

**NORME
INTERNATIONALE
INTERNATIONAL
STANDARD**

**CEI
IEC**

61032

Deuxième édition
Second edition
1997-12

PUBLICATION FONDAMENTALE DE SÉCURITÉ
BASIC SAFETY PUBLICATION

**Protection des personnes et des matériels
par les enveloppes –
Calibres d'essai pour la vérification**

**Protection of persons and equipment
by enclosures –
Probes for verification**

© IEC 1997 Droits de reproduction réservés — Copyright - all rights reserved

Aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'éditeur.

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission
Telefax: +41 22 919 0300

e-mail: inmail@iec.ch

3, rue de Varembe Geneva, Switzerland
IEC web site <http://www.iec.ch>



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE

U

For price, see current catalogue

CONTENTS

	Page
FOREWORD	5
Clause	
1 General.....	7
1.1 Scope and object	7
1.2 General recommendations	7
2 Normative references	9
3 Definitions.....	9
3.1 Enclosure.....	9
3.2 Hazardous part	9
3.3 Access probe	10
3.4 Object probe	11
3.5 IP code probe	11
3.6 Other probe	11
3.7 Adequate clearance for protection against access to hazardous parts	11
4 Classification of test probes	11
5 List of test probes	13
6 Test probes.....	15
6.1 IP code probes.....	15
6.2 Other access probes	23
7 Design characteristics of test probes	37
Annexes	
A Effect of tolerances of test probes on equipment and test results.....	39
B Rules for tolerancing of future test probes	51

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PROTECTION OF PERSONS AND EQUIPMENT BY ENCLOSURES – PROBES FOR VERIFICATION

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61032 has been prepared by IEC technical committee 70: Degrees of protection by enclosures.

This second edition cancels and replaces the first edition published in 1990 and constitutes a technical revision.

It has the status of a basic safety publication in accordance with IEC Guide 104.

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

FDIS	Report on voting
70/82/FDIS	70/85/RVD

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

Annexes A and B are for information only.

PROTECTION OF PERSONS AND EQUIPMENT BY ENCLOSURES – PROBES FOR VERIFICATION

1 General

1.1 Scope and object

This International Standard specifies details and dimensions of test probes intended to verify the protection provided by enclosures with regard to:

- protection of persons against access to hazardous parts inside the enclosure;
- protection of the equipment inside the enclosure against ingress of solid foreign objects.

The object of this International Standard is:

- to bring together in one publication object probes and access probes currently specified in other standards, together with any necessary new probes;
- to guide technical committees in the selection of test probes;
- to encourage those concerned to specify test probes in accordance with those already specified in this International Standard rather than modify details and dimensions;
- to limit the further proliferation of types of test probe.

1.2 General recommendations

When selecting probes, priority should be given to IP code probes.

The use of other probes, particularly probes which are not specified in this International Standard, should be limited to cases where the use of an IP code probe is for some reason impractical.

NOTE 1 – The selection of a test probe for a particular purpose is the responsibility of the relevant technical committees.

NOTE 2 – Technical committees wishing to develop new probes or to modify existing probes should submit proposals to technical committee 70 for amendment of this standard.

Application of the probes, test conditions, acceptance conditions and the procedure in case of conflicting test results are the responsibility of the relevant product committee.

Certificates based on test probes conforming to the first edition of IEC 61032 should remain valid.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(826): 1982, *International Electrotechnical Vocabulary (IEV) – Chapter 826: Electrical installations of buildings*

IEC 60529: 1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60536: 1976, *Classification of electrical and electronic equipment with regard to protection against electric shock*

ISO 4287-1: 1984, *Surface roughness – Terminology – Part 1: Surface and its parameters*

3 Definitions

For the purpose of this International Standard the following definitions apply:

3.1 Enclosure

A part providing protection of equipment against certain external influences and, in any direction, protection against direct contact [IEV 826-03-12]

NOTE – This definition taken from the International Electrotechnical Vocabulary (IEV) needs the following additional explanations:

- a) Enclosures provide protection of persons or livestock against access to hazardous parts.
- b) Barriers, shapes of openings or any other means – whether attached to the enclosure or formed by the enclosed equipment – suitable to prevent or limit the penetration of the specified test probes are considered as a part of the enclosure, except when they can be removed without the use of a key or tool.

(see 3.1 of IEC 60529).

3.2 Hazardous part

A part that is hazardous to approach or touch (see 3.5 of IEC 60529).

3.2.1 Hazardous live part

A live-part which, under certain conditions of external influences, can give an electric shock (see 3.5.1 of IEC 60529).

3.2.2 Hazardous mechanical part

A moving part, other than a smooth rotating shaft, that is hazardous to touch (see 3.5.2 of IEC 60529).

3.2.3 Hazardous hot or glowing part

A hot or glowing part that is hazardous to touch.

3.3 Access probe

A test probe simulating in a conventional manner a part of a person or a tool, or the like, held by a person to verify adequate clearance from hazardous parts (see 3.8 of IEC 60529).

3.4 Object probe

A test probe simulating a solid foreign object to verify the possibility of ingress into an enclosure (see 3.9 of IEC 60529).

3.5 IP code probe

A test probe to verify the degrees of protection specified in IEC 60529.

3.6 Other probe

A test probe, different from IP code probes.

3.7 Adequate clearance for protection against access to hazardous parts

A distance to prevent contact or approach of an access probe to a hazardous part (see 3.7 of IEC 60529).

NOTE – The requirements to verify adequate clearance are specified in IEC 60529.

4 Classification of test probes

Test probes are classified as follows:

- a) according to their designation
 - IP code probes;
 - other probes;
- b) according to the kind of protection they are intended to check
 - access probes;
 - object probes;
- c) according to the specific hazard they are intended to check
 - probes mainly intended to be used to verify the protection of persons against access to hazardous live parts or hazardous mechanical parts;
 - probes specifically intended to be used to verify the protection of persons against access to hazardous mechanical parts;
 - probes mainly intended to be used to verify the protection of persons against access to internal parts involving thermal hazard, for instance internal hot or glowing parts;
 - probes intended to be used to verify the protection of equipment against ingress of solid foreign objects.

5 List of test probes

The comparative list of test probes with their application is given in table 1. Other IEC publications should refer to a test probe of this standard by means of its code (column 2) and short description (column 4), without reproduction of the relevant figure (column 3).

