NOTE 2 If the pressure on the clamping members is applied by means of one or more screws engaging with separate nuts or with a thread in a part that is integral with the appliance, the cord anchorage is not considered to have one part securely fixed to the appliance. This does not apply if one of the clamping members is fixed to the appliance or the surface of the appliance is of insulating material and shaped so that it is obvious that this surface is one of the clamping members.

- screws which have to be operated when replacing the cord do not fix any other component. However, this does not apply if

• after removal of the screws, or if the component is incorrectly repositioned, the appliance becomes inoperative or is obviously incomplete;

• the parts intended to be fastened by them cannot be removed without the aid of a TOOL during the replacement of the cord;

- if labyrinths can be bypassed, the test of 25.15 is nevertheless withstood;

- for CLASS 0 APPLIANCES, CLASS 01 APPLIANCES and CLASS 1 APPLIANCES, they are of insulating material or are provided with an insulating lining, unless failure of the insulation of the cord does not make ACCESSIBLE METAL PARTS live;

- for class II APPLIANCES, they are of insulating material or, if of metal, they are insulated from accessible METAL PARTS by SUPPLEMENTARY INSULATION.

NOTE 3 Examples of acceptable and unacceptable constructions of cord anchorages are shown in Figure 9.

Compliance is checked by inspection and by the test of 25.15 under the following conditions.

The tests are carried out with the lightest permissible type of cord of the smallest cross-sectional area specified in Table 13 and then with the next heavier type cord having the largest cross-sectional area specified. However, if the appliance is fitted with a specially prepared cord, the test is carried out with this cord.

The conductors are placed in the terminals and any terminal screws tightened just sufficiently to prevent the conductors from easily changing their position. The clamping screws of the cord anchorage are tightened with two-thirds of the torque specified in 28.1.

Screws of insulating material bearing directly on the cord are fastened with two-thirds of the torque specified in column I of Table 14, the length of the slot in the screw head being taken as the nominal diameter of the screw.

After the test, the conductors shall not have moved by more than 1 mm in the terminals.

25.17 For type y attachment and type z attachment, cord anchorages shall be adequate.

Compliance is checked by the test of 25.15 with the cord supplied with the appliance.

25.18 Cord anchorages shall be arranged so that they are only accessible with the aid of a TOOL or shall be constructed so that the cord can only be fitted with the aid of a TOOL.

Compliance is checked by inspection.

25.19 For TYPE X ATTACHMENT, glands shall not be used as cord anchorages in PORTABLE APPLIANCES. Tying the cord into a knot or tying the cord with string is not allowed.

Compliance is checked by inspection.

25.20 The conductors of the supply cord for type y attachment and type z attachment shall be insulated from accessible metal parts by basic insulation for class 0 appliances, class 01 appliances and class 1 appliances, and by supplementary insulation for class 11 appliances. This insulation may be provided by the sheath of the supply cord or by other means.

Compliance is checked by inspection and by the relevant tests.

25.21 The space for the connection of SUPPLY CORDS having TYPE X ATTACHMENT, or for the connection of fixed wiring, shall be constructed

- so that it is possible to check that the supply conductors are correctly positioned and connected before fitting any cover;

- so that any cover can be fitted without risk of damage to the conductors or their insulation;

- for PORTABLE APPLIANCES, so that the uninsulated end of a conductor, should it become free from the terminal, cannot come into contact with ACCESSIBLE METAL PARTS.

Compliance is checked by inspection after fitting cables or flexible cords having the largest cross-sectional area specified in Table 13.

PORTABLE APPLIANCES are subjected to the following additional test unless they are provided with pillar terminals and the SUPPLY CORD is clamped within 30 mm of them.

NOTE The SUPPLY CORD may be clamped by a cord anchorage.

The clamping screws or nuts are loosened in turn. A force of 2 N is applied to the conductor in any direction at a position adjacent to the terminal. The uninsulated end of the conductor shall not come into contact with ACCESSIBLE METAL PARTS.

