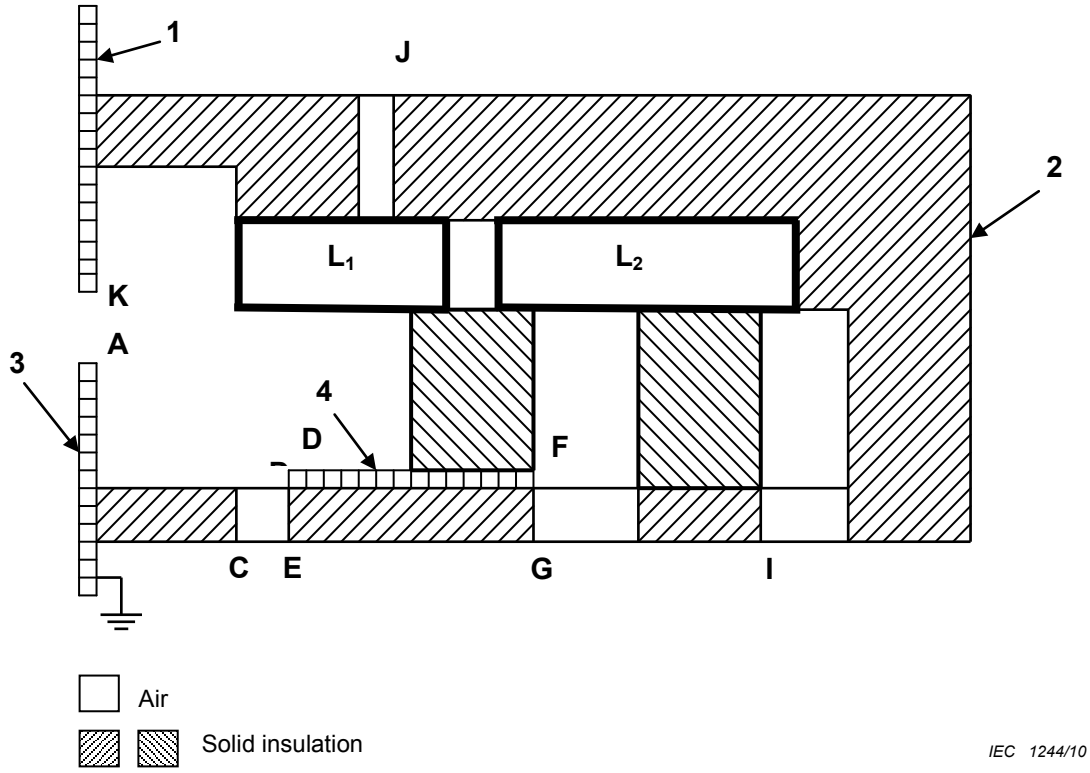


Key

1 **accessible unearthed metal part**

2 **enclosure**

3 **accessible earthed metal part**

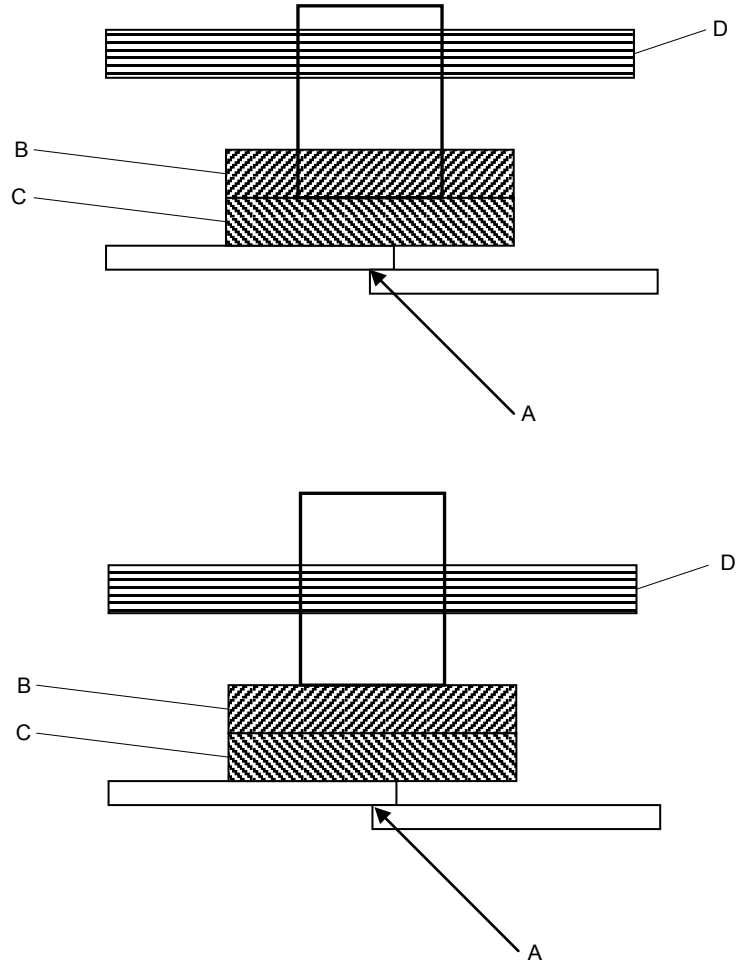
4 inaccessible unearthed metal part

The **live parts** L_1 and L_2 are separated from each other and partially surrounded by a plastic enclosure containing apertures, partially by air and are in contact with solid insulation. A piece of inaccessible metal is incorporated inside the construction. There are two metal covers, one of which is earthed.

Type of insulation	Clearance
Basic insulation	L_1A
	L_1D
	L_2F
Functional insulation	L_1L_2
Supplementary insulation	DE
	FG
Reinforced insulation	L_1K
	L_1J
	L_2I
	L_1C

NOTE If the **clearances** L_1D or L_2F meet the **clearance** requirements for **reinforced insulation**, the **clearances** DE or FG of **supplementary insulation** are not measured.

Figure 11 – Examples of clearances



IEC 990/10

Key

A connection zone

B non-metallic material

C non-metallic material

D non-metallic material

NOTE 1 The placement of the cylinder is shown with respect to example 1 in Figure O.5

NOTE 2 If C flames for longer than 2 s during the glow-wire test, then the cylinder is assumed to be located at the upper boundary of C. Consequently parts B and D are subjected to the needle-flame test.

If B flames for longer than 2 s during the glow-wire test, then the cylinder is assumed to be located on top of B. Consequently, D is subjected to the needle-flame test.

NOTE 3 In some constructions, D can be another part of the same moulding as B or C. Therefore, if B or C flame for longer than 2 s during the glow-wire test, the material used for B or C that is within the cylinder, represented by D, is also subjected to the needle-flame test.

Figure 12 – Example of the placement of the cylinder

Annex A
(informative)

Routine tests

Introduction

Routine tests are intended to be carried out by the manufacturer on each appliance to detect a production variation that could impair safety. They are normally carried out on the complete appliance after assembly but the manufacturer may perform the tests at an appropriate stage during production, provided that later manufacturing processes do not affect the results.

NOTE Components are not subjected to these tests if they have been previously subjected to routine tests during their manufacture.

The manufacturer may use a different routine test procedure provided that the level of safety is equivalent to that provided by the tests specified in this annex.

These tests are the minimum considered necessary to cover essential safety aspects. It is the manufacturer's responsibility to decide if additional routine tests are necessary. It may be determined from engineering considerations that some of the tests are impracticable or inappropriate and therefore need not be carried out.

If a product fails any of the tests, it is to be retested after rework or adjustment.