Table 1 – List of test probes

1	2	3	4	5
Probe and application ³⁾	Probe code ¹⁾	Figure No.	Short description mm	Forces to be applied N
Access probes of IEC 60529 (IP code) to verify protection of persons against access to hazardous live parts or hazardous mechanical parts	A B C ²⁾ D ²⁾	1 2 3 4	– Sphere: Ø 50 with handle – Jointed test finger – Rod: Ø 2,5 – length 100 – Wire: Ø 1,0 – length 100	50 10 3 1
Object probes of IEC 60529 (IP code) to verify protection of equipment against ingress of solid foreign objects	1 2	5 6	– Sphere: Ø 50 – Sphere: Ø 12,5	50 30
Other access probes to verify protection of persons against access to hazardous live parts or hazardous mechanical parts	11 12 13 14 15 16 17 18 19	7 8 9 10 – – 11 12 13	– Unjointed test finger – Cylindrical pin: Ø 4 – length 50 – Conical pin: Ø 3 to 4 – length 15 – Bar: 3 × 1 – Deleted – Deleted – Wire: Ø 0,5 – Small finger probe: Ø 8,6 – length 57,9 – Small finger probe: Ø 5,6 – length 44	50 * * 20 – – * 10 10
Other access probes to verify protection of persons against access to hazardous mechanical parts	31 32 33	14 15 –	– Cone: Ø 110/60 – Rod: Ø 25 – Deleted	50 30 –
Other access probes to verify protection of persons against access to hot or glowing parts	41 42 43	16 – 17	– Probe: Ø 30 – Deleted – Bar: 50 × 5	* – *

* Without appreciable force.

1) Letter codes and the single digit codes are related to the IP code.

The first numeral of the two digit codes is related to the intended use of the probe as indicated at the beginning of the respective row.

The second numeral denotes a serial number within the group.

2) Test probes C and D are also used to verify the protection of equipment against ingress of solid foreign objects having a diameter of 2,5 mm or greater and 1 mm or greater respectively.

3) The table lists probes and their main application only; there may be other applications as defined by the relevant product standard.

6 Test probes

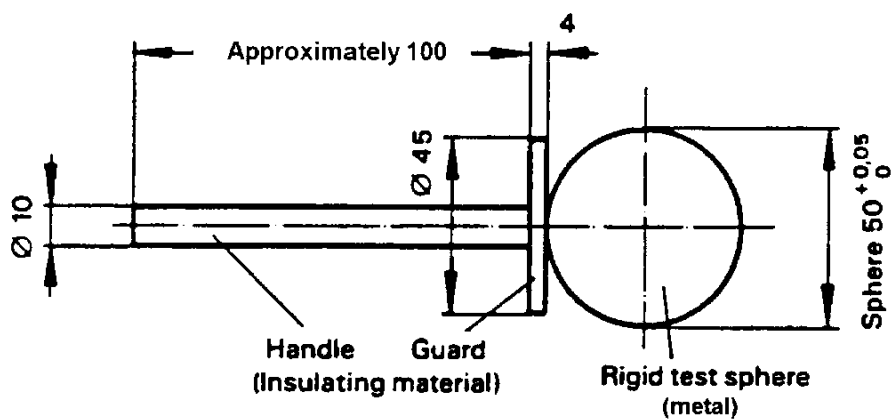
6.1 IP code probes

6.1.1 IP code probes are intended to verify

- the protection of persons against access to hazardous parts;
- the protection of the equipment against the ingress of solid foreign objects.

6.1.2 Access probes

a)

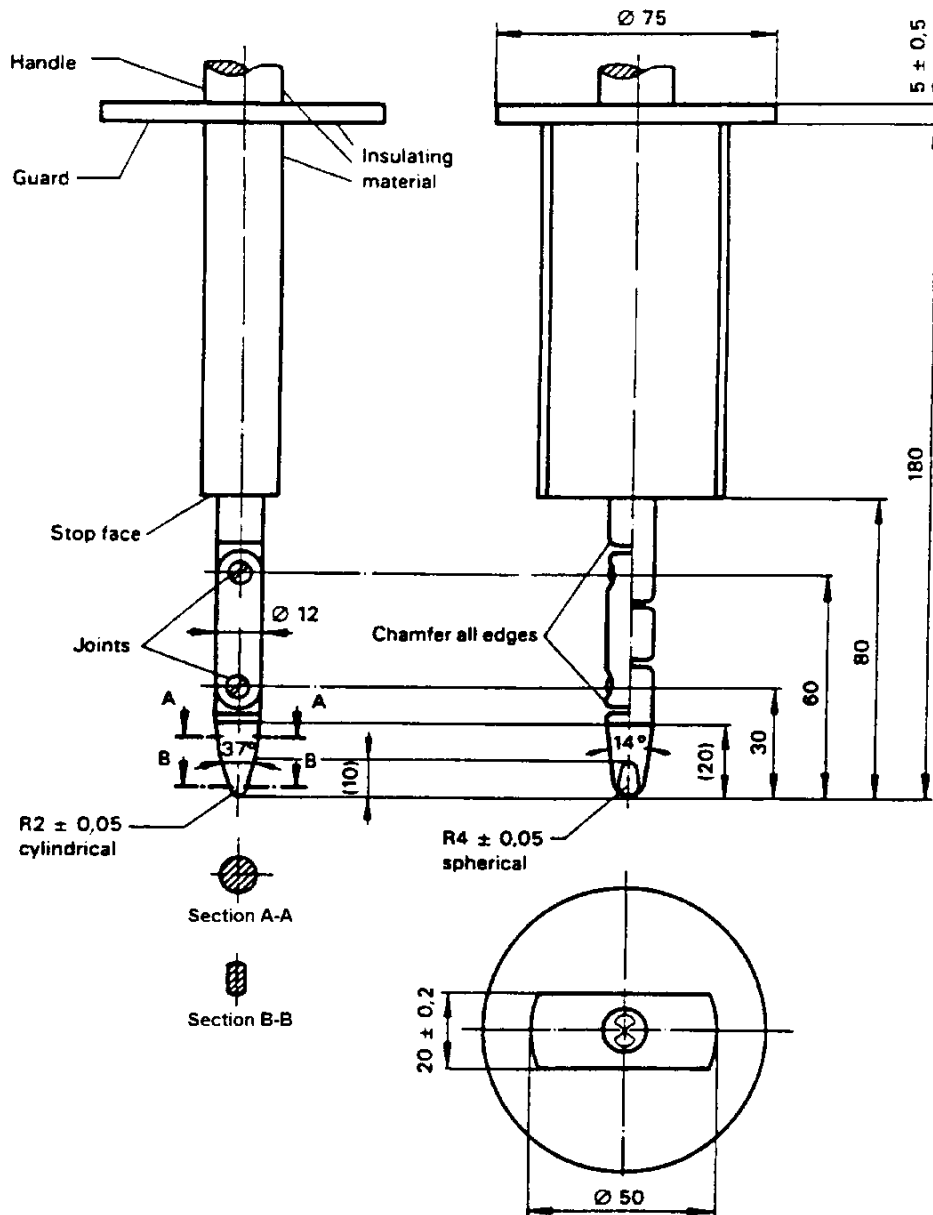


Dimensions in millimetres

This probe is intended to verify the protection of persons against access to hazardous parts. It is also used to verify the protection against access with the back of the hand.

Figure 1 – Test probe A

b)



Dimensions in millimetres

Material: metal, except where otherwise specified.

