed appliances**.

*Compliance is checked by the following test that is carried out with the **tumble dryer** placed on a horizontal surface, even if it can be stacked on top of a washing machine.*

The empty appliance is placed on a horizontal surface and a mass of 23 kg applied to the centre of the open door. The appliance shall not tilt and the door and hinges shall not be damaged to such an extent that compliance with this standard is impaired.

20.104 For appliances having a door on a vertical surface with an opening exceeding 200 mm and a drum having a volume exceeding 60 dm³, it shall not be possible to start the drum motor after closing the door until a separate means which controls the movement of the drum is operated manually.

NOTE The volume can be calculated from the maximum depth and the maximum inner diameter of the drum.

Compliance is checked by the following test.

*The appliance is supplied at **rated voltage**, and the door is opened and then closed.*

*If compliance relies on the operation of an **electronic circuit**, the test is repeated under the following conditions applied separately:*

- the fault conditions in a) to g) of 19.11.2 are applied one at a time to the **electronic circuit**;*
- the electromagnetic phenomena tests of 19.11.4.2 and 19.11.4.5 are applied to the appliance.*

The drum motor shall not start.

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

21 Mechanical strength

This clause of Part 1 is applicable.

22 Construction

This clause of Part 1 is applicable except as follows.

22.101 Heating elements shall be located or guarded so that they cannot be contacted by textile material.

Compliance is checked by inspection.

22.102 Interlocks shall be constructed so that unexpected operation of the appliance is unlikely to occur while the door is open.

Compliance is checked by inspection and by attempting to release the interlock by means of test probe B of IEC 61032.

22.103 If the instructions state that the **tumble dryer** can be placed on top of a washing machine, this shall be possible without the **tumble dryer** tilting or falling.

Compliance is checked by inspection and by the following tests.

*The washing machine and **tumble dryer** are assembled together in accordance with the instructions.*

*The combination is placed in the most unfavourable orientation on a surface that is inclined at 5 ° to the horizontal. Each appliance is supplied at **rated voltage** and operated under **normal operation** in turn *and then together*.*

The empty combination is placed on a horizontal surface and a horizontal force of 150 N is applied to the upper edge of the combination with the doors closed.

*The ~~appliances~~ combination shall not tilt and the **tumble dryer** shall not fall off the washing machine.*

22.104 The operation of ~~an overheat~~ **protective devices** for the heating circuit shall not disable the **cool down-cycle period**, if any.

Compliance is checked during the tests of Clause 19.

22.105 In order to reduce the risk of spontaneous combustion of the clothes load, the drying cycle shall conclude with a **cool down period** to reduce the temperature of the normal clothes load to a suitable value.

This requirement is not applicable to appliances having a drying cycle air temperature not exceeding 55 °C.

Compliance is checked by the following test.

The appliance is operated under the conditions in Clause 11 and the exhaust temperature of the air from the drum shall be measured at the first lint filter after the air passes the clothes load in the drum.

*At end of the **cool down period**, the air temperature shall not exceed 55 °C.*

22.106 Steam generators shall be vented to the atmosphere. The aperture shall be at least 5 mm in diameter or at least 20 mm² in area with a minimum dimension of 3 mm.

Compliance is checked by inspection and by measurement.

22.107 Appliances with a **steam generator** shall be constructed in such a way that there is no spillage of water or sudden jets of steam or hot water likely to expose the user to a hazard when the appliance is used in accordance with the instructions.

If jets of steam or liquids are emitted through **protective devices**, the electrical insulation shall not be affected or the user exposed to a hazard.

Compliance is checked by inspection during the tests of Clause 11 and Clause 19.

22.108 For appliances that are controlled by **programmable electronic circuits** that limit the number of heating elements and motors from being energized at the same time, simultaneous activation of any combination of heating elements and motors shall not render the appliance unsafe.

Compliance is checked by the following test.

- *the fault/error conditions specified in Table R.1 are applied and evaluated in accordance with the relevant requirements of Annex R; or*
- *the appliance is operated under the conditions of Clause 11 while being supplied at **rated voltage**, the **programmable electronic circuits** being modified to allow simultaneous activation of all heaters and motors under their control.*

Under these conditions, compliance with 19.13 shall be fulfilled.

23 Internal wiring

This clause of Part 1 is applicable except as follows.

23.101 The insulation and sheath of internal wiring for the supply of magnetic valves and similar components incorporated in external hoses shall be at least equivalent to light polyvinyl chloride sheathed flexible cord (code designation 60227 IEC 52).

Compliance is checked by inspection.

NOTE The mechanical characteristics specified in IEC 60227 are not checked.

24 Components

This clause of Part 1 is applicable except as follows.

