For single-phase equipment having a rated voltage not exceeding 250 V and for three-phase equipment to be tested as single-phase equipment, the leakage current is measured with the selector switch shown in Figures 8.3.2.1 and 8.3.2.2 in each of the positions 1 and 2.

For other equipment, the leakage current is measured with the switches 'a', 'b' and 'c', shown in Figures 8.3.2.3 and 8.3.2.4, closed; for three-phase equipment not suitable for single-phase supply the measurements are repeated with each of the switches 'a', 'b' and 'c' open in turn, the other two switches being closed; for single-phase equipment, the measurements are repeated with one of the switches open.

After the equipment has been operated until steady state conditions are established, the leakage current to accessible metal parts and metal foil shall not exceed the following values:

(a) For Class III equipment ..... 0.5 mA.

(b) For portable Class I equipment ..... 0.75 mA.

(c) For stationary Class I motor-operated equipment ..... 3.5 mA.

(d) For stationary Class I heating equipment with heating elements which are detachable or can be switched off separately ..... 0.75 mA or 0.75 mA per kW rated input for each element or group of elements, whichever is the greater, with a maximum of 5 mA for the equipment as a whole.

(e) For other stationary Class I heating equipment..... 0.75 mA or 0.75 mA per kW rated input of the equipment, whichever is the greater, with a maximum of 5 mA.

(f) For Class II equipment ..... 0.25 mA.

(g) For other Class I equipment ..... 5 mA.

If the equipment incorporates one or more capacitors and is provided with a single-pole switch, the measurements are repeated with the switch in the 'off' position.

NOTE 2 For equipment incorporating both heating elements and motors, the total leakage current may be within the limits specified for heating equipment or for motor-operated equipment, whichever is the greater, but the two limits should not be added.

NOTE 3 It is recommended that the equipment be supplied through an isolating transformer; otherwise, it should be insulated from earth.

NOTE 4 The metal foil has the largest area possible on the surface under test, without exceeding the dimensions specified. If its area is smaller than the surface under test, it is moved so as to test all parts of the surface; the heat dissipation of the appliance should, however, not be affected by the metal foil.

NOTE 5 The test with the switch in the 'off' position is made to verify that capacitors connected behind a single-pole switch do not cause an excessive leakage current.

NOTE 6 If the equipment incorporates a thermal control which operates during the test of Clause 8.12 or the appropriate test in the individual Approval and test specification, the leakage current is measured immediately before the control opens the circuit.

8.4 High voltage (electric strength) test

8.4.1 Between live parts

All equipment shall withstand the application between live parts of an a.c. voltage of the value indicated in Table 8.4, according to the working voltage between the parts to which the test is being applied.

8.4.2 Equipment with earthing facilities

All equipment with earthing facilities shall withstand the application between live parts and exposed metal or earth, of an a.c. voltage of the value indicated in Table 8.4, according to the working voltage between the live parts and exposed metal or earth.

Table 8.4 - Testing voltages

Working voltage between parts *	Testing voltage
≤ 50 V	500 V
> 50 V ≤ 250 V	1000 V
> 250 V ≤ 650 V	1000 V + 2 × working voltage with a maximum of 2000 V

* For example, equipment that is to be connected to two phases of a system operating at 415 V between phases and 240 V to earth would receive a test of (1000 + 2 × 415) V between live parts, i.e. between the terminals to which the phases are to be connected, but a test of only 1250 V between live parts and frame.