Tolerance on dimensions when no specific tolerance is given:

- on angles: 0
 -10°

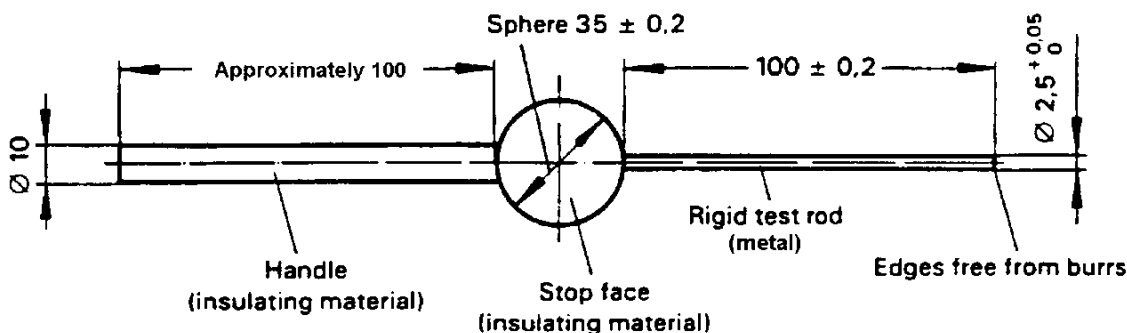
- on linear dimensions: up to 25 mm: 0
 $-0,05$ mm; over 25 mm: $\pm 0,2$ mm.

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

This probe is intended to verify the basic protection against access to hazardous parts. It is also used to verify the protection against access with a finger.

Figure 2 – Test probe B

c)

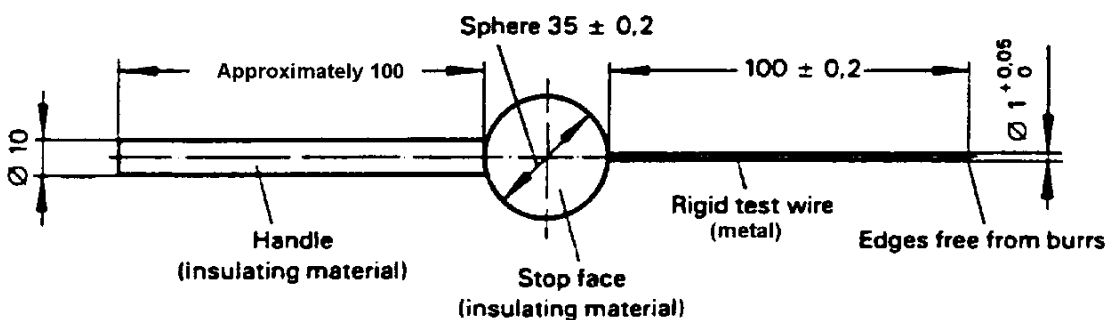


Dimensions in millimetres

This rod is intended to verify the protection of persons against access to hazardous parts. It is also used to verify protection against access with a tool.

Figure 3 – Test probe C

d)



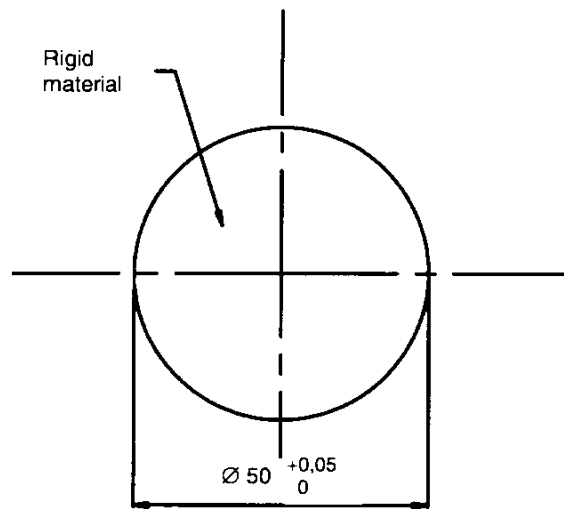
Dimensions in millimetres

This wire is intended to verify the protection of persons against access to hazardous parts. It is also used to verify the protection against access with a wire.

Figure 4 – Test probe D

6.1.3 Object probes

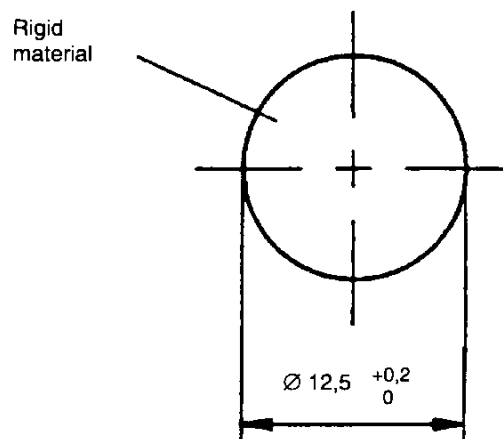
a)

*Dimensions in millimetres*

This sphere is intended to verify the degree of protection of enclosures against ingress of solid foreign objects having a diameter of 50 mm or greater.

Figure 5 – Test probe 1

b)

*Dimensions in millimetres*

This sphere is intended to verify the degree of protection of enclosures against ingress of solid foreign objects having a diameter of 12,5 mm or greater.

Figure 6 – Test probe 2

6.2 Other access probes

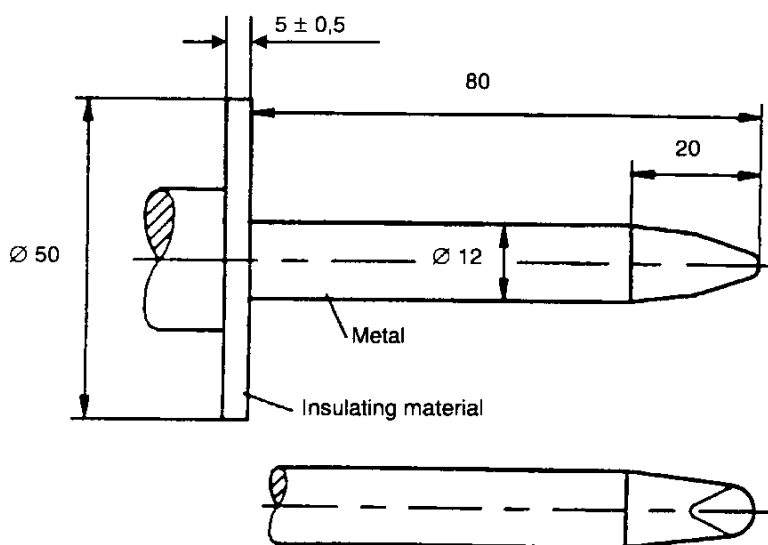
6.2.1 The probes quoted in 6.2.2 and 6.2.3 are used to cover particular requirements specified in the relevant product standards.

They should be chosen only where the use of IP code test probes is impractical.