24.1.4 Addition:

The number of cycles of operation for programmers is 3 000.

24.101 Thermal cut-outs incorporated in **tumble dryers** for compliance with 19.4 shall not be **self-resetting thermal cut-outs**.

Compliance is checked by inspection.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable.

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.

29.2 Addition:

The microenvironment is pollution degree 3, and the insulation shall have a CTI of not less than 250, unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution due to condensation produced by the appliance during normal use.

*The requirement for a minimum CTI value of 250 is not applicable to **functional insulation** if the **working voltage** does not exceed 50 V.*

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2.2 Not applicable.

30.101 Non-metallic materials in close proximity to heating elements and on which lint could accumulate shall be resistant to spread of fire. This requirement also applies to parts on which burning lint could fall.

Compliance is checked by subjecting non-metallic surfaces located within 75 mm of the heating element to the needle-flame test of Annex E. The test is also applied to surfaces located directly below the heating element. However, parts shielded by a barrier that meets the needle-flame test are not tested.

NOTE It is considered that burning lint ~~will not~~ cannot fall through a barrier with openings having a dimension less than 3 mm.

The needle-flame test is not carried out on

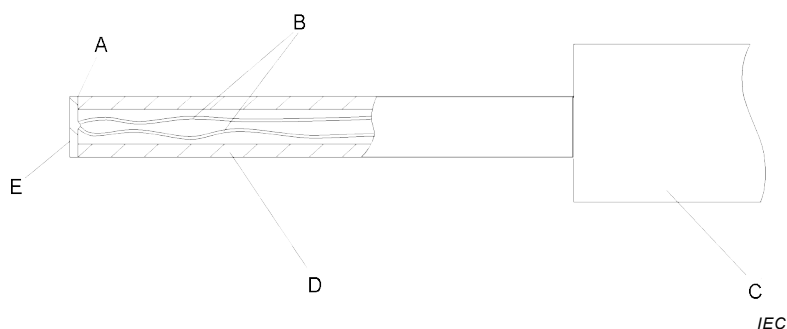
- *material classified as V-0 or V-1 according to IEC 60695-11-10, provided that the test sample was no thicker than the relevant part;*
- *rotating parts of fans;*
- *small parts as defined in IEC 60695-2-11.*

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.



Key

- A adhesive
- B thermocouple wires 0,3 mm diameter to IEC 60584-1 Type K (chrome alumel)
- C handle arrangement permitting a contact force of $4\text{ N} \pm 1\text{ N}$
- D polycarbonat tube: inside diameter 3 mm, outside diameter 5 mm
- E tinned copper disc: 5 mm diameter, 0,5 mm thick with flat contact face

~~NOTE The contact face of the disc is flat.~~

Figure 101 – Probe for measuring surface temperatures

Annexes

The annexes of Part 1 are applicable except as follows.

Annex R (normative)

Software evaluation

R.2.2.5 *Modification:*

For **programmable electronic circuits** with functions requiring software incorporating measures to control the fault/error conditions specified in Table R.1, detection of a fault/error shall occur before compliance with Clause 19, 20.104 and 22.108 is impaired.

R.2.2.9 *Modification:*

The software and safety-related hardware under its control shall be initialized and shall terminate before compliance with Clause 19, 20.104 and 22.108 is impaired.

~~Annex AA~~ (normative)

~~Rinsing agent~~

~~Any commercially available rinsing agent may be used, but if there is any doubt with regards to the test results, the composition of the rinsing agent shall be as follows:~~

Substance	Parts by mass %
Plurafac LF 221¹⁾	15,0
Cumene sulfonate (40 % solution)	11,5
Citric acid (anhydrous)	3,0
Deionized water	70,5

~~The rinsing agent has the following properties:~~

~~— viscosity, — 17 mPa s;~~

~~— pH, — 2,2 (1 % in water).~~

~~NOTE The composition of the rinsing agent is extracted from IEC 60436.~~

~~1) Plurafac LF 221 is the trade name of a product supplied by BASF. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named.~~

Annex ~~BB~~ AA (normative)

Tumble dryers that use a refrigerating system incorporating sealed motor-compressors for carrying out the drying process

The following modifications to this standard are applicable for **tumble dryers** that use a refrigerating system incorporating sealed motor-compressors.

NOTE Additional subclauses, notes and tables in this annex are numbered starting with 201.

AA.2 Normative references

Addition:

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

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

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

~~IEC/TR 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 60079-15:2010, *Explosive atmospheres – Part 15: Equipment protection by type of protection “n”*

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

IEC 60335-2-34:2012/AMD1:2015

IEC 60335-2-34:2012/AMD2:2016²

ISO/IEC 80079-20-1, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

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

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

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

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

² There exists a consolidated edition 5.2:2016 that includes edition 5:2012 and its Amendment 1:2015 and Amendment 2:2016.

