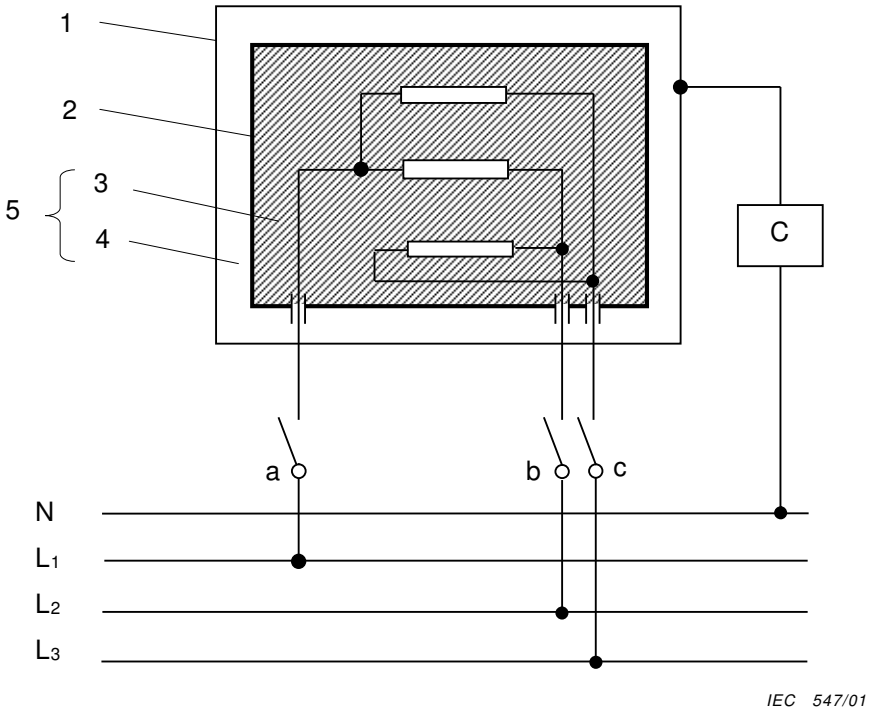


Key

C Circuit in Figure 4 of AS/NZS 60990

1 **Accessible part**

2 Inaccessible metal part

3 **Basic insulation**

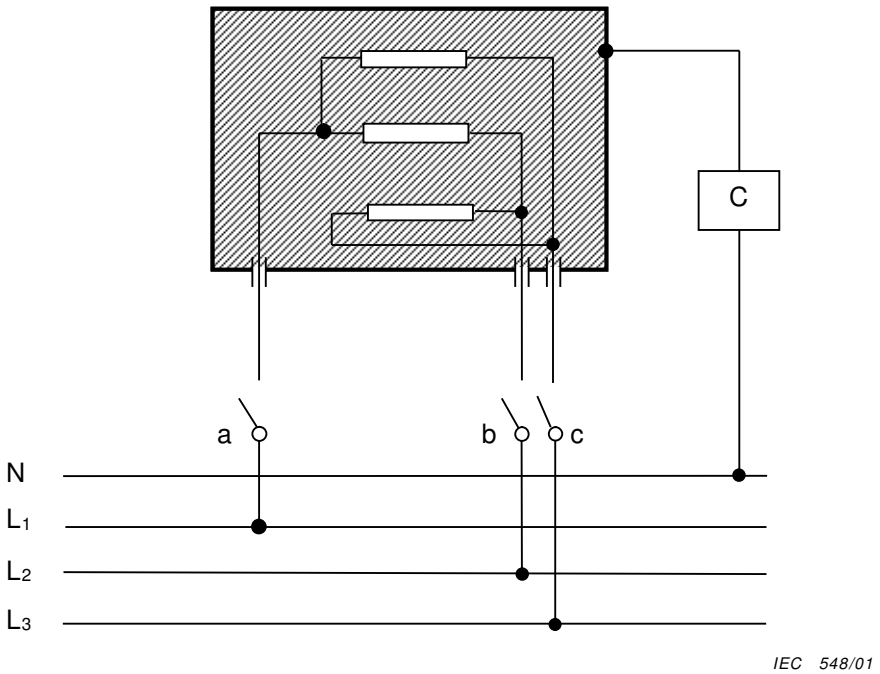
4 **Supplementary insulation**

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 equipment



Key

C Circuit in 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 equipment 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

When performing the high voltage test on an accessory, any surge protection device, such as a varistor, may be disconnected during the 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 IEC 61180 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 equipment 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.