6.2.2 Access probes to hazardous live parts or hazardous mechanical parts

Probes intended to verify the protection of persons against access to hazardous live parts or hazardous mechanical parts:

a)



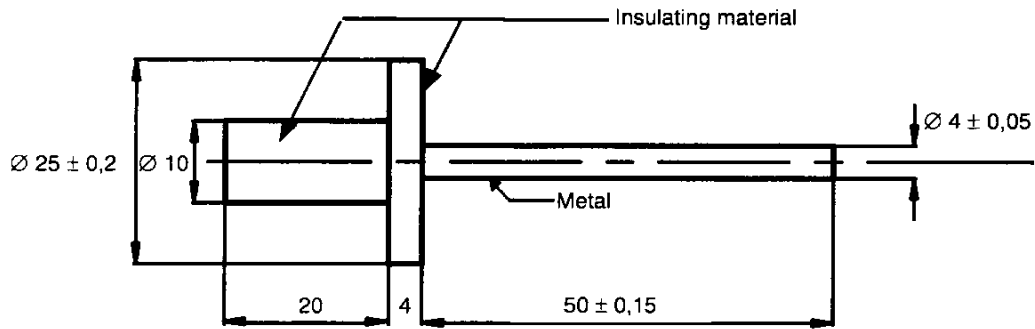
Dimensions in millimetres

For dimensions of the fingertip and tolerances see figure 2.

This probe may be used to verify the protection of persons against access to hazardous parts, and to verify the mechanical strength of openings in the enclosure or internal barriers.

Figure 7 – Test probe 11

b)

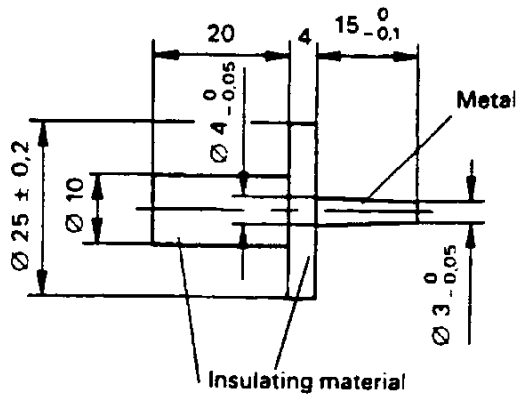


Dimensions in millimetres

This pin is intended to be used on appliances for verifying the inaccessibility of hazardous live parts or hazardous mechanical parts which are liable to be touched accidentally by a tool, for example a screwdriver or similar pointed object in normal use.

Figure 8 – Test probe 12

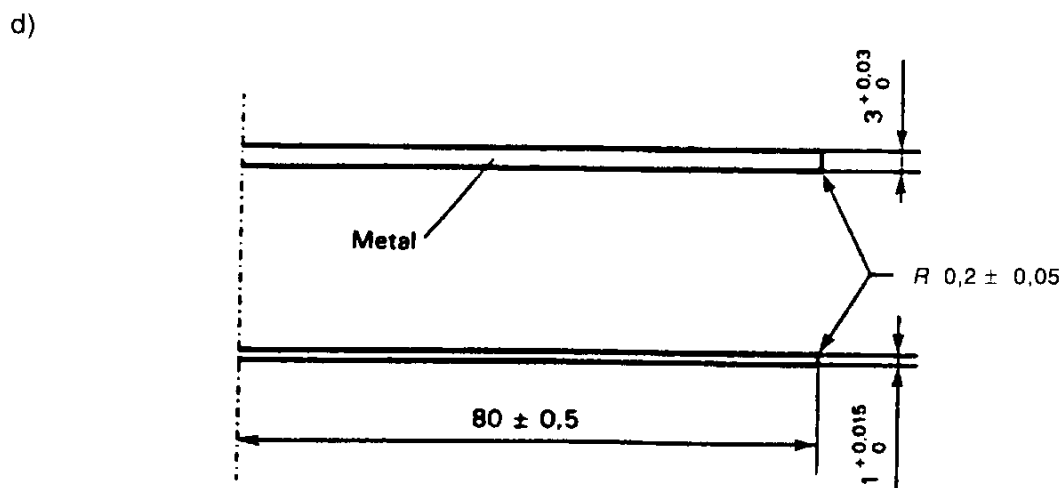
c)



Dimensions in millimetres

This pin is intended to verify the protection against access to hazardous live parts in class 0 equipment and class II equipment (see IEC 60536).

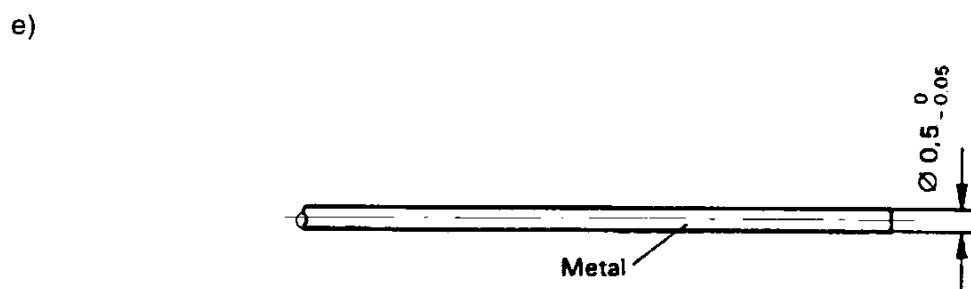
Figure 9 – Test probe 13



Dimensions in millimetres

This bar is intended to verify the protection against access to hazardous live parts of socket-outlets through shutters.

Figure 10 – Test probe 14

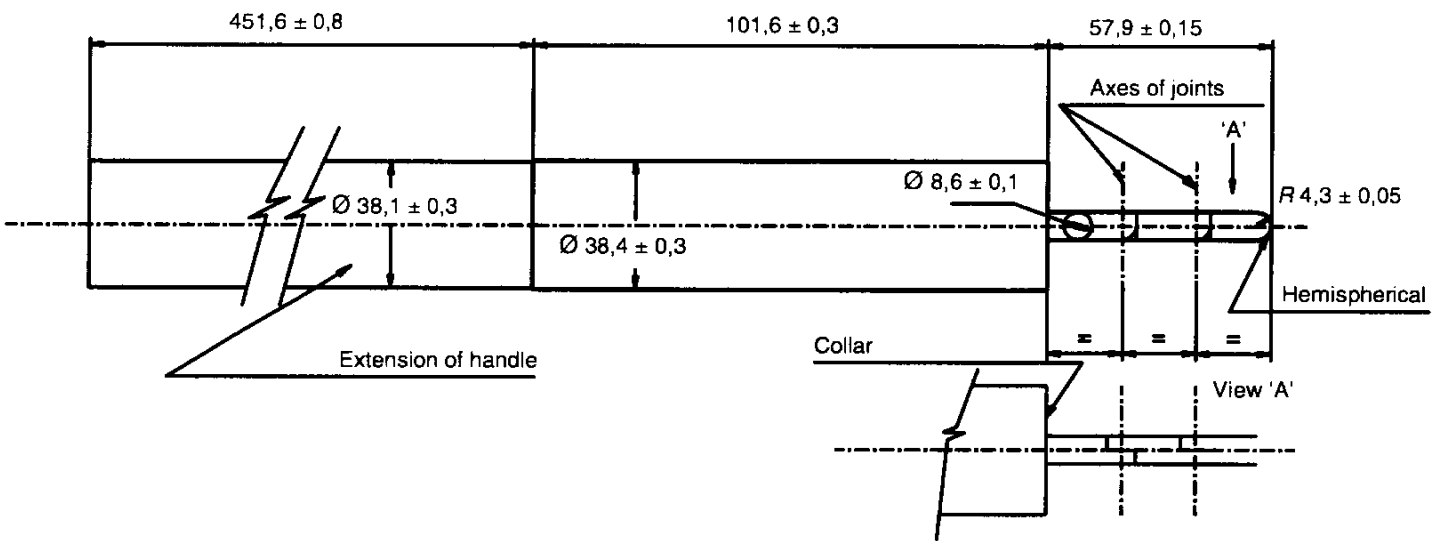


Dimensions in millimetres

This wire is intended to verify protection against access to hazardous live parts of electrical toys.