A.1 Earth continuity test

A current of at least 10 A, derived from a source having a no-load voltage not exceeding 12 V (a.c. or d.c.), is passed between each of the ***accessible earthed metal parts*** *and*

– *for* ***class 0I appliances****, and for* ***class I appliances*** *intended to be permanently connected to fixed wiring, the earthing terminal;*

– *for other* ***class I appliances****,*

- *the earthing pin or earthing contact of the plug;*
- *the earthing pin of the appliance inlet.*

The voltage drop is measured and the resistance is calculated and shall not exceed

– *for appliances having a* ***supply cord****, 0,2 Ω, or 0,1 Ω plus the resistance of the* ***supply cord****;*

– *for other appliances, 0,1 Ω.*

NOTE 1 The test is only carried out for the duration necessary to enable the voltage drop to be measured.

NOTE 2 Care is to be taken to ensure that the contact resistance between the tip of the measuring probe and the metal part under test does not influence the test results.

A.2 Electric strength test

The insulation of the appliance is subjected to a voltage of substantially sinusoidal waveform having a frequency of approximately 50 Hz or 60 Hz for 1 s. The value of the test voltage and the points of application are shown in Table A.1.

Table A.1 – Test voltages

Points of application	*Test voltage V*		
	Class 0 appliances, Class 0I appliances, Class I appliances and Class II appliances		*Class III appliances*
	Rated voltage		
	≤150 V	*>150 V*	
*Between **live parts** and **accessible metal parts** separated from **live parts** by*			
• ***basic insulation** only*	*800*	*1 000*	*400*
• ***double** or **reinforced insulation*** [a, b]	*2 000*	*2 500*	–

[a] *This test is not applicable for **class 0 appliances**.*

[b] *For **class 0I appliances** and **class I appliances**, this test need not be carried out on parts of **class II construction** if the test is considered to be inappropriate.*

NOTE 1 It may be necessary for the appliance to be in operation during the test to ensure that the test voltage is applied to all relevant insulation, for example, heating elements controlled by a relay.

No breakdown shall occur. Breakdown is assumed to occur when the current in the test circuit exceeds 5 mA. However, this limit may be increased up to 30 mA for appliances with a high leakage current.

NOTE 2 The circuit used for the test incorporates a current sensing device that trips when the current exceeds the limit.

NOTE 3 The high voltage transformer is to be capable of maintaining the specified voltage at the limiting current.

NOTE 4 Instead of being subjected to an a.c. voltage, the insulation may be subjected to a d.c. voltage of 1,5 times the value shown in the table. An a.c. voltage having a frequency up to 5 Hz is considered to be a d.c. voltage.

A.3 Functional test

The correct functioning of an appliance is checked by inspection or by an appropriate test if the incorrect connection or adjustment of components has safety implications.

NOTE Examples are verification of the correct direction of motor rotation and the appropriate operation of interlock switches. This does not require testing of thermal controls or **protective devices**.

Annex B
(normative)

Appliances powered by rechargeable batteries that are recharged in the appliance

The following modifications to this standard are applicable for appliances powered by batteries that are recharged in the appliance.

NOTE 1 Rechargeable batteries are also referred to as secondary batteries.

NOTE 2 This annex does not apply to battery chargers (IEC 60335-2-29).

These appliances take one of the following three forms of construction:

a) The appliance can be supplied directly from the supply mains or a renewable energy source such as a solar cell, the battery charging circuitry and other supply unit circuitry being incorporated within the appliance.

b) The part of the appliance incorporating the battery is supplied from the supply mains or a renewable energy source such as a solar cell, via a **detachable supply unit**. The battery charging circuitry is incorporated within the part of the appliance containing the battery. In this case, the complete appliance is the **detachable supply unit** plus the part of the appliance containing the battery and the battery charging circuitry.

c) The part of the appliance incorporating the battery is supplied from the supply mains or a renewable energy source such as a solar cell, via a **detachable supply unit**. The battery charging circuitry is incorporated within the **detachable supply unit**. In this case, the complete appliance is the detachable supply unit with the battery charging circuitry plus the part of the appliance containing the battery.

NOTE 3 Examples of the forms of construction covered by this Annex B are shown in Figure B.1.

NOTE 4 If the appliance incorporates a non-rechargeable (primary) battery or a rechargeable (secondary) battery that must be removed from the appliance for charging, then Annex S is applicable. In this case, the appliance is simply a **battery-operated appliance** and the safety requirements for the battery charger for charging the rechargeable battery are contained in IEC 60335-2-29.