AA.3 Terms and definitions

AA.3.8.201

flammable refrigerant

refrigerant with a flammability classification ~~of group 2 or 3~~ A2L, A2 or A3 in accordance with ~~ISO 5149~~ ISO 817

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

AA.4 General requirement

~~Addition:~~

NOTE 201 The use of **flammable refrigerants** involves additional hazards that are not associated with appliances using non-flammable refrigerants.

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

The hazard due to ignition of **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.

AA.5 General conditions for the tests

AA.5.2 ~~Addition:~~

At least one additional specially prepared sample is required for the tests of 22.202.

NOTE 201 Unless the motor-compressor conforms to IEC 60335-2-34, at least one additional specially prepared sample ~~may~~ can be required for the test of 19.1.

NOTE 202 At least one additional sample of the fan motor and its thermal motor protector ~~may~~ can be required for the test of 19.1.

NOTE 203 The test of 22.7 ~~may~~ can be performed on separate samples.

~~NOTE 204~~ Due to the potentially hazardous nature of the tests of AA.22.202 and AA.22.204, special precautions ~~may need to~~ shall be taken when performing the tests.

AA.5.7 ~~Addition:~~

The tests specified in Clauses 10, 11 and 13 are carried out at an ambient temperature of 23 °C ± 2 °C.

AA.6 Classification

AA.6.1 ~~Modification:~~

Tumble dryers using **flammable refrigerants** shall be class I.

AA.7 Marking and instructions

AA.7.1 ~~Addition:~~

Appliances shall also be marked with:

- the total mass of the refrigerant;

- 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.

If refrigerant numbers are used, they shall be as specified in ISO 817.

The appliance shall also be marked with the mass of the refrigerant for each separate refrigerant circuit.

Appliances that use **flammable refrigerants** shall be marked with ~~the symbol indicating “caution, risk of fire”~~ Warning sign ISO 7010-W021 (2011-06).

AA.7.6 Addition:



~~caution, risk of fire~~



[Warning sign ISO 7010-W021 (2011-06)]

Warning; Flammable material, risk of fire

AA.7.12 Addition:

If ~~the symbol indicating “caution, risk of fire”~~ Warning sign ISO 7010-W021 (2011-06) is used, its meaning shall be explained.

For appliances that 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 following:

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

WARNING: Do not damage the refrigerant circuit.

NOTE 201 This warning is only necessary if parts of the refrigerant circuit are accessible to the user.

AA.7.14 Addition:

The perpendicular height of the triangle of ~~the symbol indicating “caution, risk of fire”~~ Warning sign ISO 7010-W021 (2011-06) shall be at least 15 mm.

AA.7.15 Addition:

The marking of the type of **flammable refrigerant** and ~~the symbol indicating “caution, risk of fire”~~ Warning sign ISO 7010-W021 (2011-06) shall be visible when gaining access to the motor-compressors.

AA.11 Heating

AA.11.8 Addition:

*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.*

The temperatures of windings and housing of motor-compressors shall not exceed the values specified in Table 201 and the temperature rise of all other components associated with the motor-compressor shall not exceed the values given in Table 3.

Table 201 – Maximum temperatures for motor-compressors

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

*The 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 that*

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

AA.19 Abnormal operation

AA.19.1 Addition:

Motor-compressors not complying with IEC 60335-2-34 are subjected to the tests specified in IEC 60335-2-34:2012, 19.101 and 19.102, and shall also comply with 19.104 of that standard.

NOTE 201 For any given type of motor-compressor, this test is performed only once.

AA.19.7 Addition:

This test does not apply to motor-compressors.

AA.21 Mechanical strength

AA.21.201 Appliances using **flammable refrigerants** shall withstand the effects of vibration.

The appliance is fastened in its normal position of use to a vibration generator, in accordance with IEC 60068-2-6, 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;
- *acceleration* 5 m/s²;
- *frequencies* 100 Hz or 120 Hz depending on the **rated frequency** of the appliance (50 Hz or 60 Hz).

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. No leakage shall occur when checked according to AA.22.7.

AA.22 Construction

AA.22.7 Addition:

Appliances, including the motor-compressor, shall withstand:

- a pressure of 3,5 times the saturated vapour pressure of the refrigerant at 70 °C for the relevant refrigerant for parts exposed to high-side pressure;
- a pressure of 5 times the saturated vapour pressure of the refrigerant at 25 °C for parts exposed only to low-side pressure.

