

Singapore Standard SS 146 : Part 1 : 2004

**SPECIFICATION FOR SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –
PART 1 : GENERAL REQUIREMENTS**

AMENDMENT NO. 1

February 2006

1. *Add IEC 60335-1 : 2004 Amendment 1 : 2004-03 to the current SS 146 : Part 1 : 2004.*

FOREWORD

This amendment has been prepared by technical committee 61: Safety of household and similar electrical appliances.

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

FDIS	Report on voting
61/2569/FDIS	61/2639/RVD

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

The committee has decided that the contents of the base publication and its amendments will remain unchanged until 2006. At this date, the publication will be

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- withdrawn;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

CONTENTS

Replace the title of Annex D by the following new title:

Thermal motor protectors

Add the following new titles to the list of annexes:

Annex P (informative) Guidance for the application of this standard to appliances used in damp warm equable climates

Annex Q (informative) Sequence of tests for the evaluation of electronic circuits

Annex R (normative) Software evaluation

Replace the title of Figure 5 by the word "Void".

Replace the title of Table 10 by the following title:

Dimensions of cables and conduits

FOREWORD

Replace the third and fourth paragraphs below the table by the following:

Annexes B, C, D, E, F, G, H, I, J, K, M, N and R form an integral part of this standard.

Annexes A, L, O, P and Q are for information only.

In Note 1, *replace* "Proof tracking tests" *by* "Proof tracking test".

Singapore Standard SS 146 : Part 1 : 2004
Amendment No. 1, February 2006

Add to Note 1 the following item:

- Annex R Software evaluation IEC 60730-1

In the list of differences existing in some countries add the following new items:

- 19.11: Different tests are carried out to evaluate solid state devices used in protective electronic circuits (USA).
- 22.46: The evaluation of software is different (USA).
- 29.3 The third dashed item of the test specification does not apply (Germany).

Renumber the existing item "Clause 21" as "21.1".

INTRODUCTION

Replace the second sentence of the second paragraph by the following:

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.

1 Scope

Delete the second dashed item of Note 2.

2 Normative references

Delete from the existing list the following normative references:

IEC 60051-2

IEC 60065

IEC 60998-2-1

IEC 60998-2-2

IEC 61643

ISO 1463

ISO 2178

Replace the reference to IEC 60112:1979, by the following new reference:

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

Singapore Standard SS 146 : Part 1 : 2004
Amendment No. 1, February 2006

Replace the undated references to IEC 60249-2-4 and IEC 60249-5 by the following dated reference:

IEC 60249-2-4:1987, *Base materials for printed circuits – Part 2: Specifications – Specification No. 4: Epoxide woven glass fabric copper-clad laminated sheet, general purpose grade*

Amendment 1 (1989)

Amendment 2 (1992)

Amendment 3 (1993)

Amendment 4 (1994)

Amendment 5 (2000)

IEC 60249-2-5:1987, *Base materials for printed circuits – Part 2: Specifications – Specification No. 5: Epoxide woven glass fabric copper-clad laminated sheet of defined flammability (vertical burning test)*

Amendment 1 (1989)

Amendment 2 (1992)

Amendment 3 (1993)

Amendment 4 (1994)

Amendment 5 (2000)

Replace “IEC 60320-1:1994, ...” by “IEC 60320-1, ...”

Replace the publication date of IEC 60598-1 by 2003

Replace the reference to IEC 60664-1:1992 by the following:

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

Amendment 1 (2000)

Amendment 2 (2002)¹

Replace « IEC 60695-11-10:1999, ... » by « IEC 60695-11-10, ... »

Replace the non-dated reference to IEC 60999-1 by the following dated reference:

IEC 60999-1:1999, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)*

Replace the reference to IEC 61058-1 by the following reference:

IEC 61058-1:2000, *Switches for appliances – Part 1: General requirements*

Amendment 1 (2001)²

Add the following new references:

IEC 60068-2-2, *Environmental testing – Part 2 Tests. Tests B: Dry heat*

IEC 60320-2-2, *Appliance couplers for household and similar general purposes – Part 2-2: Interconnection couplers for household and similar equipment*

¹ There exists a consolidated edition 1.2 (2002) that includes edition 1 and its amendments 1 and 2.

² There exists a consolidated edition 3.1 (2001) that includes edition 3 and its amendment 1.

IEC 60730-2-8:2000, *Automatic electrical controls for household and similar use – Part 2-8: Particular requirements for electrically operated water valves, including mechanical requirements*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-11:1994, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 11: Voltage dips, short interruptions and voltage variations immunity tests*
Amendment 1 (2000)³

IEC 61000-4-13, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*

IEC 61770, *Electric appliances connected to the water mains – Avoidance of backsiphonage and failure of hose-sets*

Replace the reference to IEC 60417 as follows:

IEC 60417-DB:2002⁴), *Graphical symbols for use on equipment*

Replace the publication date of ISO 9772 by “2001”.

3 Definitions

Add the following new paragraph before the definitions:

An Index of the defined terms is provided at the end of this publication.

3.5.4 fixed appliance

Delete the note.

³ There exists a consolidated edition 1.1 (2001) including Edition 1 and its Amendment 1.