25.22 Appliance inlets shall

- be located or enclosed so that LIVE PARTS are not accessible during insertion or removal of the connector. This requirement is not applicable to appliance inlets complying with IEC 60320-1;

- be located so that the connector can be inserted without difficulty;

- be located so that, after insertion of the connector, the appliance is not supported by the connector when it is placed in any position of normal use on a flat surface;

- not be an appliance inlet for cold conditions if the temperature rise of external metal parts of the appliance exceeds 75 K during the test of Clause 11, unless the SUPPLY CORD is unlikely to touch such metal parts in normal use.

Compliance is checked by inspection.

# 25.22DV DC Modification to replace the first dashed item with the following:

- be located or enclosed so that LIVE PARTS are not accessible during insertion or removal of the connector. This requirement is not applicable to appliance inlets complying with the appliance inlet standards listed in Annex DVA.

25.23 INTERCONNECTION CORDS shall comply with the requirements for the SUPPLY CORD, except that

- the cross-sectional area of the conductors of the INTERCONNECTION CORD is determined on the basis of the maximum current carried by the conductor during the test of Clause 11 and not by the RATED CURRENT of the appliance;

- the thickness of the insulation of the conductor may be reduced if the voltage of the conductor is less than the BATED VOLTAGE.

Compliance is checked by inspection, by measurement and if necessary by tests, such as the electric strength test of 16.3.

25.24 INTERCONNECTION CORDS shall not be detachable without the aid of a TOOL if compliance with this standard is impaired when they are disconnected.

Compliance is checked by inspection and if necessary by appropriate tests.

25.25 The dimensions of pins of appliances that are inserted into socket-outlets shall be compatible with the dimensions of the relevant socket-outlet. Dimensions of the pins and engagement face are to be in accordance with the dimensions of the relevant plug listed in IEC/TR 60083.

Compliance is checked by measurement.

# 25.25DV DC Modification to replace 25.25 with 25.25DV.1 – 25.25DV.2:

25.25DV.1 The dimensions of pins of appliances that are inserted into socket-outlets shall be compatible with the dimensions of the relevant socket-outlet. Dimensions of the pins and engagement face are to be in accordance with the dimensions of the relevant plug / socket outlet standards of Annex DVA.

## 25.25DV.2 Compliance is checked by measurement.

#### 26 Terminals for external conductors

26.1 Appliances shall be provided with terminals or equally effective devices for the connection of external conductors. The terminals, other than terminals in CLASS III APPLIANCES that do not contain LIVE PARTS, shall only be accessible after the removal of a NON-DETACHABLE COVER. 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.

NOTE 1 Screw type terminals in accordance with IEC 60998-2-1, screwless terminals in accordance with IEC 60998-2-2 and clamping units in accordance with IEC 60999-1 are considered to be effective devices.

NOTE 2 The terminals of a component such as a switch may be used as terminals for external conductors as long as they comply with the requirements of this clause.

#### Compliance is checked by inspection and by manual test.

26.2 Appliances having TYPE X ATTACHMENT, except those having a specially prepared cord, and appliances for the connection of cables of fixed wiring shall be provided with terminals in which the connections are made by means of screws, nuts or similar devices, unless the connections are soldered.

The screws and nuts shall not be used to fix any other component except that they may also clamp internal conductors if these are arranged so that they are unlikely to be displaced when fitting the supply conductors.

If soldered connections are used, the conductor shall be positioned or fixed so that reliance is not placed upon the soldering alone to maintain it in position. However, soldering alone may be used if barriers are provided so that neither CLEARANCES nor CREEPAGE DISTANCES between LIVE PARTS and other metal parts can be reduced below the values specified for SUPPLEMENTARY INSULATION if the conductor becomes free at the soldered joint.

#### Compliance is checked by inspection and by measurement.

26.3 Terminals for TYPE X ATTACHMENT and those for the connection of cables of fixed wiring shall be constructed so that they clamp the conductor between metal surfaces with sufficient contact pressure but without causing damage to the conductor.