However, appliances, including the motor-compressor, using **flammable refrigerants** shall withstand

- a pressure of 3,0 times the adjusted value of the **protection device** for parts exposed to high-side pressure;
- a pressure of 5 times the saturated vapour pressure of the refrigerant at 25 °C for parts exposed only to low-side pressure.

NOTE 201 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.

AA.22.201 For **tumble dryers** that use **flammable refrigerants** in their refrigerant system, the mass of refrigerant shall not exceed 150 g in each separate refrigerant circuit.

Compliance is checked by inspection.

AA.22.202 For **tumble dryers** that use **flammable refrigerants**, any electrical component located inside the appliance, that during **normal operation** or abnormal operation produces sparks or arcs and luminaries, shall be tested and found at least to comply with the requirements in Annex ~~CC~~ BB for group IIA gases or the refrigerant used.

This requirement does not apply to

- **non-self-resetting protective devices** necessary for compliance with Clause 19, 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 the appliance enclosure shall not result in an explosive atmosphere outside the appliance in areas where electrical components that produce arcs and sparks during **normal operation** or abnormal operation are mounted, when doors or lids remain closed or when opening or closing doors or lids, unless these components have been tested and found at least to comply with the requirements in Annex-~~CC~~ BB, for group IIA gases or the refrigerant used.

This requirement does not apply to

- **non-self-resetting protective devices** necessary for compliance with Clause 19, 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**, that 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 Other types of protection for electrical apparatus used in potentially explosive atmospheres covered by the IEC 60079 series are also acceptable.

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

NOTE 3 The tests called up by Annex-~~CC~~ BB-~~may~~ can be carried out using the stoichiometric concentration of the refrigerant used. However, apparatus that has been independently tested and found to comply with Annex-~~CC~~ BB using the gas specified for group IIA need not be tested.

NOTE 4 Irrespective of the requirement given in 5.4.1 of IEC 60079-15, surface temperature limits are specified in AA.22.203.

The gas bottle is kept at a temperature of

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

NOTE 5 The quantity of gas injected-~~should~~ can preferably be measured by weighing the bottle.

*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 $\pm 1,5\text{ g}$, in the vapour state, is injected into the appliance enclosure in a time not exceeding 10 min. The orifice is then closed. The injection shall be as close as possible to the most critical points of the appliances.

NOTE 6 Examples are soldered joints.

The test has to be carried out while the door or lid is closed.

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 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 202, and shall not exceed 50 % of the lower explosive limit of the refrigerant as specified in Table 202 for a period exceeding 5 min.

The above test is repeated, and the door or lid is opened at a uniform rate in a time of between 1 s to 2 s to an angle of 90 ° or to the maximum possible, whichever is less. The concentration shall be the highest when the door or lid is opened.

AA.22.203 Temperatures on surfaces that may be exposed to leakage of **flammable refrigerants** shall not exceed the **auto-ignition** temperature of the refrigerant, as specified in Table 202, reduced by 100 K.

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

Table 202 – Refrigerant flammability parameters

Refrigerant number	Refrigerant name	Refrigerant formula	Refrigerant auto-ignition temperature ^{a, c} °C	Refrigerant lower explosive limit ^{b, c, d, e} %V/V
R50	Methane	CH ₄	537 600	4,4
R290	Propane	CH ₃ CH ₂ CH ₃	470 450	1,7
R600	n-Butane	CH ₃ CH ₂ CH ₂ CH ₃	372	1,4
R600a	Isobutane	CH(CH ₃) ₃	494 460	1,8 1,3
^a Values for other flammable refrigerants can be obtained from IEC 60079-4A and IEC 60079-20 IEC 80079-20-1 or ISO 5149-1. ^b Values for other flammable refrigerants can be obtained from IEC 60079-20 and ISO 5149 IEC 80079-20-1 and ISO 817. ^c IEC 60079-20 ISO/IEC 80079-20-1 is the reference standard. ISO 5149-1 and ISO 817 may be used if the required data is not contained in IEC 60079-20 IEC 80079-20-1. ^d Concentration of refrigerant in dry air. ^e In some standards, the term “flammability limit” is used for “explosive limit”.				

AA.22.204 For **tumble dryers** that use **flammable refrigerants**, a pressure responsive electrical cut-out is required for expansion valve refrigerant systems.

NOTE A capillary system is considered to be fail safe. In this case, an additional safety device is not required.

The pressure cut-out is allowed to be a **self-resetting type**. It shall not operate under the conditions of Clause 11. However during the test of 19.4, 75 % of the lint-trap is blocked and under this condition of abnormal use, the pressure cut-out is allowed to operate.

Compliance is checked by inspection during the tests of Clause 11 and 19.4.