⁴ DB refers to the IEC on-line database.

3.8.2 off position

Add the following at the end of the definition:

or, for electronic disconnection, the circuit is de-energized

Add the following new definitions:

3.1.11

dangerous malfunction

unintended operation of the appliance that may impair safety

3.9.3

protective electronic circuit

electronic circuit that prevents a hazardous situation under abnormal operating conditions

NOTE Parts of the circuit may also be used for functional purposes.

3.9.4

software class B

software that includes code intended to prevent hazards if a fault, other than a software fault, occurs in the appliance

3.9.5

software class C

software that includes code intended to prevent hazards without the use of other **protective devices**

5 General conditions for the tests

5.2 *Add the following new paragraph after the fourth paragraph of Note 1:*

If the test of Annex D has to be carried out, an additional appliance may be used.

5.3 *Replace the last sentence of the first paragraph by the following:*

The tests of Clause 14 and 21.2 and 22.24 are carried out after the tests of Clause 29.

5.14 *Add the following note:*

NOTE Guidance is given in Annex P for enhanced requirements that may be used to ensure an acceptable level of protection against electrical and thermal hazards for particular types of appliances used in an installation without a protective earthing conductor in countries that have warm damp equable climates.

7 Marking and instructions

7.1 *Add the following:*

The enclosure of electrically-operated water valves incorporated in external hose-sets for connection of an appliance to the water mains shall be marked with symbol IEC 60417-5036 (DB:2002-10) if their **working voltage** exceeds **extra-low voltage**.

7.6 Add the following:



[symbol IEC 60417-5021 (DB:2002-10)]

equipotentiality



[symbol IEC 60417-5036 (DB:2002-10)]

dangerous voltage

7.12.4 Replace the last dashed item by the following:

- necessity to allow disconnection of the appliance from the supply after installation, unless the appliance incorporates a switch complying with 24.3. The disconnection may be achieved by having the plug accessible or by incorporating a switch in the fixed wiring in accordance with the wiring rules.

Add the following new subclauses:

7.12.6 The instructions for **heating appliances** incorporating a **non-self-resetting thermal cut-out** that is reset by disconnection of the supply mains shall contain the substance of the following:

CAUTION: In order to avoid a hazard due to inadvertent resetting of the thermal cutout, this 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 the utility.

Compliance is checked by inspection.

7.12.7 The instructions for **fixed appliances** shall state how the appliance is to be fixed to its support.

NOTE The method of fixing is not to depend on the use of adhesives since they are not considered to be a reliable fixing means.

Compliance is checked by inspection.

7.12.8 The instructions for appliances connected to the water mains shall state

- the maximum inlet water pressure, in pascals;
- the minimum inlet water pressure, in pascals, if this is necessary for the correct operation of the appliance.

The instructions for appliances connected to the water mains by **detachable hose-sets** shall state that the new hose-sets supplied with the appliance are to be used and that old hose-sets should not be reused.

Compliance is checked by inspection.

8 Protection against access to live parts

8.1.4 Add the following to the last paragraph of the test specification:

The quantity of electricity in the discharge is measured using a resistor having a nominal non-inductive resistance of 2 000 Ω .

Number the existing note as Note 1 and add the following note:

NOTE 2 The quantity of electricity is calculated from the sum of all areas recorded on the voltage/time graph without taking voltage polarity into account.

11 Heating

11.8 Add to the second paragraph:

However, components in **protective electronic circuits** are allowed to operate provided they are tested for the number of cycles of operation specified in 24.1.4.

Table 3 – Maximum normal temperature rises

Replace the third paragraph of table footnote b by the following:

The temperature rise limit does not apply to switches or controls tested in accordance with the conditions occurring in the appliance.

13 Leakage current and electric strength at operating temperature

13.3 Replace the first paragraph by the following:

The appliance is disconnected from the supply and the insulation is immediately subjected to a voltage having a frequency of 50 Hz or 60 Hz for 1 min, in accordance with IEC 61180-1.

The high-voltage source used for the test is to be capable of supplying a short circuit current I_s between the output terminals after the output voltage has been adjusted to the appropriate test voltage. The overload release of the circuit is not to be operated by any current below the tripping current I_r . The values of I_s and I_r are given in Table 5 for various high-voltage sources.

Table 4

Replace the existing Table 4 by the following new table:

Table 4 – Voltage for electric strength test

Insulation	Test voltage V			
	Rated voltage ^a			Working voltage (U)
	SELV	≤150 V	>150 V and ≤250 V ^b	>250 V
Basic insulation	500	1 000	1 000	1,2 U + 700
Supplementary insulation		1 250	1 750	1,2 U + 1 450
Reinforced insulation		2 500	3 000	2,4 U + 2 400
^a For multi-phase appliances, the line to neutral or line to earth voltage is used for rated voltage . The test voltage for 480 V multi-phase appliances is that specified for a rated voltage in the range > 150 V and ≤ 250 V. ^b For appliances having a rated voltage ≤ 150 V, these test voltages apply to parts having a working voltage > 150 V ≤ 250 V.				

Delete the fourth paragraph, commencing with “Initially, not more...”.

Delete Note 3.