The terminals shall be fixed so that when the clamping means is tightened or loosened

- the terminal does not become loose. This does not apply if the terminals are fixed with two screws, or are fixed with one screw in a recess so that there is no appreciable movement or if they are not subject to torsion in normal use and they are locked by a self-hardening resin;

NOTE Terminals may be prevented from loosening by other suitable means. The use of sealing compound without other means of locking is not considered to be sufficient.

- internal wiring is not subjected to stress;

- neither CLEARANCES nor CREEPAGE DISTANCES are reduced below the values specified in Clause 29.

Compliance is checked by inspection and by the test of Subclause 9.6 of IEC 60999-1, the torque applied being equal to two-thirds of the torque specified.

After the test, the conductors shall show no deep or sharp indentations.

26.4 Terminals for TYPE X ATTACHMENT, except TYPE X ATTACHMENTS having a specially prepared cord, and terminals for the connection of cables of fixed wiring, shall not require special preparation of the conductor such as by soldering of the strands of the conductor, the use of cable lugs, eyelets or similar devices. They shall be constructed or placed so that the conductor cannot slip out when clamping screws or nuts are tightened.

Compliance is checked by inspection of the terminals and conductors after the test of 26.3.

NOTE Reshaping of the conductor before its introduction into the terminal or twisting a stranded conductor to consolidate the end is allowed.

26.5 Terminals for TYPE X ATTACHMENT shall be located or shielded so that if a wire of a stranded conductor escapes when the conductors are fitted, there is no risk of accidental connection to other parts that could result in a hazard.

Compliance is checked by inspection and by the following test.

A 8 mm length of insulation is removed from the end of a flexible conductor having a nominal cross-sectional area as specified in Table 11. One wire of the stranded conductor is left free and the other wires are fully inserted and clamped in the terminal. The free wire is bent, without tearing the insulation back, in every possible direction but without making sharp bends around barriers.

NOTE The test is also applied to earthing conductors.

There shall be no contact between live parts and accessible metal parts and, for class il constructions, between live parts and metal parts separated from accessible metal parts by supplementary insulation only.

## 26.5DV DR Modification to replace the third paragraph of 26.5 with the following:

A 8 mm length of insulation is removed from the end of a flexible conductor complying with 25.8DV. One wire of the stranded conductor is left free and the other wires are fully inserted and clamped in the terminal. The free wire is bent, without tearing the insulation back, in every possible direction but without making sharp bends around barriers.

26.6 Terminals for TYPE X ATTACHMENT and for the connection of cables of fixed wiring shall allow the connection of conductors having the nominal cross-sectional areas shown in Table 13. However, if a specially prepared cord is used, the terminals need only be suitable for the connection of that cord.

RATED CURRENT of appliance			Nominal cross-sectional area					
А			Flexible cords			Cables for fixed wiring		
		≤3	0,5	and	0,75	1	to	2,5
>3	and	≤6	0,75	and	1	1	to	2,5
>6	and	≤10	1	and	1,5	1	to	2,5
>0	and	≤16	1,5	and	2,5	1,5	to	4
>16	and	≤25	2,5	and	4	2,5	to	6
>25	and	≤32	4	and	6	4	to	10
>32	and	≤50	6	and	10	6	to	16
>50	and	≤63	10	and	16	10	to	25

# Table 13 – Nominal cross-sectional area of conductors

Compliance is checked by inspection, by measurement and by fitting cables or cords of the smallest and largest cross-sectional areas specified.

### 26.6DV DR Modification:

Replace the wording "shown in Table 13" in the first paragraph by "in accordance with the national electrical codes".

# Table 13DV DR *Deletion:*

### Delete Table 13.

26.7 Terminals for TYPE X ATTACHMENT, other than those in CLASS III APPLIANCES that do not contain LIVE PARTS, shall be accessible after removal of a cover or part of the enclosure.

#### Compliance is checked by inspection.

26.8 Terminals for the connection of fixed wiring, including the earthing terminal, shall be located close to each other.

#### Compliance is checked by inspection.

26.9 Terminals of the pillar type shall be constructed and located so that the end of a conductor introduced into the hole is visible, or can pass beyond the threaded hole for a distance equal to half the nominal diameter of the screw but at least 2,5 mm.

