16 Screws and connections

16.1 Fixings

Fixings, the failure of which may impair compliance with this standard and electrical connections shall withstand the mechanical stresses occurring during play.

Screws used for these purposes shall not be of metal that is soft or liable to creep, such as zinc or aluminium. If they are of insulating material they shall have a nominal diameter of at least 3 mm and they shall not be used for any electrical connection.

Screws or rivets used for electrical connections shall affix to metal.

Compliance is checked by inspection and by the following test.

Screws and nuts are tested if they are used for electrical connections or are likely to be tightened by the user.

The screws or nuts are tightened and loosened without jerking

– *10 times, for screws in engagement with a thread of insulating material;*
– *5 times, for nuts and other screws.*

Screws in engagement with a thread of insulating material are completely removed and reinserted each time.

The test is carried out using a suitable screwdriver, spanner or key and by applying a torque as shown in Table 3.

Column I is applicable for metal screws without heads if the screw does not protrude from the hole when tightened.

Column II is applicable for other metal screws and for nuts and screws of insulating material.

Table 3 – Torque for testing screws and nuts

Nominal diameter of screw (outer thread diameter) mm	**Torque** Nm	
	I	**II**
< 2,8	0,2	0,4
> 2,8 and ≤ 3,0	0,25	0,5
> 3,0 and ≤ 3,2	0,3	0,6
> 3,2 and ≤ 3,6	0,4	0,8
> 3,6 and ≤ 4,1	0,7	1,2
> 4,1 and ≤ 4,7	0,8	1,8
> 4,7 and ≤ 5,3	0,8	2,0
> 5,3	—	2,5

No damage impairing compliance with this standard shall occur.

The shape of the blade of the test screwdriver shall fit the head of the screw.

16.2 Connections

Electrical connections carrying a current exceeding 0,5 A shall be constructed so that contact pressure is not transmitted through insulating material that is liable to shrink or to distort unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or distortion of the insulating material.

Compliance is checked by inspection.

NOTE Ceramic material is not considered liable to shrink or to distort.

17 Clearances and creepage distances

Clearances and **creepage distances** of **functional insulation** shall not be less than 0,5 mm except when the **electric toy** meets the requirements of Clause 9 with this distance short-circuited.

However, for **functional insulation** on printed circuit boards, except at their edges, this distance may be reduced to 0,2 mm provided that the degree of pollution in the microenvironment in which the insulation is located is unlikely to exceed pollution degree 2 during normal use of the **electric toy**.

Internal parts of **electric toys** that comply with 13.8 and have a voltage exceeding 24 V shall have **clearance** and **creepage distances** for **functional insulation** equal to or greater than the values in Table 18 of IEC 60335-1:2010 for pollution degree 2 except when the **electric toy** meets Clause 9 with this distance short-circuited.

For guidance, the pollution degrees as defined in IEC 60335-1 are as follows:

Degrees of pollution in the microenvironment:

For the purpose of evaluating **creepage distances**, the following four degrees of pollution in the microenvironment are established

– pollution degree 1: no pollution or only dry, non-conductive pollution occurs. The pollution has no influence;
– pollution degree 2: only non-conductive pollution occurs, except that occasionally a temporary conductivity caused by condensation is to be expected;
– pollution degree 3: conductive pollution occurs or dry non-conductive pollution occurs that becomes conductive due to condensation that is to be expected;
– pollution degree 4: the pollution generates persistent conductivity caused by conductive dust or by rain or snow.

NOTE Pollution degree 4 is not applicable to **electric toys**.

For **electric toys** that can be connected to class I equipment both the **creepage distance** and **clearance** between **accessible parts** and conductive parts shall be at least 1,5 mm (see 13.9 b)).

Compliance is checked by measurement.

18 Resistance to heat and fire

18.1 Resistance to heat

External parts of non-metallic material enclosing electric parts, and parts of insulating material supporting electric parts, shall be sufficiently resistant to heat if the **electric toy** has a **working voltage** exceeding 12 V and a current exceeding 3 A.

NOTE 1 The voltage and current are measured during the test of 9.3.

NOTE 2 **Electric toys** having a lower **working voltage** or current are not considered to generate sufficient heat to create a hazard.

Compliance is checked by subjecting the relevant part to the ball pressure test of IEC 60695-10-2.

The test is carried out at a temperature of 40 °C ± 2 °C plus the maximum temperature rise determined during the tests of Clause 9 but it shall be at least 75 °C ± 2 °C.

NOTE 3 The test is only carried out on parts that could deteriorate to the extent that compliance with this standard is impaired.

NOTE 4 For coil formers, only those parts that support or retain terminals in position are subjected to the test.

NOTE 5 The test is not carried out on parts of ceramic material.

18.2 Resistance to fire

18.2.1 General

Parts of non-metallic material enclosing electric parts, and parts of insulating material supporting electric parts, shall be resistant to ignition and spread of fire.

This requirement does not apply to decorative trims, knobs and other parts unlikely to be ignited or to propagate flames that originate from inside the **electric toy**.