8.4.3 Equipment with double insulation

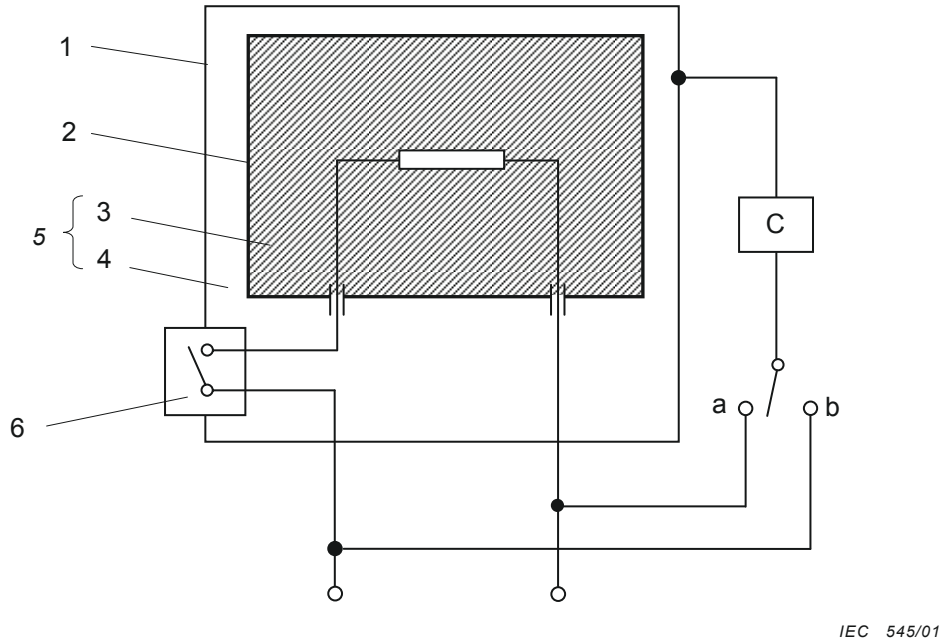
This test shall not apply to insulation that encloses only conductors or live parts operating at extra-low voltage supplied from a transformer complying with AS/NZS 61558.2.6.

The insulation between live parts and external metal, or live parts and a flexible electrode applied to the surface of the insulation, shall withstand high voltages applied as follows:

(a) Across basic insulation ..... 1250 V.

(b) Across supplementary insulation ..... 2500 V.

Where it is not possible to test the basic and supplementary insulation separately, or where a single layer of insulation is provided as the equivalent of separate layers of basic and supplementary insulation, a test voltage of 3750 V shall be applied between live parts and external metal or live parts and a flexible electrode applied to the outer surface of the insulation.



Key

C Circuit Annex E or Figure 4 of AS/NZS 60990

1 **Accessible part**

2 Inaccessible metal part

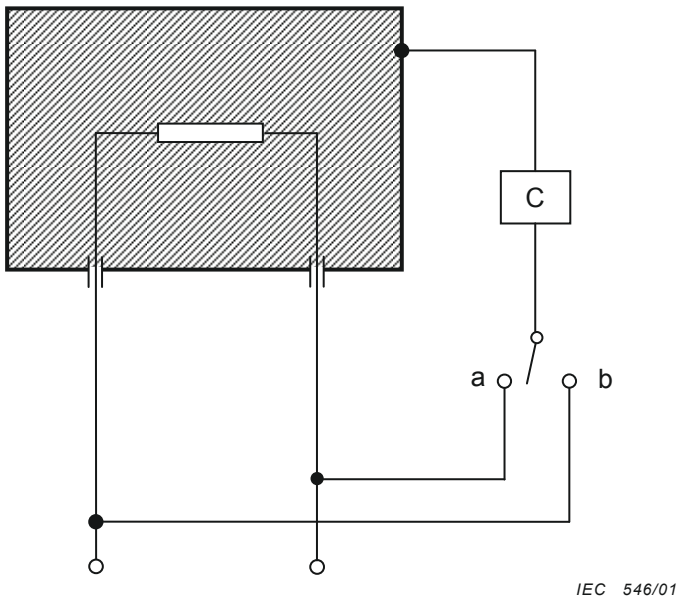
3 **Basic insulation**

4 **Supplementary insulation**

5 **Double insulation**

6 **Reinforced insulation**

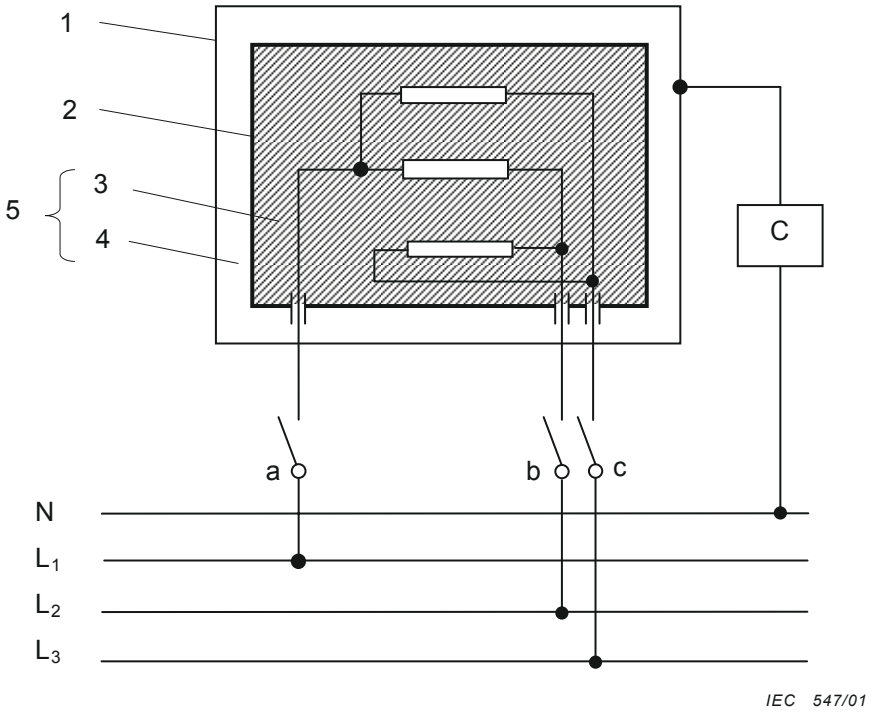
Figure 8.3.2.1 – Circuit diagram for leakage current measurement at operating temperature for single-phase connection of Class II appliances