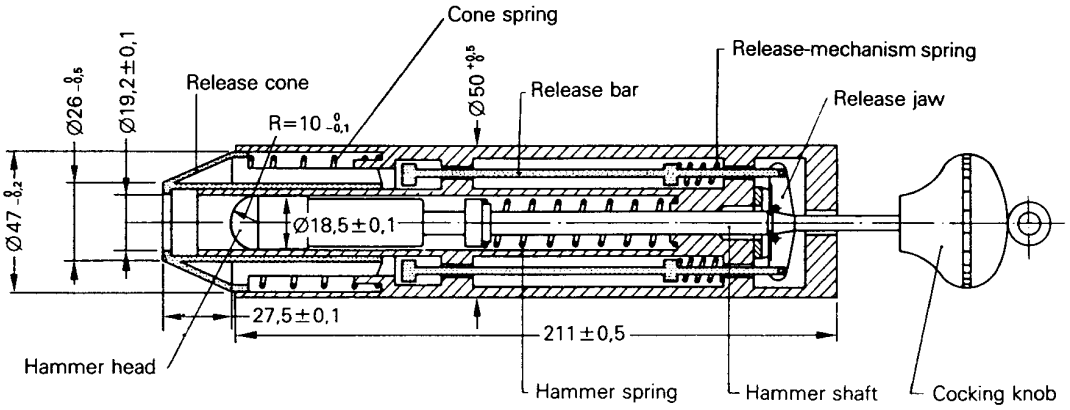
The hammer spring is adjusted so that the product of the compression, in millimetres, and the force exerted, in newtons, equals 1000, the compression being approximately 20 mm. With this adjustment, the impact energy is 0.5 ± 0.05 Nm.

The release mechanism springs are adjusted so that they exert just sufficient pressure to keep the release jaws in the engaged position.

The apparatus is cocked by pulling the cocking knob until the release jaws engage with the groove in the hammer shaft.

The blows are applied by pushing the release cone against the sample in a direction perpendicular to the surface at the point to be tested.

The pressure is slowly increased so that the cone moves back until it is in contact with the release bars, which then move to operate the release mechanism and allow the hammer to strike.



Dimensions in millimeters

Figure 8.8.2 - Impact-test apparatus

8.8.3 Procedure

The sample as a whole is rigidly supported against a plane surface and three blows are applied to every point of the enclosure that is likely to be weak.

To ensure that the sample is rigidly supported, it may be necessary to place it against a solid wall of brick, concrete or the like, covered by a sheet of polyamide which is tightly fixed to the wall, care being taken that there is no appreciable air gap between the sheet and the wall. The sheet shall have a Rockwell hardness of HR 100, a thickness of at least 8 mm and a surface area such that no part of the sample is mechanically overstressed due to insufficient supporting area.

If necessary, the blows are also applied to handles, levers, knobs and the like, and to signal lamps and their covers, but only if the lamps or covers protrude from the enclosure by more than 10 mm or if their surface area exceeds 400 mm^2. Lamps within the equipment, and their covers, are only tested if they are likely to be damaged in normal use.

8.8.4 Criteria

After the test, the sample shall show no damage within the meaning of this Specification; in particular, live parts shall not have become exposed so as to impair compliance with Clauses 5.1 and 5.2, and there shall not have been such distortion as to impair compliance with

Clause 4.1.3. In case of doubt, supplementary insulation is subjected to an electric strength test as specified in Clause 8.4.3.

If there is a doubt as to whether a defect has been promoted by the application of preceding blows, this defect is neglected and the group of three blows which led to the defect is applied to the same place on a new sample, which shall then withstand the test.