Table 5

Replace the existing Table 5 by the following new table:

Table 5 – Characteristics of high-voltage sources

Test voltage V	Minimum current mA	
	I_s	I_r
≤4 000	200	100
>4 000 and ≤10 000	80	40
>10 000 and ≤20 000	40	20
NOTE The currents are calculated on the basis of the short circuit and release energies of 800 VA and 400 VA respectively at the upper end of the voltage ranges		

14 Transient overvoltages

Table 6

Replace the existing Table 6 by the following new table:

Table 6 – Impulse test voltage

<i>Rated impulse voltage</i>	<i>Impulse test voltage</i>
V	V
330	350
500	550
800	910
1 500	1 750
2 500	2 950
4 000	4 800
6 000	7 300
8 000	9 800
10 000	12 300

Replace the existing Note 2 by the following new note:

NOTE 2 The impulse test voltages have been calculated using correction factors for testing at locations situated at sea level. It is considered that they are appropriate for any location between sea level and 500 m. If tests are carried out at other locations, other correction factors should be used as noted in subclause 4.1.1.2.1.2 of IEC 60664-1.

15 Moisture resistance

15.1.1 Add the following:

*Water valves containing **live parts** and that are incorporated in external hoses for connection of an appliance to the water mains are subjected to the test specified for IPX7 appliances.*

15.1.2 Add the following after the seventh paragraph:

Appliances normally fixed to a ceiling are mounted underneath a horizontal unperforated support that is constructed to prevent water spraying onto its top surface. The pivot axis of the oscillating tube is located at the same level as the underside of the support and aligned centrally with the appliance. The spray is directed upwards.

For IPX4 appliances, the movement of the tube is limited to two times 90° from the vertical for a period of 5 min.

16 Leakage current and electric strength

Table 7

Replace the existing Table 7 by the following new table:

Table 7 – Test voltages

Insulation	Test voltage V			
	Rated voltage ^a			Working voltage (U)
	SELV	≤150 V	>150 V and ≤250 V ^b	>250 V
Basic insulation	500	1 250	1 250	1,2 U + 950
Supplementary insulation	–	1 250	1 750	1,2 U + 1 450
Reinforced insulation	–	2 500	3 000	2,4 U + 2 400
^a For multi-phase appliances, the line to neutral or line to earth voltage is used for rated voltage . The test voltage for 480 V multi-phase appliances is that specified for a rated voltage in the range > 150 V and ≤ 250 V.				
^b For appliances having a rated voltage ≤150 V, these test voltages apply to parts having a working voltage > 150 V and ≤ 250 V.				

19 Abnormal operation

19.1 In the second paragraph, replace “dangerous malfunction” by “**dangerous malfunction**”.

19.2 Add the following note:

NOTE Controls that operate during the test of Clause 11 are allowed to operate.

19.3 Add the following note:

NOTE Controls that operate during the test of Clause 11 are allowed to operate.

19.7 Replace the text of Note 2 by “Void”.

19.9 Delete Note 2.

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

Appliances incorporating a **protective electronic circuit** are subjected to the tests of 19.11.3 and 19.11.4.

Appliances having a switch with an **off position** obtained by electronic disconnection, or a switch that can place the appliance in a stand-by mode, are subjected to the tests of 19.11.4.

NOTE 1a The sequence of tests for the evaluation of **electronic circuits** is given in Annex Q.

19.11.1 In the second dashed item, replace “dangerous malfunction” by “**dangerous malfunction**”.

19.11.2 Delete the second sentence of item f), commencing with “In this case the possible hazardous”

Replace the last paragraph by the following:

In each case, the test is ended if a non-self-resetting interruption of the supply occurs within the appliance.

Add the following subclauses:

19.11.4 Appliances having a switch with an **off position** obtained by electronic disconnection, or a switch that can be placed in the stand-by mode, are subjected to the tests of 19.11.4.1 to 19.11.4.7. The tests are carried out with the appliance supplied at **rated voltage**, the switch being set in the **off position** or in the stand-by mode.

Appliances incorporating a **protective electronic circuit** are subjected to the tests of 19.11.4.1 to 19.11.4.7. The tests are carried out after the **protective electronic circuit** has operated during the relevant tests of Clause 19 except 19.2, 19.6 and 19.11.3. However, appliances that are operated for 30 s or 5 min during the test of 19.7 are not subjected to the tests for electromagnetic phenomena.

The tests are carried out with surge arresters disconnected, unless they incorporate spark gaps.

NOTE 1 If the appliance has several modes of operation, the tests are carried out with the appliance operating in each mode, if necessary.

NOTE 2 Appliances incorporating electronic controls complying with the IEC 60730 series are not exempt from the tests.

19.11.4.1 The appliance is subjected to electrostatic discharges in accordance with IEC 61000-4-2, test level 4 being applicable. Ten discharges having a positive polarity and ten discharges having a negative polarity are applied at each preselected point.

19.11.4.2 The appliance is subjected to radiated fields in accordance with IEC 61000-4-3, test level 3 being applicable.

NOTE The dwell time for each frequency is to be sufficient to observe a possible malfunction of the **protective electronic circuit**.