Figure 11 – Test probe 17

f)



Dimensions in millimetres

- Finger: metal material
- Handle: insulating material

The extension of the handle represents the arm of the child.

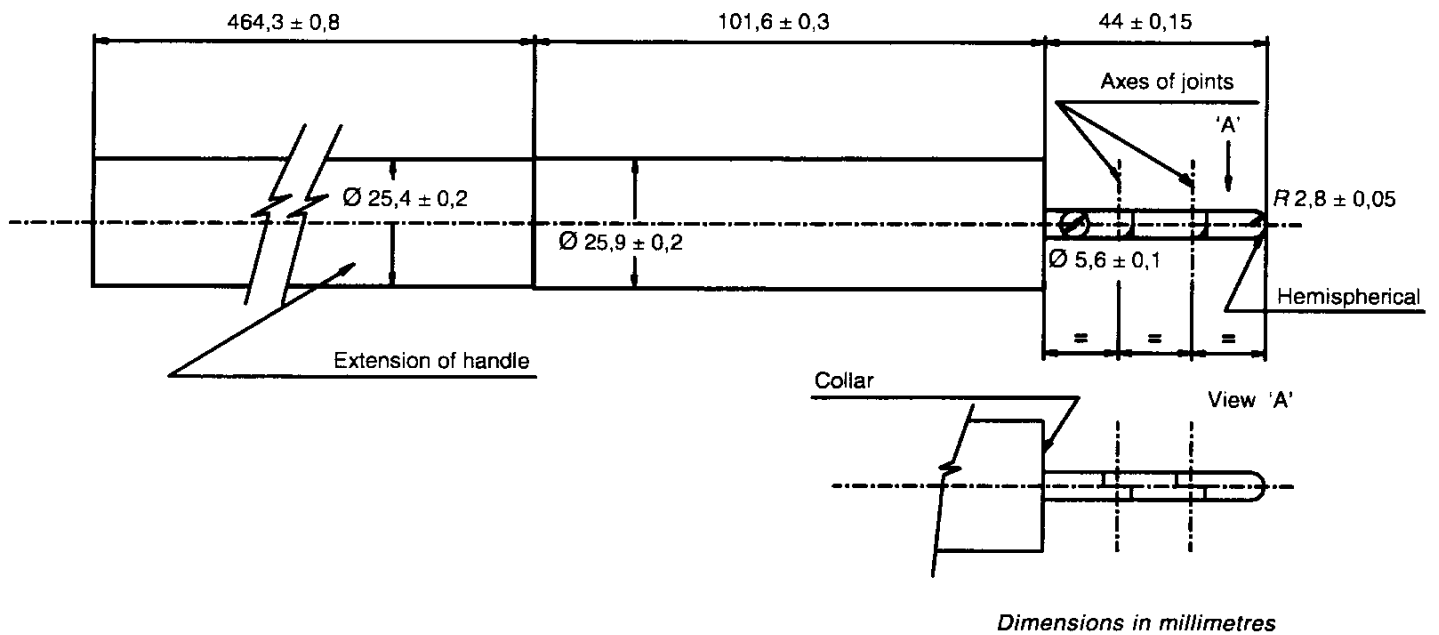
The handle is provided with an extension 451,6 mm long, and the probe should be applied with or without this extension, whichever is the more onerous condition.

Both joints shall permit movement in the same plane and the same direction through an angle of 90°.

This probe is intended to simulate access to hazardous parts by children of more than 36 months and less than 14 years.

Figure 12 – Test probe 18 (small finger probe Ø 8,6)

g)



- Finger: metal material
- Handle: insulating material

The extension of the handle represents the arm of the child.

The handle is provided with an extension, 464,3 mm long and the probe should be applied with or without this extension, whichever is the more onerous condition.

Both joints shall permit movement in the same plane and the same direction through an angle of 90°.

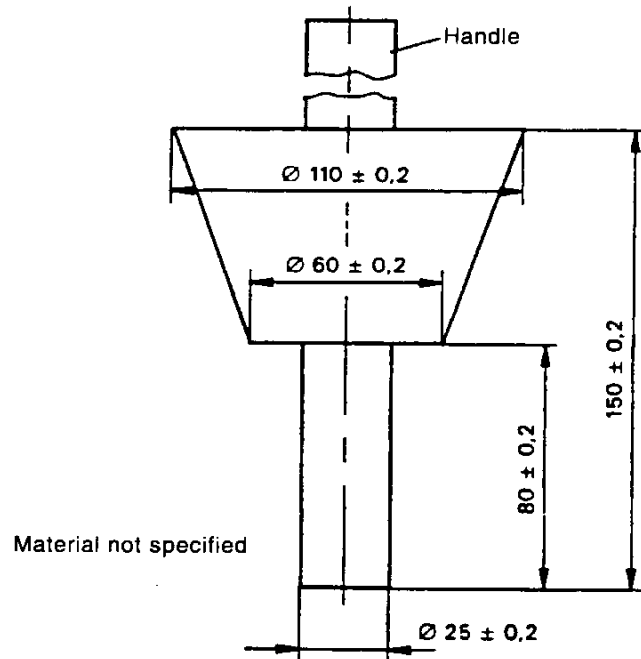
This probe is intended to simulate access to hazardous parts by children of 36 months or less.

Figure 13 – Test probe 19 (small finger probe Ø 5,6)

6.2.3 Access probes to hazardous mechanical parts

Probes specifically intended to verify the protection of persons against access to hazardous mechanical parts.

a)

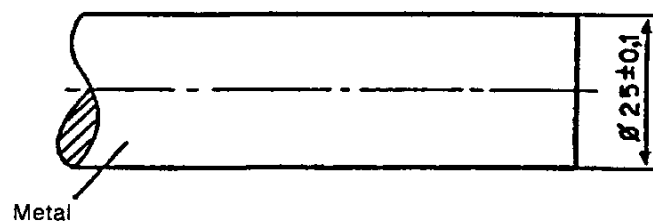


Dimensions in millimetres

This probe is intended to verify the protection against access to hazardous mechanical parts of the grinding system of food waste disposal units.