#### Compliance is checked by inspection and by measurement.

26.10 Terminals with screw clamping and screwless terminals shall not be used for the connection of the conductors of flat twin tinsel cords unless the ends of the conductors are fitted with means suitable for use with screw terminals.

Compliance is checked by inspection and by applying a pull of 5 N to the connection.

After the test, the connection shall show no damage that could impair compliance with this standard.

26.11 For appliances having TYPE Y ATTACHMENT OF TYPE Z ATTACHMENT, soldered, welded, crimped or similar connections may be used for the connection of external conductors. For CLASS II APPLIANCES, the conductor shall be positioned or fixed so that reliance is not placed upon the soldering, crimping or welding alone to maintain the conductor in position. However, these methods may be used alone if barriers are provided so that CLEARANCES and CREEPAGE DISTANCES between LIVE PARTS and other metal parts cannot be reduced below the values specified for SUPPLEMENTARY INSULATION, if the conductor becomes free at the soldered or welded joint or slips out of the crimped connection.

Compliance is checked by inspection and by measurement.

# 27 Provision for earthing

27.1 ACCESSIBLE METAL PARTS OF CLASS OF APPLIANCES and CLASS F APPLIANCES that may become live in the event of a failure of BASIC INSULATION, shall be permanently and reliably connected to an earthing terminal within the appliance or to the earthing contact of the appliance inlet.

NOTE Metal parts behind a decorative cover that does not withstand the test of 21.1 are considered to be ACCESSIBLE METAL PARTS.

Earthing terminals and earthing contacts shall not be connected to the neutral terminal.

CLASS 0 APPLIANCES, CLASS II APPLIANCES and CLASS III APPLIANCES shall have no provision for protective earthing. CLASS II APPLIANCES and CLASS III APPLIANCES may incorporate an earth for functional purposes.

SAFETY EXTRA-LOW VOLTAGE circuits shall not be earthed unless they are protective extra-low voltage circuits.

### Compliance is checked by inspection.

27.2 The clamping means of earthing terminals shall be adequately secured against accidental loosening.

NOTE 1 In general, the constructions commonly used for current-carrying terminals, other than some terminals of the pillar type, provide sufficient resiliency to comply with this requirement. For other constructions, special provisions, such as the use of an adequately resilient part that is not likely to be removed inadvertently, may be necessary.

Terminals for the connection of external equipotential bonding conductors shall allow the connection of conductors having nominal cross-sectional areas of 2,5 mm<sup>2</sup> to 6 mm<sup>2</sup> and shall not be used to provide earthing continuity between different parts of the appliance. It shall not be possible to loosen the conductors without the aid of a TOOL.

NOTE 2 The earthing conductor in a SUPPLY CORD is not considered to be an equipotential bonding conductor.

These requirements are not applicable to CLASS II APPLIANCES and CLASS III APPLIANCES that incorporate an earth for functional purposes.

Compliance is checked by inspection and by manual test.

# 27.2DV D1 *Modification to add 27.2DV.1 – 27.2DV.2:*

27.2DV.1 If a fastener is intended to be used to secure a bonding conductor, it shall only be used for that purpose unless it is clear that it is unlikely to be removed or replaced during servicing.

# 27.2DV.2 A single binding post may be used to secure both bonding conductors and the earthing conductor, providing that the nut securing the earthing conductor is not relied on to secure the bonding conductors.

27.3 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.

For appliances with SUPPLY CORDS, the arrangement of the terminals, or the length of the conductors between the cord anchorage and the terminals, shall be such that the current-carrying conductors become taut before the earthing conductor if the cord slips out of the cord anchorage.

These requirements are not applicable to CLASS II APPLIANCES and CLASS III APPLIANCES that incorporate an earth for functional purposes.

#### Compliance is checked by inspection and by manual test.

27.4 All parts of the earthing terminal intended for the connection of external conductors shall be such that there is no risk of corrosion resulting from contact between these parts and the copper of the earthing conductor or any other metal in contact with these parts.