19.11.4.3 The appliance is subjected to fast transient bursts in accordance with IEC 61000-4-4. Test level 3 is applicable for signal and control lines. Test level 4 is applicable for the power supply lines. The bursts are applied for 2 min with a positive polarity and for 2 min with a negative polarity.

19.11.4.4 The power supply terminals of the appliance are subjected to voltage surges in accordance with IEC 61000-4-5, five positive impulses and five negative impulses being applied at the selected points. Test level 3 is applicable for the line-to-line coupling mode, a generator having a source impedance of 2 Ω being used. Test level 4 is applicable for the line-to-earth coupling mode, a generator having a source impedance of 12 Ω being used.

Earthed heating elements in **class I appliances** are disconnected during this test.

NOTE If a feedback system depends on inputs related to a disconnected heating element, an artificial network may be needed.

For appliances having surge arresters incorporating spark gaps, the test is repeated at a level that is 95 % of the flashover voltage.

19.11.4.5 The appliance is subjected to injected currents in accordance with IEC 61000-4-6, test level 3 being applicable. During the test, all frequencies between 0,15 MHz to 80 MHz are covered.

NOTE The dwell time for each frequency is to be sufficient to observe a possible malfunction of the **protective electronic circuit**.

19.11.4.6 *The appliance is subjected to voltage dips and interruptions in accordance with IEC 61000-4-11. The durations specified in Table 1 of IEC 61000-4-11 are applied to each test level, the dips and interruptions being applied at zero crossing of the supply voltage.*

19.11.4.7 *The appliance is subjected to mains signals in accordance with IEC 61000-4-13, test level class 2 being applicable.*

19.13 *Add the following:*

*The appliance shall not undergo a **dangerous malfunction**, and there shall be no failure of **protective electronic circuits** if the appliance is still operable.*

*Appliances tested with an electronic switch in the **off position**, or in the stand-by mode, shall not become operational.*

20 Stability and mechanical hazards

20.2 *In the first paragraph of the test specification, replace “clause 21” by “21.1”.*

21 Mechanical strength

Number the existing text of Clause 21 as 21.1.

Replace the first and second paragraphs of the test specification by the following:

Compliance is checked by applying blows to the appliance in accordance with test Ehb of IEC 60068-2-75, the spring hammer test.

The appliance is rigidly supported and three blows, having an impact energy of 0,5 J, are applied to every point of the enclosure that is likely to be weak.

NOTE 1 *Replace the existing text of the note by “Void”.*

Add the following subclause:

21.2 Accessible parts of solid insulation shall have sufficient strength to prevent penetration by sharp implements.

*Compliance is checked by subjecting the insulation to the following test, unless the thickness of **supplementary insulation** is at least 1 mm and that of **reinforced insulation** is at least 2 mm.*

The insulation is raised to the temperature measured during the test of Clause 11. The surface of the insulation is then 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 held at an angle of 80° – 85° to the horizontal and 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 insulation at a speed of approximately 20 mm/s. Two parallel scratches are made. They are spaced sufficiently apart so that they are not affected by each other, their length covering approximately 25 % of the length of the insulation. Two similar scratches are made at 90° to the first pair without crossing them.

The test fingernail of Figure 7 is then applied to the scratched surface with a force of approximately 10 N. No further damage, such as separation of the material, shall occur. The insulation shall then withstand the electric strength test of 16.3.

The hardened steel pin is then applied perpendicularly with a force of $30\text{ N} \pm 0,5\text{ N}$ to an unscratched part of the surface. The insulation shall then withstand the electric strength test of 16.3 with the pin still applied and used as one of the electrodes.

22 Construction

22.5 Replace the test specification by the following:

Compliance is checked by the following test.

*The appliance is supplied at **rated voltage**. Any switch is then placed in the **off position** and the appliance is disconnected from the supply mains at the instant of voltage peak. One second after disconnection, the voltage between the pins of the plug is measured with an instrument that does not appreciably affect the value to be measured.*

The voltage shall not exceed 34 V.

22.10 Replace the existing text by the following new text:

It shall not be possible to reset voltage-maintained **non-self-resetting thermal cut-outs** by the operation of an automatic switching device incorporated within the appliance.

NOTE 1 Voltage-maintained controls will automatically reset if they become de-energized.

Non-self-resetting thermal motor protectors shall have a trip-free action unless they are voltage maintained.

NOTE 2 Trip-free is an automatic action that is independent of manipulation or position of the actuating member.

Reset buttons of non-self-resetting controls shall be located or protected so that their accidental resetting is unlikely to occur if this could result in a hazard.

NOTE 3 For example, this requirement precludes the location of reset buttons on the back of an appliance, which could result in them being reset by pushing the appliance against a wall.

Compliance is checked by inspection.

22.26 Replace “Class II appliances” by “Appliances”.

Add the following new subclauses:

22.46 Software used in **protective electronic circuits** shall be **software class B** or **software class C**.

NOTE 1 Failure of **software class B** in the presence of another fault in the appliance, or failure of **software class C** alone, could result in **dangerous malfunction**, electric shock, fire, mechanical or other hazards. Software class A denotes software used for functional purposes.

Compliance is checked by evaluating the software in accordance with Annex R.