NOTE 1 When applying the release cone to the guard of a heating element which glows visibly in normal use, care should be taken that the hammer head passing through the guard does not strike the heating element.

NOTE 2 Damage to the finish, small dents that do not reduce creepage distances and clearances below the values specified in Clause 4.1.3, and small chips that do not adversely affect the protection against electrical shock or moisture, are disregarded.

NOTE 3 Cracks not visible to the naked eye and surface cracks in fibre-reinforced mouldings and the like are ignored.

NOTE 4 If a decorative cover is backed by an inner cover, fracture of the decorative cover is neglected if the inner cover withstands the test after removal of the decorative cover.

A2 DOW 28/6/21 NOTE 5 For the calibration of the spring-operated impact-test apparatus see AS 60068.2.75.

A2 DOA 28/6/21 NOTE 5 For the calibration of the spring-operated impact-test apparatus see IEC 60068.2.75.

8.9 Standard electrodes for electric strength tests

Where the electric strength of a material in sheet form is to be tested, the electrodes used shall be constructed of solid brass. The electrodes shall be in the form of solid brass cylinders, one of 75 mm diameter by 25 mm depth, and the other of 38 mm diameter by 38 mm depth. Where the electric strength over a surface is to be tested, the same pair of electrodes, or two of the latter size, may be used.

8.10 Standard test finger and protective impedance

8.10.1 General

For the purpose of determining whether or not either live parts (see Clause 5.1) or non-current-carrying conductive parts are exposed to personal contact, use shall be made of the standard test finger.

8.10.2 Design and construction

The standard test finger, as shown in Figure 8.10, shall be so designed that each of the jointed sections can be turned through an angle of 90° with respect to the axis of the finger in the same direction only.

The tip of the finger shall be made of copper or copper alloy; the handle shall be made of insulating material. The finger shall be provided with two joints operating in the same plane and so constructed that they will remain in any desired position.

A terminal or other equivalent means shall be provided to permit attachment of a flexible wire lead to the finger.

8.10.3 Method of use

The standard test finger may be applied directly to the live or non-current-carrying conductive part in question and a visual examination made to determine whether or not the finger is in contact with the part under test. The test finger shall be applied in every possible position, making use of the joints incorporated, provided that where bending takes place at both joints the direction of bending at each joint shall be the same, either clockwise or anti-clockwise.

Where, however, there is any doubt as to whether contact is made or whether a given part is live, the flexible wire lead from the test finger shall be connected through a high-resistance voltmeter having a resistance of not less than 1000 Ω/V of the scale reading, or other convenient indicator of equivalent current sensitivity, to one pole of a battery (6 V to 12 V) the other pole of which shall be connected to the supply terminals or points of the inner wiring of the equipment, which shall be entirely disconnected from the supply mains during this test.

8.10.4 Protective impedance

Protective impedance shall consist of at least two separate components, the impedances of which are unlikely to change significantly throughout the life of the equipment.

If any one of the components is short-circuited or open-circuited, the current between the part and the supply source shall not exceed 2 mA for d.c. and its peak value shall not exceed 0.7 mA for a.c., and also the following shall apply:

(a) For potentials not exceeding 450 V peak, the capacitance shall not exceed 0.1 μF.

(b) For potentials not exceeding 15 000 V peak, the quantity of electricity in the discharge shall not exceed 45 μC.

(c) For potentials exceeding 15 000 V peak, the energy in the discharge shall not exceed 350 mJ.