Figure 14 – Test probe 31

b)



Dimensions in millimetres

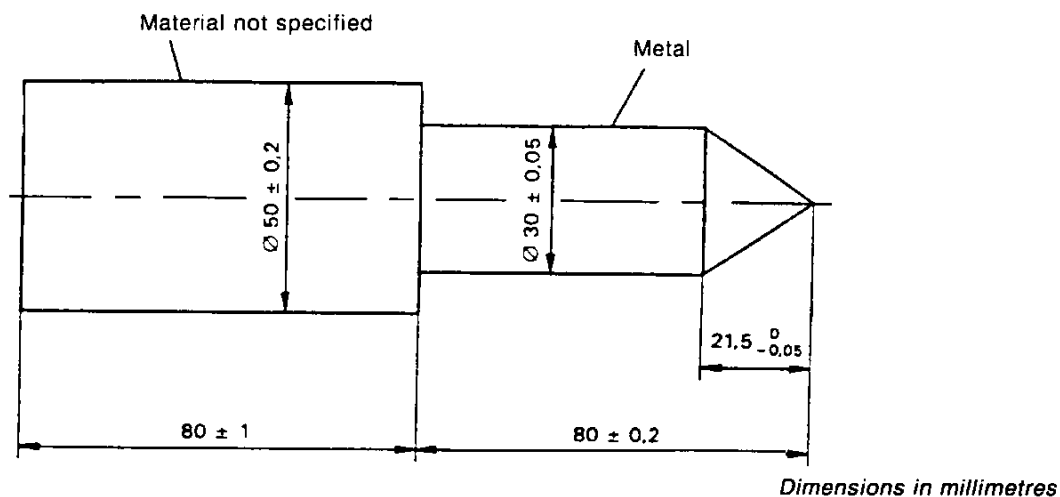
This rod is intended to verify the protection provided by fan guards against access to hazardous mechanical parts.

Figure 15 – Test probe 32

6.2.4 Access probes to hazardous hot or glowing parts

Probes intended to verify the protection of persons against access to hazardous hot or glowing parts.

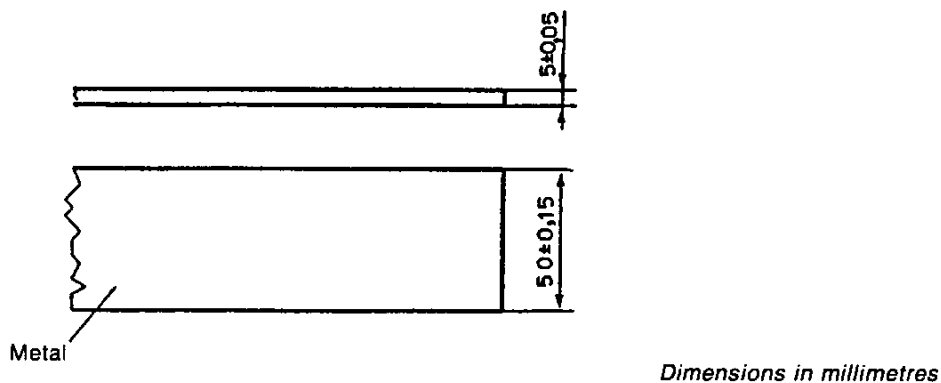
a)



This probe is intended to verify the protection against access to glowing heating elements.

Figure 16 – Test probe 41

b)



This bar is intended to verify the protection of fixed and portable visibly glowing radiant heaters.

Figure 17 – Test probe 43

7 Design characteristics of test probes

7.1 Adequate means (e.g. spring) shall be specified for measuring the force to be applied.

7.2 The surface roughness Ra according to ISO 4287-1 of metal parts of test probes, when delivered, shall not exceed 1,6 µm.

All parts of the probes that can be in contact with the test specimen shall be of a minimum hardness of 50 HCR (Rockwell, C scale).

NOTE 1 – When it is necessary to check by electrical means, a terminal should be provided to permit connection of an extra low voltage supply.

Unless otherwise specified in the product standards, it is recommended that the voltage of the indicator circuit is not less than 40 V and not more than 50 V.

NOTE 2 – Test probes should be protected from corrosion. If a probe is made of material susceptible to corrosion some protection should be afforded, especially when not in use. Use of oil and similar protection is recommended.

NOTE 3 – Handles should be designed so that they can be securely held.

Annex A (informative)

Effect of tolerances of test probes on equipment and test results

A.1 General

Test probes are well established and specified means to verify the protection of electrical equipment with regard to access to hazardous parts.

Tight tolerances are desired to ensure compatibility and reproducibility of test results, however, wide tolerances are required for economic manufacture of the probes and to allow for wear due to frequent use.

It is important that both the designers of electrical equipment with hazardous parts and the users of test probes are aware of these facts and of the natural limits in the application of test probes.

As a matter of principle, the relevant dimensions of electrical apparatus (e.g. apertures or clearances) should be designed to provide an ample safety margin between the hazardous parts and the test probe taking account of the greatest tolerance applicable for the probe.

The following examples are given to explain the matter in more detail.

A.2 Test probes of undefined length

Examples: probes 17, 32, 43.

According to the test conditions specified in the relevant product standards, the purpose of the test is to verify the protection of persons against access to hazardous parts inside an enclosure.

These probes are designed to show that no access can be made into the enclosure (see figure A.1).

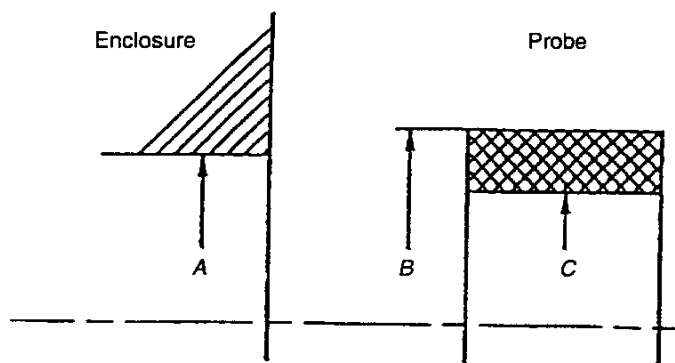


Figure A.1 – Tolerance range on the diameter of a cylindrical test probe

A: maximum aperture in the enclosure under test

B: maximum dimension of the probe

C: minimum dimension of the probe

B-C: tolerance range of the probe

Instruction for the designer of the equipment: $A < C$

Instruction for the user of the test probe:

$A > B$: test failed

$A < C$: test passed

$C < A < B$: range of uncertainty which can be avoided if the rule $A < C$ is followed

A.3 Test probes of defined length

Examples: probes C, D, 14, and the cylindrical parts of probes B, 11, 31, 41.

These probes simulate parts of the human body or tools held by a person.

According to the test conditions specified in the relevant product standards, the purpose of the test is to verify the protection of persons against access to hazardous parts inside an enclosure.

The probe may penetrate through an opening until its stop face, but adequate clearance is kept between the probe and hazardous parts (see figure A.2).

