BS EN 60832-2:2010

BSI Standards Publication

Live working — Insulating sticks and attachable devices

Part 2: Attachable devices

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National foreword

This British Standard is the UK implementation of EN 60832-2:2010. It is identical to IEC 60832-2:2010. Together with BS EN 60832-1:2010, it supersedes BS EN 60832:1997, which will be withdrawn on 1 March 2013.

The UK participation in its preparation was entrusted to Technical Committee PEL/78, Tools for live working.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Amendments issued since publication

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EUROPEAN STANDARD

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EN 60832-2

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ICS 13.260; 29.240.20.

Supersedes EN 60832:1996 (partially)

English version

Live working - Insulating sticks and attachable devices - Part 2: Attachable devices

(IEC 60832-2:2010)

Travaux sous tension - Perches isolantes et outils adaptables - Partie 2: Outils adaptables
(CEI 60832-2:2010)

Arbeiten unter Spannung - Isolierende Stangen und auswechselbare Adapter/Arbeitsköpfe - Teil 2: Auswechselbare Adapter/Arbeitsköpfe
(IEC 60832-2:2010)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 78/839/FDIS, future edition 1 of IEC 60832-2, prepared by IEC TC 78, Live working, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60832-2 on 2010-03-01.

This EN 60832-2, together with EN 60832-1, supersedes EN 60832:1996. The two parts have been created to clearly separate the requirements and testing of insulating sticks from those of attachable universal devices.

Compared to EN 60832, the major changes included in EN 60832-2 are:

- updating of the list of devices;
- clarifying the applicability of the document to other attachment system than splined end-fitting;
- application of conformity assessment for products having completed the production phase, according to IEC 61318:2007 (Edition 3), focusing on the classification of defects and the introduction of alternative testing in case of production follow-up.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2010-12-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2013-03-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60832-2:2010 was approved by CENELEC as a European Standard without any modification.

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

~~Publication~~	~~Year~~	~~Title~~	~~EN/HD~~	~~Year~~
IEC 60060-1	-	High-voltage test techniques - Part 1: General definitions and test requirements	HD 588.1 S1	-
IEC 60212	1971	Standard conditions for use prior to and during the testing of solid electrical insulating materials	HD 437 S1	1984
IEC 60417	-	Graphical symbols for use on equipment	-	-
IEC 61318	2007	Live working - Conformity assessment applicable to tools, devices and equipment	EN 61318	2008
IEC 61477	-	Live working - Minimum requirements for the utilization of tools, devices and equipment	EN 61477	-

CONTENTS

INTRODUCTION

The purpose of this standard is to provide essential requirements. Each user of this standard may supplement it with their own requirements. For example, the user may add requirements regarding the use of attachable devices on d.c. electrical installations or the mechanical performance or compatibility and interchangeability with tools already in service. In such cases, caution should be taken to maintain or improve the performance of the products.

This publication has been prepared in accordance with the requirements of IEC 61477.

The products designed and manufactured according to this standard contribute to the safety of the users provided they are used by skilled persons, in accordance with safe methods of work and the instructions for use.

The product covered by this standard may have an impact on the environment during some or all stages of its life cycle. These impacts can range from slight to significant, be of short-term or long-term, and occur at the global, regional or local level.

Except for a disposal statement in the instructions for use, this standard does not include requirements and test provisions for the manufacturers of the product, or recommendations to the users of the product for environmental improvement. However, all parties intervening in its design, manufacture, packaging, distribution, use, maintenance, repair, reuse, recovery and disposal are invited to take account of environmental considerations.

LIVE WORKING – INSULATING STICKS AND ATTACHABLE DEVICES –

Part 2: Attachable devices

1 Scope

This part of IEC 60832 gives the essential requirements for devices that can be attached onto and removed from the fitting of the insulating sticks for live working, for use on a.c. electrical installations.

Part 1 of IEC 60832 covers insulating sticks.

In this part of the standard, the term “device” is used for “attachable device”, unless otherwise specified.

Products designed and manufactured according to this standard contribute to the safety of the users provided they are used by skilled persons, in accordance with safe methods of work and the instructions for use.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this international standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60212:1971, *Standard conditions for use prior to and during the testing of solid electrical insulating materials*

IEC 60417, *Graphical symbols for use on equipment*

IEC 61318:2007, *Live working – Conformity assessment applicable to tools, devices and equipment*

IEC 61477, *Live working – Minimum requirements for the utilization of tools, devices and equipment*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61318 and the following apply.