Compliance is checked by the tests of 18.2.2 and 18.2.3.

*The tests are carried out on parts of non-metallic material that have been removed from the **electric toy**. When the glow-wire test is carried out, they are placed in the same orientation as they would be in normal use.*

These tests are not carried out on the insulation of cords and wires.

18.2.2 Non-metallic parts

Parts of non-metallic material are subjected to the glow-wire test of IEC 60695-2-11, which is carried out at 550 °C.

The glow-wire test is not carried out on parts of material classified at least HB40 according to IEC 60695-11-10, provided that the test sample was no thicker than the relevant part.

Parts for which the glow-wire test cannot be carried out, such as those made of soft or foamy material, shall meet the requirements specified in ISO 9772 for category HBF material, the test sample being no thicker than the relevant part.

18.2.3 Insulating material

*Parts of insulating material supporting connections carrying a current exceeding 3A and having a **working voltage** exceeding 12 V, and parts of insulating material within a distance*

of 3 mm of such connections, are subjected to the glow-wire test of IEC 60695-2-11 at a temperature of 650 °C. However, the glow-wire test is not carried out on parts of material classified as having a glow-wire ignition temperature according to IEC 60695-2-13 of at least 675 °C, provided that the test sample was no thicker than the relevant part.

NOTE 1 Contacts in components such as switch contacts are considered to be connections.

NOTE 2 The tip of the glow-wire is applied to the part in the vicinity of the connection.

Parts that withstand the glow-wire test of IEC 60695-2-11, but which, during the test, produce a flame that persists for longer than 2 s, are further tested as follows. Parts above the connection within the envelope of a vertical cylinder having a diameter of 20 mm and a height of 50 mm are subjected to the needle flame test of Annex B. However, parts shielded by a barrier that meets the needle-flame test of Annex B are not tested.

The needle-flame test is not carried out on parts of 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.

19 Radiation and similar hazards

19.1 General

Electric toys shall not emit harmful optical radiation or harmful electromagnetic radiation due to their operation in normal use.

*Compliance is checked by the requirements of the following clauses but where no applicable requirements are present the **electric toy** is deemed to comply without measurement.*

NOTE Toxicological hazards are addressed by the ISO 8124 series of standards.

19.2 Optical radiation

***Electric toys** incorporating **lasers** and or light emitting diodes (**LED**) or UV emitting lamps shall comply with Annex E.*

19.3 Other electromagnetic radiation

*Measurements methods for **electric toys** with an integrated field source that may produce harmful electromagnetic radiation are given in Annex I.*

NOTE Attention is drawn to the fact that in many countries, requirements limiting electromagnetic fields are specified by the national authorities.

Annex A
(normative)

Experimental sets

The following modifications to this standard are applicable to all components of **experimental sets** supplied together or separately.

5 General conditions for tests

5.2 Preconditioning

Not applicable.

5.3 Assembly

Addition:

The tests are carried out with the experiments described in the instructions that result in the most unfavourable condition.

7 Marking and instructions

Addition:

7.3.4 Experimental sets

The following warning shall be indicated on the packaging:

> WARNING: This toy is only intended for use by children over the age of X years (where X must be a minimum of 8)

The substance of the following shall be indicated on the packaging:

– an indication of the reasons for the age restriction;
– that instructions for parents or care givers are included and shall be followed.

The instructions for parents or care givers shall state the minimum age of the child for whom the set is intended.

Detailed information shall be given in the instructions on how to set up and perform each experiment, indicating which phenomena are to be investigated. The instructions shall point out possible hazards and give technical information concerning the **electronic components** and electrical components, their behaviour and how to handle them properly. All hazards that can be expected during an experiment, such as those resulting from the short-circuiting of batteries or the wrong connection of capacitors, shall be described in detail.

The instructions shall be written so that they are understandable by the age group for which the experimental set is intended.

Instructions for children and for parents may be given separately. If the instructions are given in one leaflet, the section addressed to parents shall be given first.

The instructions shall include a warning against manipulation of protective devices such as current-limiting devices. They shall describe the consequential dangers, such as overheating of cords, eruption of batteries and excessive heating.

8 Power input

Not applicable.

9 Heating and abnormal operation

9.4 Normal operation with insulation short-circuited

Not applicable.

9.6 Electric toys with accessible moving parts locked

Not applicable.

9.10 Compliance criteria

Addition:

The temperature rise of surfaces, other than those of handles, knobs, buttons and similar parts can exceed the limits if an appropriate warning is given in the instructions.

10 Electric strength

10.1 Electric strength at operating temperature

Not applicable.

11 Electric toys used in water, electric toys used with liquid and electric toys cleaned with liquid

Not applicable.

12 Mechanical strength

Not applicable.

13 Construction

13.1 Nominal supply voltage

Addition:

The current shall not exceed 5 A and the power input shall not exceed 50 VA. However these values may be exceeded during a period not exceeding 10 s.

Compliance is checked by measurement during the tests.

14 Protection of cords and wires

Not applicable.