Key

C Circuit Annex E or Figure 4 of AS/NZS 60990

Figure 8.3.2.2 – Circuit diagram for leakage current measurement at operating temperature for single-phase connection of appliances, other than those of Class II



Key

C Circuit Annex E or Figure 4 of AS/NZS 60990

1 **Accessible part**

2 Inaccessible metal part

3 **Basic insulation**

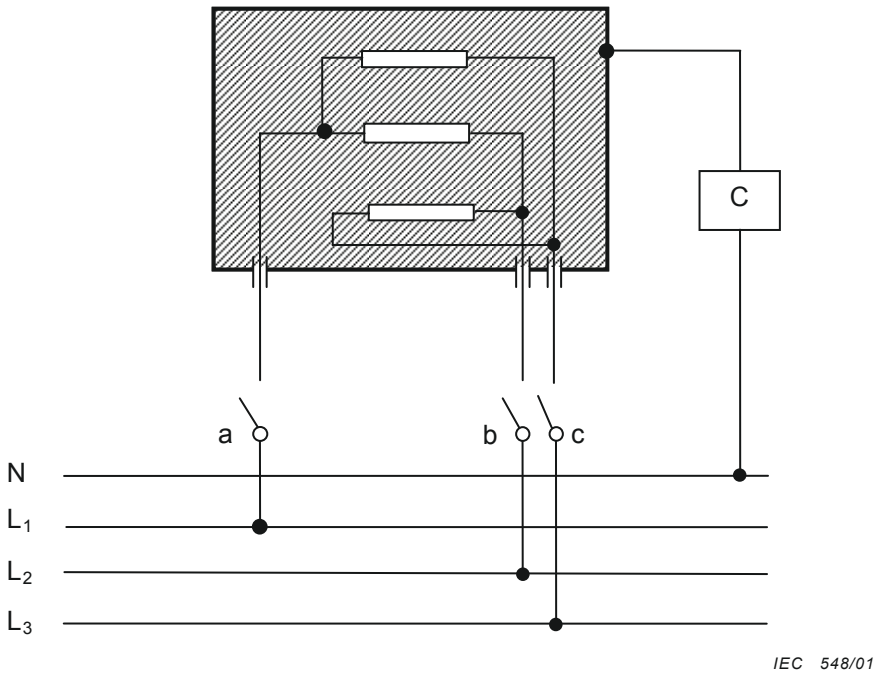
4 **Supplementary insulation**

5 **Double insulation**

Connections and supplies

L_1, L_2, L_3, N Supply voltage with neutral

Figure 8.3.2.3 – Circuit diagram for leakage current measurement at operating temperature for three-phase connection of Class II appliances



Key

C Circuit Annex E or Figure 4 of AS/NZS 60990

Connections and supplies

L_1, L_2, L_3, N Supply voltage with neutral

Figure 8.3.2.4 – Circuit diagram for leakage current measurement at operating temperature for three-phase connection of appliances other than those of Class II

8.4.4 Non-conducting external parts

An a.c. voltage of 3750 V shall be applied between live parts and a flexible electrode applied to non-conducting parts normally handled in service.

8.4.5 Method of applying test

Any radio interference suppression devices shall remain connected during the following high voltage test. The test equipment and the test method shall be generally in accordance with AS 1931.1 and AS 1931.2, as detailed below.