Parts providing earthing continuity, other than parts of a metal frame or enclosure, shall be of metal having adequate resistance to corrosion, unless they are parts of copper or copper alloys containing at least 58 % copper for parts that are worked cold, and at least 50 % copper for other parts, or unless they are parts of stainless steel containing at least 13 % chrome. If these parts are of steel, they shall be provided with an electroplated coating having a thickness of at least 5  $\mu$ m at essential areas such as those liable to transmit a fault current.

NOTE 1 In evaluating such essential areas, the thickness of the coating in relation to the shape of the part has to be taken into account. In case of doubt, the thickness of the coating is measured as described in ISO 2178 or in ISO 1463.

Parts of coated or uncoated steel that are only intended to provide or to transmit contact pressure shall be adequately protected against rusting.

NOTE 2 Examples of parts providing earthing continuity and parts that are only intended to provide or to transmit contact pressure are shown in Figure 10.

NOTE 3 Parts subjected to a treatment such as chromate conversion coating are in general not considered to be adequately protected against corrosion, but they may be used to provide or to transmit contact pressure.

If the body of the earthing terminal is a part of a frame or enclosure of aluminium or aluminium alloy, precautions shall be taken to avoid the risk of corrosion resulting from contact between copper and aluminium or its alloys.

These requirements are not applicable to CLASS II APPLIANCES and CLASS III APPLIANCES that incorporate an earth for functional purposes.

Compliance is checked by inspection and by measurement.

27.5 The connection between the earthing terminal or earthing contact and earthed metal parts shall have low resistance.

If the CLEARANCES of BASIC INSULATION in a PROTECTIVE EXTRA-LOW VOLTAGE CIRCUIT are based on the RATED VOLTAGE of the appliance, this requirement does not apply to connections providing earthing continuity in the PROTECTIVE EXTRA-LOW VOLTAGE CIRCUIT.

These requirements are not applicable to CLASS II APPLIANCES and CLASS III APPLIANCES that incorporate an earth for functional purposes.

Compliance is checked by the following test.

A current derived from a source having a no-load voltage not exceeding 12 V (a.c. or d.c.) and equal to 1,5 times RATED CURRENT of the appliance or 25 A, whichever is higher, is passed between the earthing terminal or earthing contact and each of the ACCESSIBLE METAL PARTS in turn. The test is carried out until steady conditions have been established.

The voltage drop between the earthing terminal of the appliance or the earthing contact of the appliance inlet and the ACCESSIBLE METAL PART is measured. The resistance calculated from the current and this voltage drop shall not exceed 0,1  $\Omega$ . The resistance of the supply cord is not included in the resistance calculation.

NOTE 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.

27.5DV.1 D1 Modification to replace the 5th and 6th paragraph with 27.5DV.1.1 – 27.5DV.1.4 and Table 27DV.1:

27.5DV.1.1 A current derived from a source having a no-load voltage not exceeding 12 V (a.c. or d.c.) and equal at least 2,0 times the rating of the earthed branch circuit, shall be passed between the earthing terminal or earthing contact and each of the ACCESSIBLE METAL PARTS in turn.

NOTE For the purpose of this requirement, the minimum rating of the branch circuit is 20 A.

27.5DV.1.2 The voltage drop between the earthing terminal of the appliance or the earthing contact of the appliance inlet and the ACCESSIBLE METAL PART shall be measured and shall not exceed 4 volts.

27.5DV.1.3 The resistance of the PROTECTIVE EARTHING CONDUCTOR is not included in the measurement. However, if the PROTECTIVE EARTHING CONDUCTOR is supplied with the equipment, it may be included in the test circuit, but the measurement of the voltage drop shall be made only from the main protective earthing terminal to the part required to be earthed.

27.5DV.1.4 The resistance calculated from the current of this voltage drop shall not exceed 0,1 ohm. The test duration is specified in Table 27DV.1.