3 Terms and definitions

3.1.9
normal operation
operation of the appliance under the following conditions:

– the appliance, supplied by its fully charged battery, is operated as specified in the relevant part 2;

– the battery is charged, the battery being initially discharged to such an extent that the appliance cannot operate;

– if possible, the appliance is supplied from the supply mains through its battery charger, the battery being initially discharged to such an extent that the appliance cannot operate. The appliance is operated as specified in the relevant part 2;

– if the appliance incorporates inductive coupling between two parts that are detachable from each other, the appliance is supplied from the supply mains with the **detachable part** removed.

3.6.2

NOTE If a part has to be removed in order to discard the battery before scrapping the appliance, this part is not considered to be detachable even if the instructions state that it is to be removed.

5 General conditions for the tests

5.B.101 *When appliances are supplied from the supply mains, they are tested as specified for* ***motor-operated appliances****.*

7 Marking and instructions

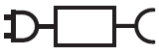
7.1 The battery compartment of appliances incorporating batteries that are intended to be replaced by the user shall be marked with the battery voltage and the polarity of the terminals.

The positive terminal shall be indicated by symbol IEC 60417-5005 (2002-10)and the negative terminal by symbol IEC 60417-5006 (2002-10).

Appliances intending to be supplied from a **detachable supply unit** for the purposes of recharging the battery shall be marked with symbol IEC 60417-6181 (2013-03) and its type reference along with symbol ISO 7000-0790 (2004-01) or with the substance of the following:

Use only with <model designation> supply unit

7.6

	Symbol IEC 60417-5005 (2002-10)	Plus; positive polarity
	Symbol IEC 60417-5006 (2002-10)	Minus; negative polarity
	[symbol IEC 60417-6181 (2013-03)]	**detachable supply unit**

7.12 The instructions shall give information regarding charging.

The instructions for appliances incorporating batteries that are intended to be replaced by the user shall include the following:

– the type reference of the battery;
– the orientation of the battery with regard to polarity;
– the method of replacing batteries;
– details regarding safe disposal of used batteries;
– warning against using non-rechargeable batteries;
– how to deal with leaking batteries.

The instructions for appliances incorporating a battery that contains materials that are hazardous to the environment shall give details on how to remove the battery and shall state that

– the battery must be removed from the appliance before it is scrapped;
– the appliance must be disconnected from the supply mains when removing the battery;
– the battery is to be disposed of safely.

For appliances intending to be supplied from a **detachable supply unit** for the purposes of recharging the battery, the type reference of the **detachable supply unit** shall be stated along with the substance of the following:

WARNING: For the purposes of recharging the battery, only use the detachable supply unit provided with this appliance.

If the symbol for **detachable supply unit** is used, its meaning shall be explained.

7.15 Markings, other than those associated with the battery, shall be placed on the part of the appliance that is connected to the supply mains.

The type reference of the **detachable supply unit** shall be placed in close proximity to the symbol.

8 Protection against access to live parts

8.2 Appliances having batteries that according to the instructions may be replaced by the user need only have **basic insulation** between **live parts** and the inner surface of the battery compartment. If the appliance can be operated without the batteries, **double insulation** or **reinforced insulation** is required.

11 Heating

11.7 *The battery is charged for the period stated in the instructions or for 24 h, whichever is longer.*

11.8 *The temperature rise of the battery surface shall not exceed the temperature rise limit in the battery manufacturer's specification for the type of battery supplied. If no limit is specified, the temperature rise shall not exceed 20 K.*

19 Abnormal operation

19.1 *Appliances are also subjected to the tests of 19.B.101, 19.B.102, and 19.B.103.*