NOTE 2 If the software program is modified, the evaluation and relevant tests are repeated if the modification can influence the results of the test involving **protective electronic circuits**.

22.47 Appliances intended to be connected to the water mains shall withstand the water pressure expected in normal use.

Compliance is checked by connecting the appliance to a water supply having a static pressure equal to twice the maximum inlet water pressure or 1,2 MPa, whichever is higher, for a period of 5 min.

There shall be no leakage from any part, including any inlet water hose.

22.48 Appliances intended to be connected to the water mains shall be constructed to prevent backsiphonage of non-potable water into the water mains.

Compliance is checked by the relevant tests of IEC 61770.

23 Internal wiring

Add the following new subclause:

23.10 The insulation and sheath of internal wiring, incorporated in external hoses for the connection of an appliance to the water mains, shall be at least equivalent to that of 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 evaluated.

24 Components

24.1 *Add the following new paragraph to Note 1.*

Motors are not required to comply with IEC 60034-1.

24.1.3 *Number the existing note as Note 1.*

Add the following:

If the switch operates a relay or contactor, the complete switching system is subjected to the test.

NOTE 2 Motor starting relays complying with IEC 60730-2-10 are not retested.

24.1.4 *Replace the fourth dashed item by the following:*

- | | |
|---|-------|
| – voltage-maintained non-self-resetting thermal cut-outs | 1 000 |
| – other non-self-resetting thermal cut-outs | 30 |

Add, after Note 2, the following new note and additional paragraphs:

NOTE 3 The ambient temperature during the test of Clause 17 of IEC 60730-1 is that occurring during the test of Clause 11 in the appliance, as specified in footnote b of Table 3.

Thermal motor protectors are tested in combination with their motor under the conditions specified in Annex D.

*For water valves containing **live parts** and that are incorporated in external hoses for connection of an appliance to the water mains, the degree of protection provided by enclosures against harmful ingress of water declared for subclause 6.5.2 of IEC 60730-2-8 shall be IPX7.*

24.1.5 *Add the following new paragraph:*

The relevant standard for interconnection couplers is IEC 60320-2-2.

Add the following new subclause:

24.7 Hose-sets for the connection of appliances to the water mains shall comply with IEC 61770. They shall be supplied with the appliance.

Compliance is checked by inspection.

25 Supply connections and external flexible cords

25.4 *Replace “diameter” by “dimension” in the first paragraph.*

Table 10 – Diameter of cables and conduits

Replace the title of Table 10 by “Dimensions of cables and conduits”.

In the title of the “Maximum overall diameter” column, replace “diameter” by “dimension”.

In table footnote b, replace “diameters” by “dimensions”.

25.7 *Add the following new item after the second dashed item of the first paragraph:*

- ordinary polychloroprene sheathed flexible cord (code designation 60245 IEC 57);

Table 11 – Minimum cross-sectional area of conductors

Replace the fourth and fifth lines of Table 11 by the following:

Rated current of appliance A	Nominal cross-sectional area mm ²
> 6 and ≤10	1,0 (0,75) ^b
> 10 and ≤16	1,5 (1,0) ^b

Add the following footnote to the table:

b Cords having the cross-sectional areas indicated in the parentheses may be used for portable appliances if their length does not exceed 2 m.

26 Terminals for external conductors

26.1 *Add the following new sentence to the first paragraph:*

However, earthing terminals may be accessible if a **tool** is required to make the connections and means are provided to clamp the wire independently from its connection.

27 Provision for earthing

27.1 *In Note 2, replace "clause 21" by "21.1".*

27.3 *Add the following new paragraph before the existing text :*

If a **detachable part** having an earth connection is plugged into another part of the appliance, the earth connection shall be made before the current-carrying connections are established. The current-carrying connections shall be separated before the earth connection when removing the part.

29 Clearances, creepage distances and solid insulation

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

*If coatings are used on printed circuit boards to protect the microenvironment (Type A coating) or to provide **basic insulation** (Type B coating), Annex J applies. The microenvironment is pollution degree 1 under Type A coating. There are no **creepage distance** or **clearance requirements** under Type B coating.*

29.1 *Replace the first paragraph by the following:*

Clearances shall not be less than the values specified in Table 16, taking into account the **rated impulse voltage** for the overvoltage categories of Table 15, unless, for **basic insulation** and **functional insulation**, they comply with the impulse voltage test of Clause 14. However, if the construction is such that the distances could be affected by wear, by distortion, by movement of the parts or during assembly, the **clearances** for **rated impulse voltages** of 1 500 V and above are increased by 0,5 mm and the impulse voltage test is not applicable.

The impulse voltage test is not applicable when the microenvironment is pollution degree 3 or for **basic insulation** of **class 0 appliances** and **class 0I appliances**.

Delete the paragraph after Table 15.

Table 16

Replace the existing Table 16 by the following new table:

Table 16 – Minimum clearances

Rated impulse voltage V	Minimum clearance ^a mm
330	0,5 ^{b, c}
500	0,5 ^{b, c}
800	0,5 ^{b, c}
1 500	0,5 ^c
2 500	1,5
4 000	3,0
6 000	5,5
8 000	8,0
10 000	11,0
^a The distances specified apply only to clearances in air. ^b The smaller clearances specified in IEC 60664-1 have not been adopted for practical reasons, such as mass-production tolerances. ^c This value is increased to 0,8 mm for pollution degree 3.	