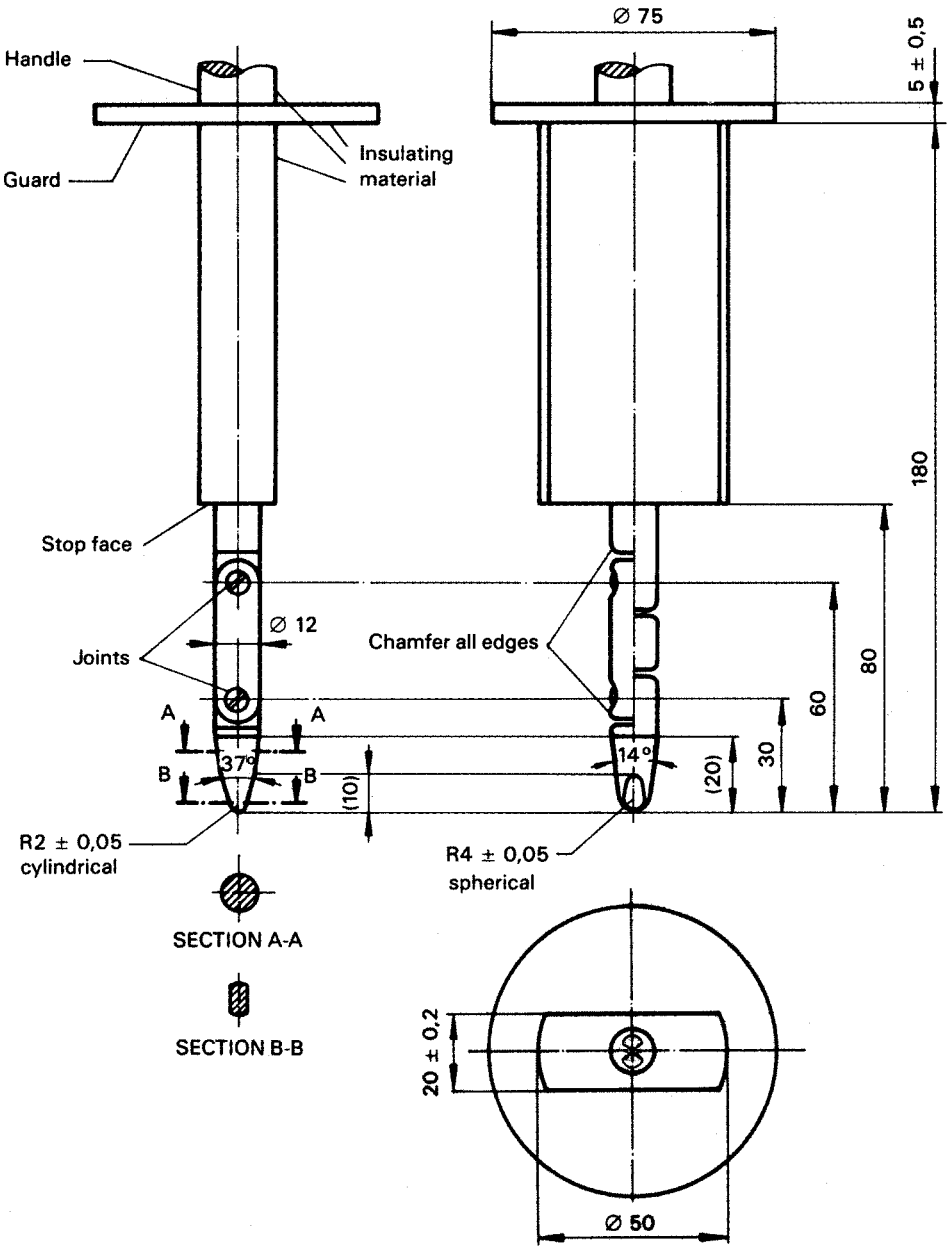
Voltage, current and capacitance are measured between the relevant part and either pole of the supply source, the equipment being supplied at rated voltage.

Discharge parameters are measured immediately after interruption of the supply, ensuring that the method of interruption of the supply does not break the connection to earth of one of the poles of the supply source.

The circuit for measuring the current is that in Figure 4 of AS/NZS 60990.

The quantity of electricity or energy in the discharge shall be measured into a load consisting of a non-inductive resistor of 2000 Ω.

Resistors or capacitors used as protective impedances shall comply with Clause 14.1(a), or Clause 14.2 of AS/NZS 60065, as appropriate.



Dimensions in millimetres

Material: metal, except where otherwise specified

Linear dimensions in millimetres

Tolerances on dimensions without specific tolerance:

on angles: 0/–10°

on linear dimensions:

up to 25 mm: 0/–0,05
over 25 mm: ±0,2

Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0 to +10° tolerance.

Figure 8.10 - Standard test finger