To prevent overvoltages due to switching surges, the initial voltage shall not exceed 30% of the full test voltage and shall be increased uniformly to the full voltage in a time of not more than 30 s. The full test voltage shall be maintained for 1 min after which the test voltage shall be diminished rapidly to 30% of its full value before switching off.

The specified test voltage shall be maintained for the 1 min duration of the test within ±3%.

The test voltage shall be alternating, of any frequency between 25 Hz and 100 Hz, and approximately of sine waveform.

There shall be no disruptive discharges, that is, flashovers or insulation punctures, during any high voltage tests.

NOTE Where an individual Approval and test specification specifies an insulation resistance test immediately after the high voltage test, the insulation resistance test of Clause 8.3.1 is not repeated.

The high voltage transformer used for the test shall be so designed that when the output terminals are short-circuited, after the output voltage has been adjusted to the appropriate test voltage, the output current shall be greater than 180 mA. The overcurrent relay shall not trip when the output current is less than 100 mA.

8.4.6 Number of samples

In cases where high voltage tests specified in any Specification would require the same insulation to be stressed more than once, the person submitting the equipment may submit, at the person's discretion, a sufficient number of samples to permit each such test to be made on a separate sample.

8.5 Test of earthing connection

The connection between the earthing terminal or earthing contact, and parts required to be connected thereto, shall be of low resistance.

Compliance is checked by an earthing connection test, whereby a current derived from an a.c. source having a no-load voltage not exceeding 12 V, and equal to 1.5 times rated current of the equipment or 25 A, whichever is the greater, is passed between the earthing terminal or earthing contact, and each of the accessible metal parts in turn.

The voltage drop between the earthing terminal of the equipment or the earthing contact of the appliance inlet and the accessible metal part is measured, and the resistance calculated from the current and this voltage drop.

The resistance shall not exceed

(a) for readily accessible exposed parts which rotate, reciprocate or oscillate continuously ..... 1 Ω.

(b) in all other cases ..... 0.1 Ω.

NOTE 1 In case of doubt, the test is carried out until steady conditions have been established.

NOTE 2 The resistance of the flexible cord is not included in the resistance measurement.

NOTE 3 Care is taken that the contact resistance between the tip of the measuring probe and the metal part under test does not influence the test results.

NOTE 4 For Item (a), a minimum current of 12 A is acceptable.

8.6 Cord anchorage

For the purpose of testing the cord anchorage, the equipment shall be wired in the normal manner with a flexible cord of the appropriate type. If the equipment is provided with an earthing terminal, the flexible cord shall include an earthing conductor.

For Type X attachment, the conductors are introduced into the terminals, the terminal screws, if any, being tightened just sufficiently to prevent the conductors from easily changing their position. The cord anchorage is used in the normal way, its clamping screws being tightened with a torque equal to two-thirds of that specified in Table 8.7.

The flexible cord shall be PVC-sheathed, unless otherwise specified in an individual Approval and test specification. Any sleeving or packing around the cord where it passes through the cord anchorage device shall be removed before the test is applied.

The equipment is tested with the cord as delivered. It shall not be possible to push the cord into the equipment to such an extent that the cable or cord, or internal parts of the equipment, could be damaged.

After the equipment has been correctly wired with all the strands intact, it shall be held fixed in position.

The cord shall then be subjected 25 times to a pull of the value shown in Table 8.6. The pulls are applied in the most unfavourable direction without jerks, each time for 1 s.

Unless varied in an individual specification, accessories shall be subjected to a pull of 65 N.

Immediately afterwards, the cord is subjected for 1 min to a torque of the value shown in Table 8.6.

Table 8.6 - Test values for cord pull test

Mass of appliance kg	Pull N	Torque Nm
Up to and including 1	30	0.1
Over 1 up to and including 4	60	0.25
Over 4	100	0.35

For Type X attachments having a specially prepared cord and Type Y and Z attachments, any additional sleeving used for cord protection purposes shall not be totally displaced from its anchorage point when tested. The sleeving shall be tested separately after the cord anchorage test in accordance with the method specified in this Clause; however, the pull shall be 30 N and the torque test shall not be applied.

During the tests, the cord shall not be damaged.

After the tests, the cord shall not have been longitudinally displaced by more than 2 mm and the conductors shall not have moved over a distance of more than 1 mm in the terminals, nor shall there be appreciable strain at the connection.

For the measurement of the longitudinal displacement, a mark is made on the cord while it is subjected to the pull, at a distance of approximately 20 mm from the cord anchorage or other suitable point before starting the tests.