Over-current protection of branch circuit required for equipment (A)	Time (min)
0 - 30	2
31 – 60	4
61 – 100	6
101 – 200	8
201 and over	10

# Table 27DV.1 – Earthing resistance test duration

# 27.5DV.2 D1 Modification:

# Delete the Note at the end of 27.5.

27.6 The printed conductors of printed circuit boards shall not be used to provide earthing continuity in HAND-HELD APPLIANCES. They may be used to provide earthing continuity in other appliances if at least two tracks are used with independent soldering points and the appliance complies with 27.5 for each circuit. This requirement is not applicable to CLASS II APPLIANCES and CLASS III APPLIANCES that incorporate an earth for functional purposes.

Compliance is checked by inspection and by the relevant tests.

27.6DV D2 Modification to replace 27.6 with 27.6DV.1 – 27.6DV.2:

27.6DV.1 The printed conductors of printed circuit boards shall not be used to provide earthing continuity in HAND-HELD APPLIANCES. They may be used to provide earthing continuity in other appliances provided that they comply with 27.5 and 27.7DV.1.4 to 27.7DV.1.7.

27.6DV.2 Compliance is checked by inspection and by the relevant tests.

27.7DV D1 Addition of 27.7DV.1 – 27.7DV.1.8:

27.7DV.1 Size of protective conductors

27.7DV.1.1 PROTECTIVE EARTHING CONDUCTORS shall at least be of the same size as supply conductors and shall comply with the minimum conductor sizes of column A of Table 27DV.2.

27.7DV.1.2 Compliance is checked by inspection and measurement.

RATED CURRENT of the equipment under consideration	Minimum conductor sizes AWG (mm <sup>2</sup> )			
Amperes	Α	В		
	PROTECTIVE EARTHING CONDUCTOR AWG (mm <sup>2</sup> )	PROTECTIVE BONDING CONDUCTOR AWG (mm <sup>2</sup> )		
Up to and including 10	18 (0,82)	20 (0,52)		
Over 10 up to and including 13	16 (1,31)	18 (0,82)		
Over 13 up to and including 18	14 (2,08)	16 (1,31)		
Over 18 up to and including 25	12 (3,31)	14 (2,08)		
Over 25 up to and including 30	10 (5,26)	12 (3,31)		
Over 30 up to and including 40	8 (8,36)	10 (5,26)		
Over 40 up to and including 55	6 (13,29)	8 (8,36)		
Over 55 up to and including 70	4 (21,14)	6 (13,29)		
Over 70 up to and including 95	2 (33,61)	4 (21,14)		

# Table 27DV.2 – Minimum size of protective conductors

27.7DV.1.3 PROTECTIVE BONDING CONDUCTORS shall comply with the following:

a) Shall pass the resistance test of 27.5;and

b) Shall be no smaller than the minimum conductor sizes in column B of Table 27DV.2; or for components only, be no smaller than the conductors that supply power to the component.

27.7DV.1.4 If the PROTECTIVE BONDING CONDUCTOR is smaller than the conductor supplying power to the component, or smaller than the conductor size in column B of Table 27DV.2, or a printed conductor on a printed circuit board, the protective bonding path shall demonstrate the ability to withstand a limited short circuit.

27.7DV.1.5 Compliance is determined by conducting the limited short circuit test specified in 27.7DV.1.6 and 27.7DV.1.7.

27.7DV.1.6 The protective earthing path shall be connected to the supply circuit having a capacity in accordance with Table 27DV.3. The capacity shall be determined without the protective earthing path in the circuit. The supply voltage shall be the nominal voltage of the a.c. mains supply. The specified over-current PROTECTIVE DEVICE rated no less than specified in 27.7DV.1.8 shall be connected in series with the protective earthing path.

27.7DV.1.7 During the test, the protective earthing path shall not open, and there shall be no damage to any insulation, the failure of which would result in contact between the earth path and a LIVE PART. The integrity of the insulation shall be checked by the electric strength test of 16.1 by applying the test between LIVE PART and earthed parts.

27.7DV.1.8 The current rating of the overcurrent PROTECTIVE DEVICE shall be the smallest of the following:

a) The current rating of the attachment plug but not less than 20 A;

b) The rating of an overcurrent **PROTECTIVE DEVICE** which is specified by the manufacturer for installation in the field to protect the equipment; or