Annex B
(normative)

Needle-flame test

The needle-flame test is carried out in accordance with IEC 60695-11-5 with the following modifications.

7 Severities

Replacement:

The duration of application of the test flame is 30 s ± 1 s.

9 Test procedure

9.1 Position of test specimen

Modification:

The specimen is arranged so that the flame can be applied to a vertical or horizontal edge as shown in the examples of Figure 1.

9.2 Application of needle-flame

Modification:

The first paragraph does not apply.

Addition:

If possible, the flame is applied at least 10 mm from a corner.

9.3 Number of test specimens

Replacement:

The test is carried out on one specimen. If the specimen does not withstand the test, the test may be repeated on two additional specimens, both of which shall then withstand the test.

11 Evaluation of test results

Addition:

The duration of burning (t_b) shall not exceed 30 s. However, for printed circuit boards, the duration of burning shall not exceed 15 s.

Annex C
(normative)

Automatic controls and switches

C.1 Automatic controls

Automatic controls that are tested with the **electric toy** shall comply with this standard and with 11.3.5 to 11.3.8 and Clause 17 of IEC 60730-1:2013 as type 1 controls.

The tests according to IEC 60730-1 are carried out under the conditions occurring in the **electric toy**.

For the tests of Clause 17 of IEC 60730-1:2013, the number of cycles of operation are

– thermostats 3 000;
– **self-resetting thermal cut-outs** 300;
– **non-self-resetting thermal cut-outs** 10.

NOTE The tests of Clauses 12, 13 and 14 are not carried out before making the test of Clause 17 of IEC 60730-1.

Automatic controls may be tested separately from the electric toy.

C.2 Switches

Mechanical switches that are tested with the **electric toy** shall comply with this standard and with the following clauses of IEC 61058-1-1, as modified below.

Electronic switches that are tested with the **electric toy** shall comply with this standard and with the following clauses of IEC 61058-1-2, as modified below

The tests of IEC 61058-1-1 and IEC 61058-1-2 are carried out under the conditions occurring in the **electric toy**.

Before being tested, switches are operated 20 times without load.

12 Construction

Switches are not required to be marked. However, a switch that can be tested separately from the appliance shall be marked with the manufacturer's name or trade mark and the type reference.

13 Mechanism

NOTE The tests can be carried out on a separate sample.

15 Insulation resistance and dielectric strength

Subclause 15.1 is not applicable.

Subclause 15.2 is not applicable.

Subclause 15.3 is applicable for full disconnection and micro-disconnection.

NOTE This test is carried out immediately after the humidity test of 10.2 of this standard.

17 Endurance

Compliance is checked on three separate appliances or switches.

For 17.5.4, the number of cycles of actuation declared according to 7.4 is 3 000.

Subclause 17.6.2 is not applicable.

At the end of the tests, the temperature rise of the terminals shall not have increased by more than 30 K above the temperature rise measured in Clause 9 of this standard. The tests may be carried out at the same time as the tests of Clause 9, provided the tests of Clause 9 are not affected.

NOTE The temperature rise limits of Table 1 of Clause 9 of this standard apply only to **accessible parts**.

20 Clearances, creepage distances, solid insulation and coatings of rigid printed board assemblies

This clause is applicable to **clearances** across full disconnection and micro-disconnection. It is also applicable to **creepage distances** for **functional insulation**, across full disconnection and micro-disconnection, as stated in Table 14.

Annex D
(normative)

Electric toys with protective electronic circuits

D.1 General

If during the tests of 9.9 an **electronic circuit** prevents the hazardous conditions listed in 9.10 or **dangerous malfunction**, it shall additionally comply with the following requirements. In this case, the **electronic circuit** is considered as a **protective electronic circuit**. For **electric toys** with a **protective electronic circuit**, the following requirement is therefore applicable in addition to Clause 9.

If the **protective electronic circuit** includes only passive **electronic components** such as positive temperature co-efficient (PTC) resistors, negative temperature co-efficient (NTC) resistors or voltage dependent resistors (VDRs), the tests of Annex D are not applied.

D.2 Dangerous malfunction

D.2.1 General

The **electric toy** shall not malfunction in such a way as to cause an unintended operation that may impair safety or present a **dangerous malfunction** due to influence from electromagnetic phenomena (EMP).

*Compliance is checked by the test of D.2.2 and D.2.3. **Electric toys** using a **transformer** or a **power supply** where the **electric toy** incorporates a **protective electronic circuit** are additionally subjected to the tests of D.2.4 to D.2.8, using the supplied or the recommended **transformer** or **power supply**. The tests are carried out under the following conditions.*

*The tests are carried out with the **electric toy** supplied at **rated voltage** and the **electric toy** operated in the following modes:*

– *electronic off mode;*
– *stand-by mode;*
– *operating mode.*

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

*The tests are carried out after the **protective electronic circuit** has operated during the fault conditions of 9.9.*

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

***Electric toys** incorporating electronic controls complying with the IEC 60730 series are not exempt from the tests.*

D.2.2 Electrostatic discharge

*The **electric toy** 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.*