After the tests, the displacement of the mark on the cord in relation to the cord anchorage or other point is measured while the cord is subjected to the pull.

8.7 Test for screw threads and fixings (See Clause 4.7)

8.7.1 Threaded fastenings of metal in metal or thermosetting plastic or wood, or the like

The screwed component shall be tightened and loosened in a steady and uniform manner the following number of times, by means of a suitable test screwdriver or other appropriate device applying a torque of appropriate value given in Table 8.7:

(a) Where it operates in a thread in metal..... 5 times.

(b) Where it operates in a thread in insulating material ..... 10 times.

Screwed components operating in a thread in insulating material shall be completely removed and re-inserted for each operation.

The shape of the blade of any test screwdriver shall be compatible with the slot of the screw to be tested.

Threads of the screwed component and its fixing shall not strip, insulating material shall not crack, nor shall there be any other failure which would render the screwed component non-reusable.

Where a screw is intended to secure a conductor, the test shall be carried out so that the stress is applied to the working section of the thread. Where applicable, the test shall be conducted with the appropriate conductor inserted in the terminal. For terminals that may be used for looping purposes, the test shall be conducted with the maximum and minimum number of conductors respectively which the terminal is intended to accommodate.

8.7.2 Threaded fastenings with any component of thermoplastic material

The length of thread engagement shall be measured and shall comply with Clause 4.7.

The screwed components shall be tightened and loosened as described in Clause 8.7.1, except that the following procedure shall be used instead of the application of the specified torque values.

The tightening shall be effected by first taking the screw up to the point where it bottoms and then tightening by a further 180° of turning or to the required torque in Table 8.7, whichever is reached first.

NOTE Bottoming' refers to the condition where the screw has just gripped. If the test cannot be done by normal clamping, that is, where the point of grip cannot be positively identified, use may be made of a suitable parallel metal washer or distance piece under the head of the screw, provided that the minimum length of engagement of the fastening is observed.

Threads of the fastening shall not jump or strip, insulating material shall not crack, nor shall there be any other failure which would render either component of the fastening non-reusable.

Where a screw is intended to secure a conductor, the test shall be carried out so that the stress is applied to the working section of the thread.

Table 8.7 - Test values for screw torque test

Nominal diameter of screw, mm	Torque*, Nm	
≤ 2.8	0.2	0.4
> 2.8 ≤ 3.0	0.25	0.5
> 3.0 ≤ 3.2	0.3	0.6
> 3.2 ≤ 3.6	0.4	0.8
> 3.6 ≤ 4.1	0.7	1.2
> 4.1 ≤ 4.7	0.8	1.8
> 4.7 ≤ 5.3	0.8	2.0
> 5.3 ≤ 6.0	–	2.5

* Column 2 applies to screws without heads where the screw does not protrude above its fixing when tightened; Column 3 applies to other screws.

NOTE 1 For tapered screws, the maximum diameter over the thread is deemed the nominal diameter.

NOTE 2 In Column 2, if screws greater than 5.3 mm are used it is considered that a test of 0.8 Nm is sufficient, unless varied in the individual Approval and test specification.

NOTE 3 In Column 3, if screws greater than 6 mm are used it is considered that a test of 2.5 Nm is sufficient, unless varied in the individual Approval and test specification.

8.8 Mechanical strength test

8.8.1 General

Equipment shall be subjected to blows, with an impact energy of 0.5 ± 0.05 Nm, by any means having the same performances as the spring-operated impact-test apparatus described in Clauses 8.8.2 to 8.8.4.

8.8.2 Spring-operated impact-test apparatus

The apparatus consists of three main parts, the body, the striking elements and the spring-loaded release cone as shown in Figure 8.8.2.

The body comprises the housing, the striking element guide, the release mechanism and all parts rigidly fixed thereto. The mass of this assembly is 1250 g.

The striking element comprises the hammer head, the hammer shaft and the cocking knob. The mass of this assembly is 250 g.

The hammer head has a hemispherical face of polyamide having a Rockwell hardness of HR 100, with a radius of 10 mm; it is fixed to the hammer shaft in such a way that the distance from its tip to the plane of the front of the cone when the striking element is on the point of release is 20 mm.

The cone has a mass of 60 g and the cone spring is such that it exerts a force of 20 N when the release jaws are on the point of releasing the striking element.

The hammer spring is adjusted so that the product of the compression, in millimetres, and the force exerted, in newtons, equals 1000, the compression being approximately 20 mm. With this adjustment, the impact energy is 0.5 ± 0.05 Nm.