29.1.1 *Replace the third paragraph of the requirement by:*

Lacquered conductors of windings are considered to be bare conductors.

29.1.4 *In the first paragraph of the requirement, replace the third sentence by:*

Lacquered conductors of windings are considered to be bare conductors. However, **clearances** at crossover points are not measured.

Delete the third paragraph of the requirement.

29.1.5 *Delete the second sentence of Note 2.*

29.3 *Replace the existing text by the following:*

Supplementary insulation and **reinforced insulation** shall have adequate thickness, or have a sufficient number of layers, to withstand the electrical stresses that can be expected during the use of the appliance.

Compliance is checked by

- *measurement, in accordance with 29.3.1, or by*
- *an electric strength test in accordance with 29.3.2, if the insulation consists of more than one separate layer, other than natural mica or similar flakey material, or by*
- *an assessment of the thermal quality of the material combined with an electric strength test, in accordance with 29.3.3.*

29.3.1 *The thickness of the insulation shall be at least*

- 1 mm for **supplementary insulation**;
- 2 mm for **reinforced insulation**.

29.3.2 *Each layer of material shall withstand the electric strength test of 16.3 for **supplementary insulation**. **Supplementary insulation** shall consist of at least 2 layers of material and **reinforced insulation** of at least 3 layers.*

29.3.3 *The insulation is subjected to the dry heat test Bb of IEC 60068-2-2 for 48 h at a temperature of 50 K in excess of the maximum temperature rise measured during the test of Clause 19. At the end of the period, the insulation is subjected to the electric strength test of 16.3 at the conditioning temperature and also after it has cooled down to room temperature.*

If the temperature rise of the insulation measured during the tests of Clause 19 does not exceed the value specified in Table 3, the test of IEC 60068-2-2 is not carried out.

30 Resistance to heat and fire

30.2.1 *In the last paragraph, replace “category FH3” by “category HBF”.*

Figures

Figure 5 – Circuit diagram for electric strength test at operating temperature

Delete this figure and replace the title by the word “Void”.

Annexes

Annex D – Alternative requirements for protected motors

Replace this annex by the following:

Annex D (normative)

Thermal motor protectors

This annex is applicable to appliances having motors that incorporate thermal motor protectors.

The appliance is supplied at **rated voltage** with the rotor of the motor locked.

The duration of the test is as follows:

- *motors having self-resetting thermal motor protectors are operated for 300 cycles or for 72 h, whichever occurs first, unless they are likely to be permanently subjected to the supply voltage in which case the duration is 432 h;*
- *motors having non-self-resetting thermal motor protectors are operated for 30 cycles, the thermal motor protector being reset as soon as possible after each operation, but in not less than 30 s;*

During the test, temperatures shall not exceed the values specified in 19.7 and the appliance shall comply with 19.13.

NOTE This test may be carried out on a separate appliance.

Annex H (normative)

Switches

17 Endurance

Replace the fourth paragraph by the following new paragraph:

Subclauses 17.2.2 and 17.2.5.2 are not applicable. The ambient temperature during the test is that occurring in the appliance during the test of Clause 11 in IEC 60335-1, as specified in footnote b of Table 3.

Annex N
(informative)

Proof tracking test

Replace the text by the following:

The proof tracking test is carried out in accordance with IEC 60112 with the following modifications.

7 Test apparatus

7.3 Test solutions

Test solution A is used.

10 Determination of proof tracking index (PTI)

10.1 Procedure

Modification:

The proof voltage is 100 V, 175 V, 400 V or 600 V, as appropriate.

The last paragraph of Clause 3 applies.

The test is carried out on five specimens.

In case of doubt, a material is considered to have a PTI of the specified value if it withstands the test at a voltage equal to the proof voltage reduced by 25 V, the number of drops being increased to 100.

10.2 Report

Addition:

The report shall state if the PTI value was based on a test using 100 drops with a test voltage of (PTI-25) V.

Annex O
(informative)

Selection and sequence of the tests of Clause 30

Figure O.2 – Tests for resistance to fire

Replace in the diagram “FH3” by “HBF”.

Add the following annexes:

Annex P (informative)

Guidance for the application of this standard to appliances used in warm damp equable climates

The following modifications to this standard are applicable for **class 0 appliances** and **class 0I appliances** having a **rated voltage** exceeding 150 V, that are intended to be used in countries having a warm damp equable climate and that are marked WDaE.

NOTE Warm damp equable climates are characterized by high humidity and high ambient temperatures with little variation, as specified in IEC 60721-2-1.

They may also be applied to **class I appliances** having a **rated voltage** exceeding 150 V that are intended to be used in countries having a warm damp equable climate and that are marked WDaE, if they are liable to be connected to a supply mains that excludes the protective earthing conductor due to deficiencies in the fixed wiring system.