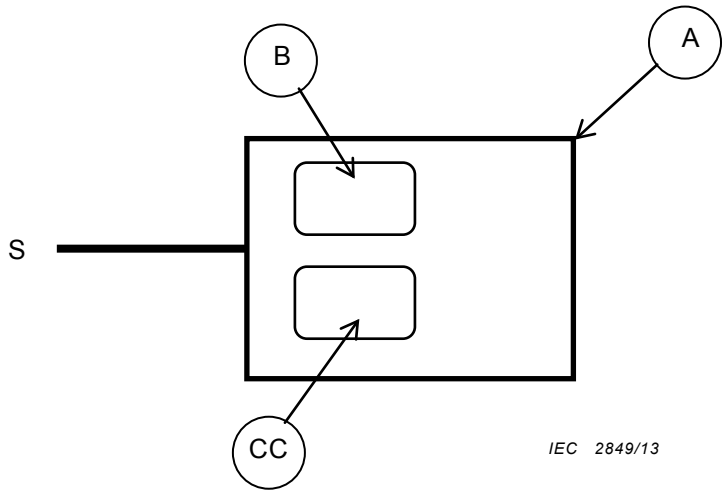
19.10 Not applicable.

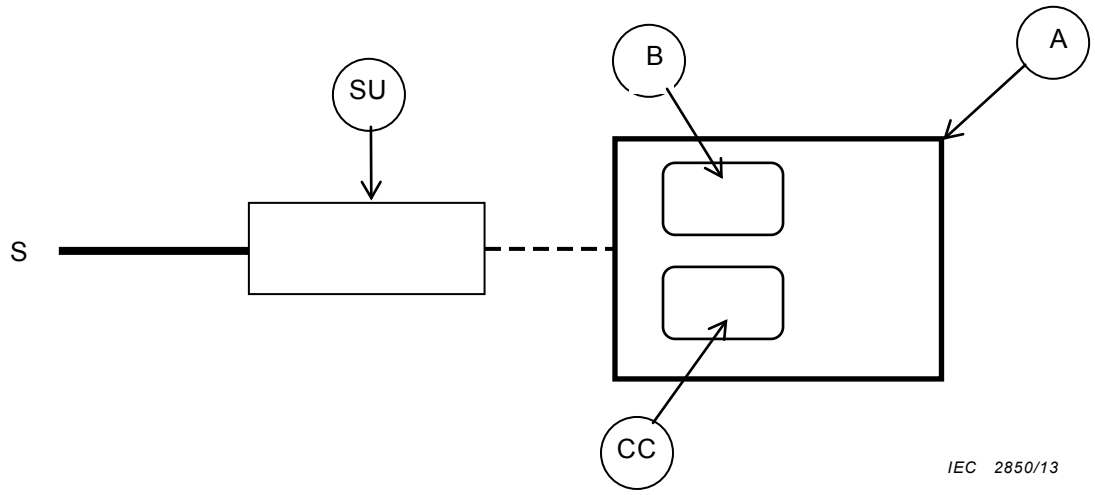
19.B.101 *Appliances are supplied at **rated voltage** for 168 h, the battery being continually charged during this period.*

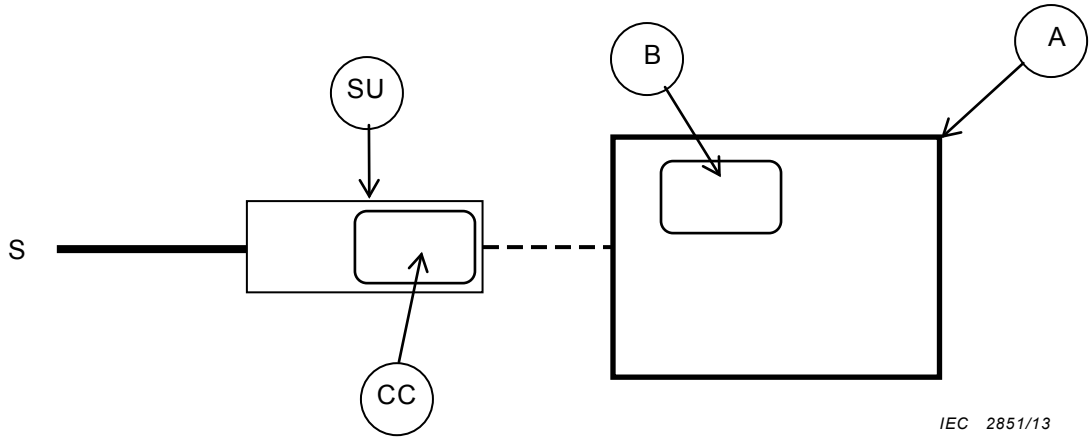
19.B.102 *For appliances having batteries that can be removed without the aid of a **tool**, and having terminals that can be short-circuited by a thin straight bar, the terminals of the battery are short-circuited, the battery being fully charged.*