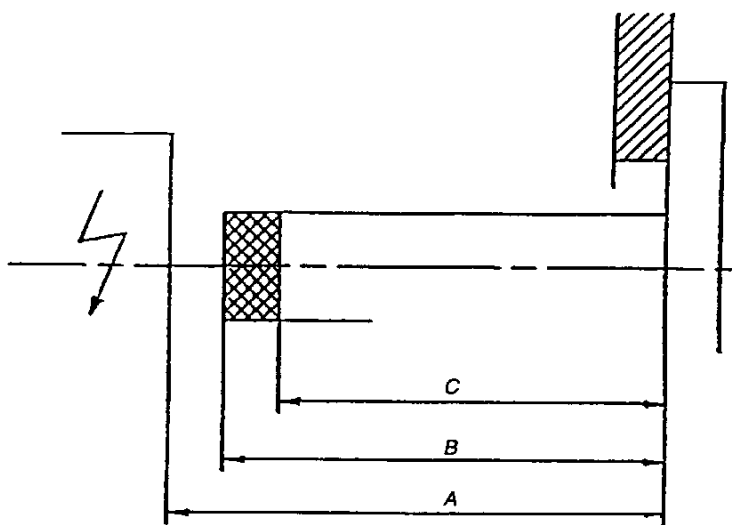


Figure A.2 – Tolerance range on the length of a test probe

A: shortest distance of hazardous parts under test

B: maximum dimension of the probe

C: minimum dimension of the probe

B-C: tolerance range of the probe

Instruction for the designer:

$A > B$ including the specified clearance dimension in case of high-voltage equipment

Instructions for the user of the test probe:

$A \leq C$: test failed

$A > B$: test passed

$C < A \leq B$: range of uncertainty which can be avoided if the rule $A > B$ is followed

A.4 Test probes with tapered section

Examples: probes B, 11, 13, 31, 41.

Basically the rules given in A.3 apply.

The penetration depth of the tapered section is limited by the diameter of the probe, however, particularly in case of small taper angles there is a wide range of uncertainty, as shown in figure A.3.

The general statements made in the initial part of this annex should be carefully noted by designers if test probes with tapered sections need to be applied.

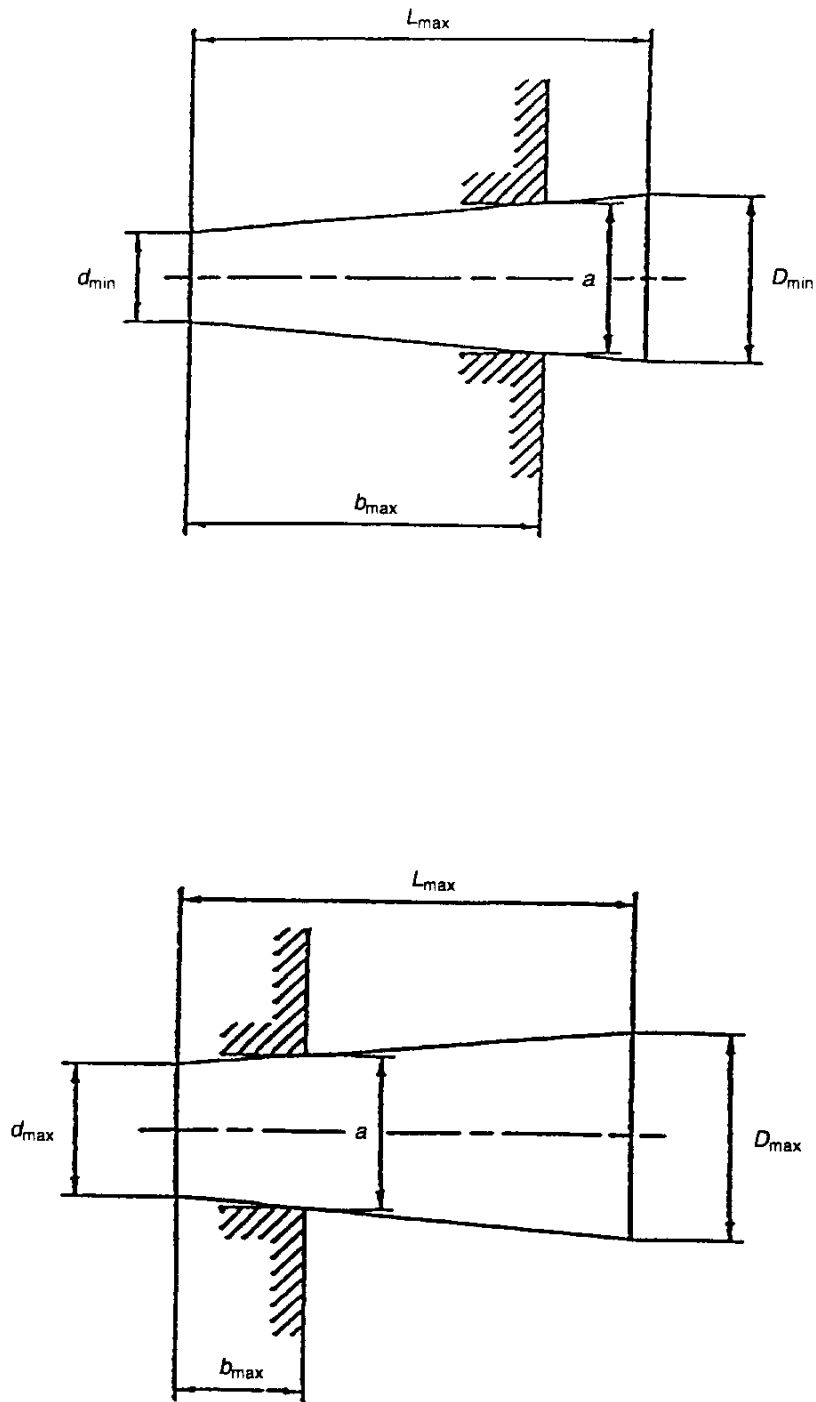


Figure A.3 – Variation of penetration depth b with tapered test probes

The following graphs show the penetration depths b and their deviations as a function of the opening widths a and the tolerance on dimensions b for test probes with tapered sections listed in this standard:

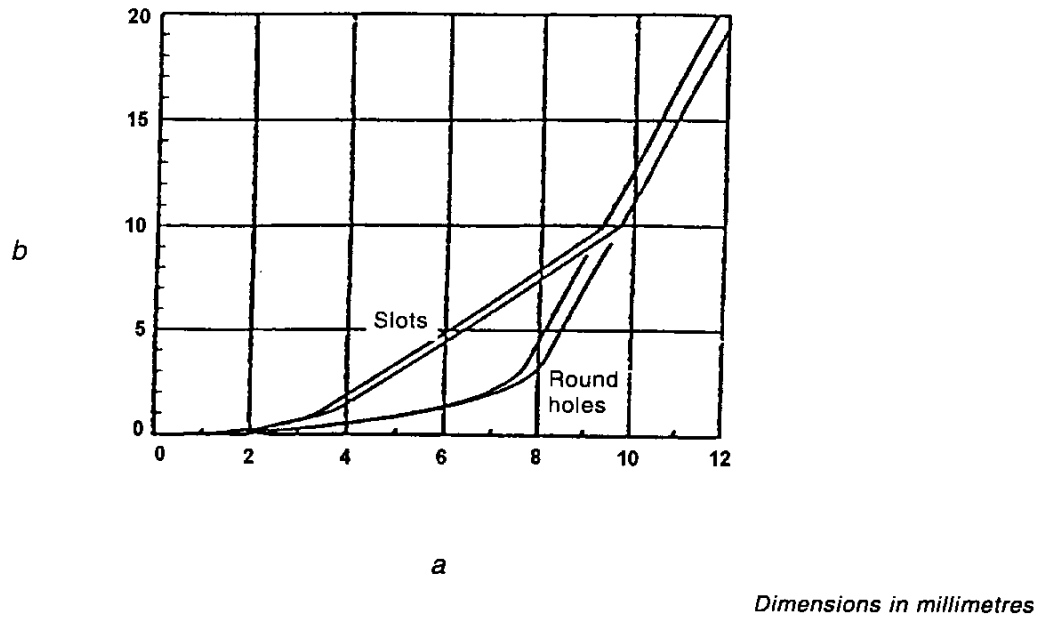


Figure A.4 – Tolerance range of the penetration depths b through opening width a for test probe B: jointed test finger and test probe 11: unjointed test finger