5 General conditions for the tests

5.7 *The ambient temperature for the tests of Clauses 11 and 13 is 40^{+3}_0 °C.*

7 Marking and instructions

7.1 The appliance shall be marked with the letters WDaE.

7.12 The instructions shall state that the appliance is to be supplied through a residual current device (RCD) having a rated residual operating current not exceeding 30 mA.

The instructions shall state the substance of the following:

This appliance is considered to be suitable for use in countries having a warm damp equable climate. It may also be used in other countries.

11 Heating

11.8 *The values of Table 3 are reduced by 15 K.*

13 Leakage current and electric strength at operating temperature

13.2 *The leakage current for **class I appliances** shall not exceed 0,5 mA.*

15 Moisture resistance

15.3 *The value of t is 37 °C.*

16 Leakage current and electric strength

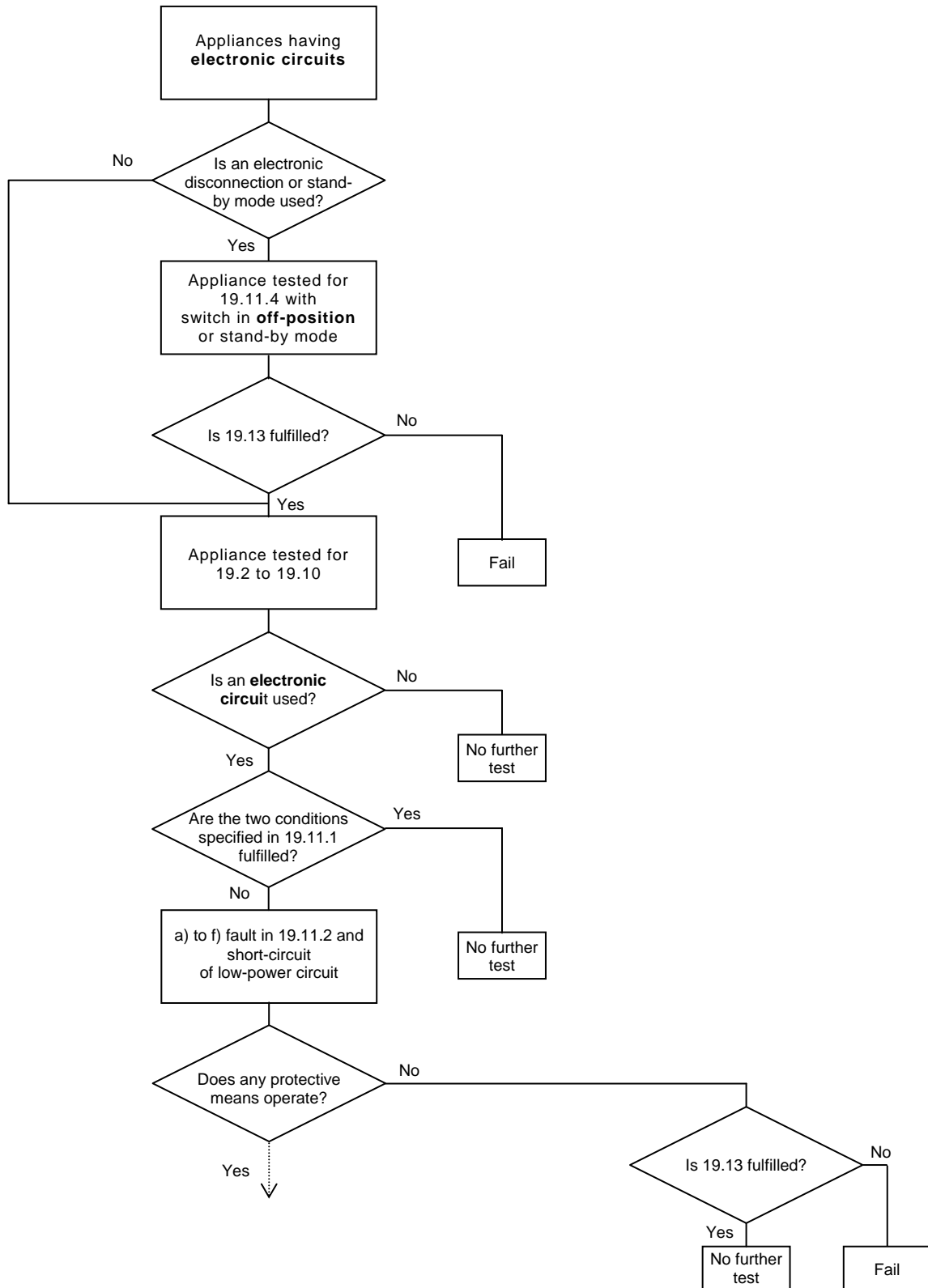
16.2 *The leakage current for **class I appliances** shall not exceed 0,5 mA.*

19 Abnormal operation

19.13 *The leakage current test of 16.2 is applied in addition to the electric strength test of 16.3.*

Annex Q (informative)

Sequence of tests for the evaluation of electronic circuits



Continued on next page

Annex R (normative)

Software evaluation

Software shall be evaluated in accordance with the following clauses of Annex H of IEC 60730-1, as modified below.

H.2 Definitions

Only definitions H.2.16 to H.2.20 are applicable.

H.7 Information

Only footnotes 12) to 18) of Table 7.2 are applicable.