19.B.103 *Appliances having batteries that are replaceable by the user are supplied at **rated voltage** and operated under **normal operation** but with the battery removed or in any position allowed by the construction.*

19.13 *The battery shall not rupture or ignite.*







Key
A appliance
B battery
S supply mains
CC charging circuitry
SU supply unit

Figure B.1 – Examples of forms of constructions for appliances covered by Annex B

21 Mechanical strength

21.B.101 Appliances having pins for insertion into socket-outlets shall have adequate mechanical strength.

Compliance is checked by subjecting the part of the appliance incorporating the pins to the test, Free fall repeated, procedure 2, of IEC 60068-2-31.

The number of falls is

– *100, if the mass of the part does not exceed 250 g;*

– *50, if the mass of the part exceeds 250 g.*

The height of the falls is 500 mm.

After the test, the requirements of 8.1, 15.1.1, 16.3 and Clause 29 shall be met.

22 Construction

22.3

NOTE Appliances having pins for insertion into socket-outlets are tested as fully assembled as possible.

25 Supply connection and external flexible cords

25.13 An additional lining or bushing is not necessary for **interconnection cords** in **class III appliances** or **class III constructions** that do not contain **live parts**.

30 Resistance to heat and fire

30.2 *For parts of the appliance that are connected to the supply mains during the charging period, 30.2.3 applies. For other parts, 30.2.2 applies.*

Annex C
(normative)

Ageing test on motors

This annex is applicable when there is doubt with regard to the temperature classification of the insulation of a motor winding, for example

– if the temperature rise of the motor winding exceeds the values specified in Table 3;

– when well-known insulating materials are used in an unconventional way;

– when combinations of materials of different temperature classes are used at a temperature higher than that allowed for the lowest class;

– when materials are used for which sufficient experience is not available, for instance in motors having integral core insulation.

This test is carried out on six samples of the motor.

The rotor of each motor is locked and a current is passed individually through the rotor winding and the stator winding, this current being such that the temperature of the relevant winding is equal to the maximum temperature rise measured during the test of Clause 11, increased by 25 K. This temperature is further increased by one of the values chosen from Table C.1. The corresponding total time during which the current is passed is indicated in the table.

Table C.1 – Test conditions

Temperature increase *K*	***Total time*** *h*
0 ± 3	*p* [a]
10 ± 3	*0,5 p*
20 ± 3	*0,25 p*
30 ± 3	*0,125 p*
NOTE The temperature increase chosen is selected by the manufacturer.	
[a] *p is 8 000 unless otherwise specified in the relevant part 2.*	

The total time is divided into four equal periods, each being followed by a period of 48 h during which the motor is subjected to the humidity test of 15.3. After the final humidity test, the insulation shall withstand the electric strength test of 16.3, but with the test voltage reduced to 50 % of the value specified.

After each of the four periods and before the subsequent humidity test, the leakage current of the insulating system is measured as specified in 13.2, any component not forming part of the insulation system under test being disconnected before the measurement is made.

The leakage current shall not exceed 0,5 mA.

Failure of only one of the six motors during the first of the four periods of the test is ignored.

If one of the six motors fails during the second, third or fourth period of the test, the remaining five motors are subjected to a fifth period followed by the humidity test and the electric strength test.

The remaining five motors shall complete the test.