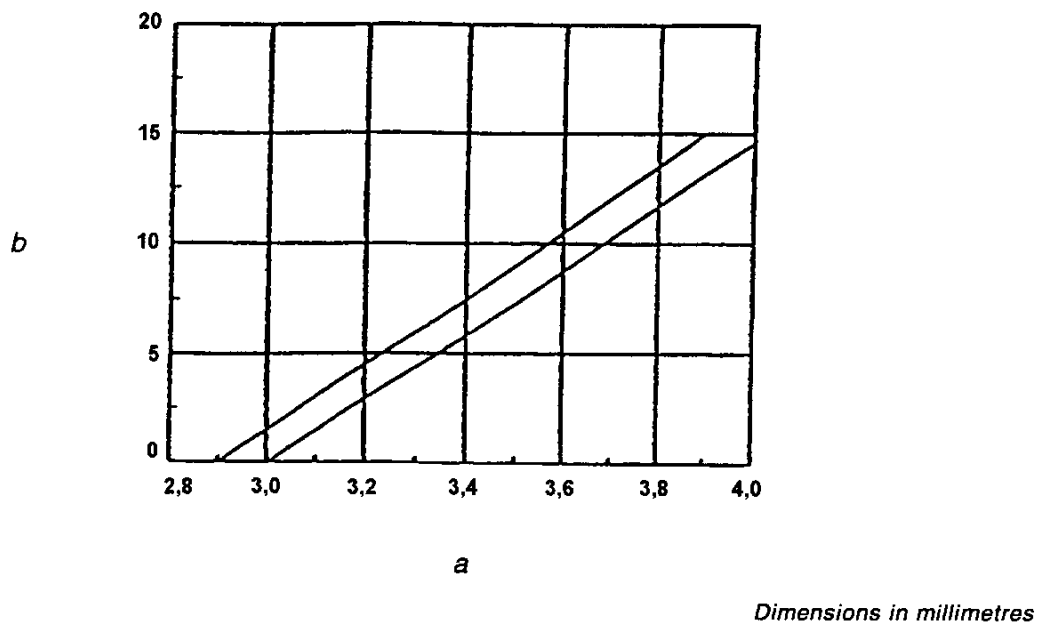
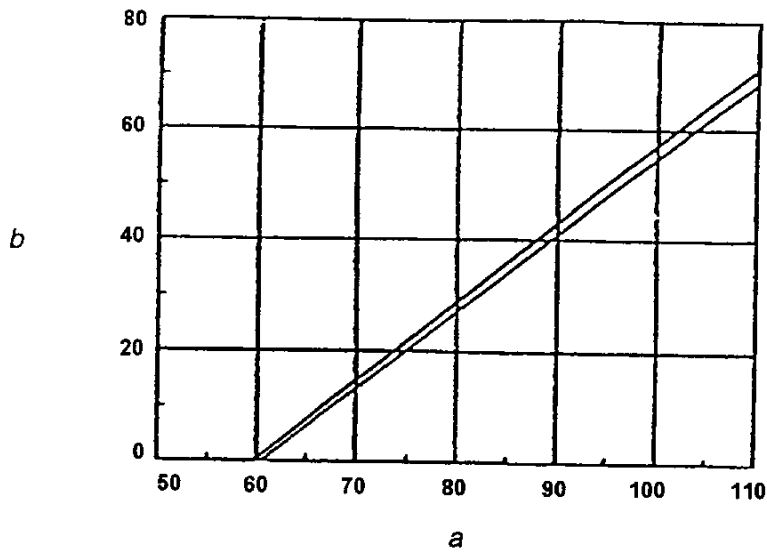
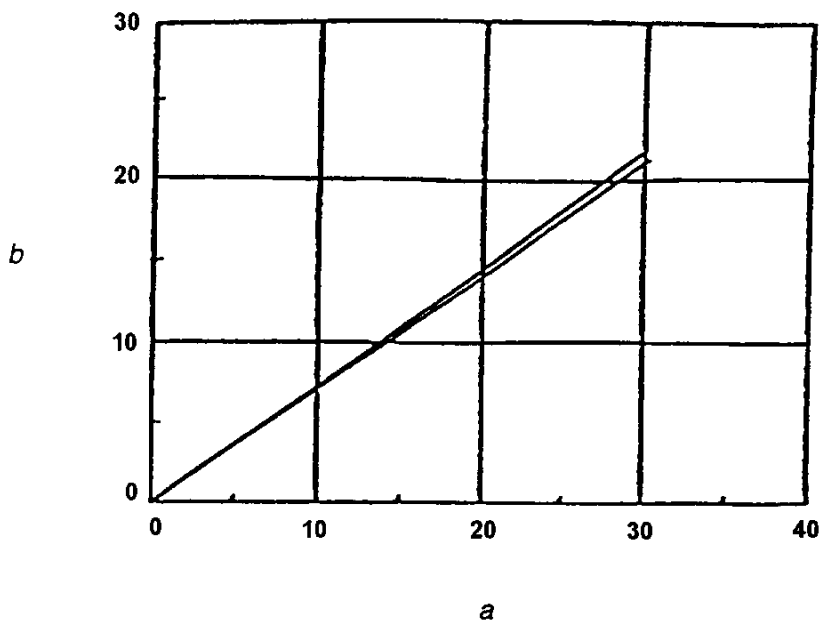


Figure A.5 – Tolerance range of the penetration depths b through opening width a for test probe 13: conical pin, \varnothing 3 to 4, 15 long



Dimensions in millimetres

Figure A.6 – Tolerance range of the penetration depths b through opening width a for test probe 31: cone \varnothing 110/60



Dimensions in millimetres

Figure A.7 – Tolerance range of the penetration depths b through opening width a for test probe 41: probe \varnothing 30

Annex B (informative)

Rules for tolerancing future probes

B.1 Dimensions

B.1.1 Dimensions of active parts of probes should be toleranced according to tables 1, 2 and 3 of ISO 2768-1*, as follows.

- Linear dimensions should be toleranced according table 1 and namely
 - tolerance class fine for metallic parts, and
 - tolerance class medium for insulating or not-specified parts.
- Broken edges (external radii and chamfer heights) should have tolerance class fine/medium, as specified in table 2.
- Angular dimensions should have tolerance class fine/medium, as specified in table 3.

B.1.2 Dimensions of non-active parts, such as handles, guards, etc., are given without tolerances.

B.2 Forces

The forces to be applied to the probes should have a tolerance of $\pm 10\%$.

* ISO 2768-1: 1989, *General tolerances – Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*