In footnote 15), replace “the requirements of 17, 25, 26 and 27” by “19.13 of IEC 60335-1” and replace “H.27” by “19.11.2 of IEC 60335-1”.

H.11.12 Controls using software

All of the subclauses of H.11.12 as modified below are applicable, except subclauses H.11.12.6 and H.11.12.6.1 which are not applicable.

In the second paragraph, replace “required in items 66 to 72 inclusive” by “referred to in footnotes 12) to 18) inclusive”.

H.11.12.7 *Delete “and identified in table 7.2, requirement 68”.*

H.11.12.7.1 *Replace the text by the following:*

For appliances using **software class C** having a single channel with self-test and monitoring structure, the manufacturer shall provide the measures necessary to address the fault/errors in safety related segments and data indicated in Table H.11.12.7-1.

H.11.12.8 *Replace the text by the following:*

Software fault/error detection shall occur before compliance with 19.13 of IEC 60335-1 is impaired.

H.11.12.8.1 *Replace “result in the response declared in table 7.2, requirement 72” by “occur before compliance with 19.13 of IEC 60335-1 is impaired”.*

H.11.12.13 *Replace the text by the following:*

The software and safety related hardware under its control shall initialize and terminate before compliance with 19.13 of IEC 60335-1 is impaired.

Bibliography

Add the following:

IEC 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60065, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60721-2-1, *Classification of environmental conditions – Part 2: Environmental conditions appearing in nature – Temperature and humidity*

IEC 60730-2-10, *Automatic electrical controls for household and similar use – Part 2: Particular requirements for electrically operated motor starting relays*

IEC 60998-2-1, *Connecting devices for low voltage circuits for household and similar purposes – Part 2-1: Particular requirements for connecting devices as separate entities with screw-type clamping units*

IEC 60998-2-2, *Connecting devices for low voltage circuits for household and similar purposes – Part 2-2: Particular requirements for connecting devices as separate entities with screwless-type clamping units*

IEC 61643-1, *Surge protective devices connected to low-voltage power distribution systems – Part 1: Performance requirements and testing methods.*

ISO 1463, *Metallic and oxide coatings – Measurement of coating thickness – Microscopical method*

ISO 2178, *Non-magnetic coatings on magnetic substrates – Measurement of coating thickness – Magnetic method*

IEC Guide 104, *The preparation of safety publications and the use of basic safety publications and group safety publications*

IEC Guide 110, *Home control systems – Guidelines relating to safety*

ISO/IEC Guide 14, *Product information for consumers*

ISO/IEC Guide 37, *Instructions for use of products of consumer interest*

ISO/IEC Guide 50, *Safety aspects – Guidelines for child safety*

ISO/IEC Guide 51, *Safety aspects – Guidelines for their inclusion in standards*

ISO/IEC Guide 71, *Guidelines for standards developers to address the needs of older persons and persons with disabilities*

Index of defined words

accessible part.....	3.6.3	PTC heating element.....	3.8.4
all-pole disconnection.....	3.8.1	portable appliance	3.5.1
basic insulation.....	3.3.1	protective device.....	3.7.6
built-in appliance.....	3.5.5	protective electronic circuit.....	3.9.3
class 0 appliance	3.3.7	protective extra-low voltage circuit	3.4.4
class 0I appliance	3.3.8	protective impedance	3.3.6
class I appliance	3.3.9	rated current	3.1.6
class II appliance	3.3.10	rated frequency	3.1.7
class III appliance	3.3.12	rated frequency range	3.1.8
class II construction	3.3.11	rated impulse voltage	3.1.10
class III construction	3.3.13	rated power input.....	3.1.4
clearance	3.3.14	rated power input range	3.1.5
combined appliance	3.5.8	rated voltage	3.1.1
creepage distance.....	3.3.15	rated voltage range	3.1.2
dangerous malfunction	3.1.11	reinforced insulation.....	3.3.4
detachable cord	3.2.1	safety extra-low voltage	3.4.2
detachable part.....	3.6.2	safety isolating transformer	3.4.3
double insulation.....	3.3.3	self-resetting thermal cut-out	3.7.4
electronic circuit.....	3.9.2	software class B	3.9.4
electronic component	3.9.1	software class C	3.9.5
extra-low voltage.....	3.4.1	stationary appliance	3.5.3
fixed appliance	3.5.4	supplementary insulation.....	3.3.2
functional insulation	3.3.5	supply cord.....	3.2.3
hand-held appliance.....	3.5.2	supply leads	3.2.7
heating appliance.....	3.5.6	temperature limiter.....	3.7.2
interconnection cord.....	3.2.2	thermal cut-out	3.7.3
live part	3.6.4	thermal link.....	3.7.7
motor-operated appliance.....	3.5.7	thermostat	3.7.1
non-detachable part	3.6.1	tool	3.6.5
non-self-resetting thermal cut-out	3.7.5	type X attachment.....	3.2.4
normal operation.....	3.1.9	type Y attachment.....	3.2.5
off position	3.8.2	type Z attachment	3.2.6
		user maintenance	3.8.5
		visibly glowing heating element	3.8.3
		working voltage	3.1.3