3.1.1
rated value
value of a quantity used for specification purposes, established for a specified set of operating conditions of a component, device, equipment or system

[IEV 151-16-08]

3.1.2
type of device
family of devices which are of the same design and application and are of similar dimensions

3.2 Symbols

T_N rated torque given by the manufacturer for a given device and for testing purposes

F_{TN} rated tensile force given by the manufacturer for a given device and for testing purposes

F_{CN} rated compression force given by the manufacturer for a given device and for testing purposes

F_{BN} rated bending force given by the manufacturer for a given device and for testing purposes

4 Requirements

4.1 General

The following requirements have been prepared in order that the products covered by this standard are designed and manufactured to contribute to the safety of the users, provided they are used by persons skilled for live working, in accordance with safe methods of work and the instructions for use.

All bolts used to join two parts together shall be of suitable and sufficient mechanical strength both in tension and shear for that purpose.

Devices subjected to tensile or compressive forces when in use shall be designed in such a way that the force shall be exerted along the axis of the stick.

The method for fixing the device shall ensure that it cannot become accidentally detached when in use.

The method for fixing the device shall be designed and constructed to allow the angle formed by the axis of the stick and the device fitted to it to be adjusted in steps of 30°. Two examples of such a system are shown in Annex A.

4.2 Dimensional and mechanical requirements

4.2.1 Dimensional requirements

For each type of device complying with this part of the standard, the manufacturer shall provide in writing the rated dimensions and parameters relating directly to its specific functions.

NOTE Conducting devices should be designed to be as small as possible consistent with their proper functioning to reduce the risk of short-circuits.

4.2.2 Mechanical requirements

For each type of device complying with this part of the standard, the manufacturer shall provide in writing the rated values corresponding to the characteristics specified in Tables 1 and 2.

Conductor cleaning brushes shall resist uses under low and high temperature conditions.

NOTE 1 A cold crushing test and a hot crushing test of the brush are included in 5.6.4.3.

NOTE 2 In general, for other devices intended to be used in unusual atmospheric conditions (very high or very low temperature or relative humidity), the client should discuss with the manufacturer the interest of performing more restricting mechanical tests in appropriate conditions.

Only visual inspection (see 5.2), dimensional check (see 5.3) and compatibility check (see 5.4) are required for the following devices:

- Positive grip clamp stick head
- Shepherd's hook
- Ball-socket adjuster
- Fixed double-prong head
- Retaining device installer (cotter key installer)
- Insulator ball guide
- Hammer
- Self-aligning fuse puller
- Screw clamp
- Spiral disconnect
- Pruning saw
- Screwdriver
- Conductor polisher

Table 1 – Mechanical characteristics of splined end devices (to be supplied by the manufacturer)

Characteristics	Type of devices					
	Hook stick adaptor and universal adaptor	Formed-wire ring	Locating drift	Conductor cleaning brush	Holding fork	Spanner (wrench)
T_N	X					X
F_{TN}	X					
F_{BN}			X		X	
Specific characteristics		Tension strength of the spigot		Resistance to crushing F_{CN}		

Characteristics	Type of devices										
	Retaining pin remover				Retaining device installer or retaining device installer/ remover	Binding wire cutter blade (tie wire cutter)	Rotary blade	Rotary prong	Adjustable pliers	Vice-grip pliers	Adjustable insulator fork
	Spiral type	Fine point type	Cam type (pry type)	Snap-out type							
T_N	X	X									X
F_{TN}				X			X	X			
F_{BN}			X		X	X			X	X	X
			X Rated distance for the bending								
Specific characteristics				Rated return force F_R					Tightening capability	Tightening capability	Strength of the articulation

Characteristics	Type of devices							
	All-angle pliers	Pin holder	Flexible spanner head (flexible wrench head)	Ammeter holder	Anti-interference braid applicator	Hack saw	Conductor gauge	Gap gauge
T_N			X	X				
F_{TN}								X
F_{BN}	X	X			X	X		
Specific characteristics	Tightening strength						Resistance to distortion	

Table 2 – Mechanical characteristics of clevis and tongue stick devices (to be supplied by the manufacturer)

Characteristics	Type of devices					
	Clevis eye attachment	Tension link tongue attachment	Clevis-tongue adaptor	Clevis-tongue extension	Roller tongue attachment	Clevis screw adaptor
F_{TN}	X	X	X	X	X	X

4.3 Mechanical protection

When necessary, the ends of each device shall have adequate means for mechanical protection, such as an end-cap. Metal devices shall be carefully designed to ensure that all edges are rounded where this does not impair the function of the device.

4.4 Protection against corrosion

Metal parts shall be protected against corrosion either by their composition or by the use of a suitable surface treatment.

4.5 Marking

Each device shall be marked with the following permanent items of marking:

- manufacturer's name or trademark;
- type reference;
- year and (if possible) month of manufacture;
- symbol IEC 60417-5216 (2002-10) – Suitable for live working; double triangle (see Annex B);

  NOTE The exact ratio of the height of the figure to the base of the triangle is 1,43. For the purpose of convenience, this ratio can be between the values of 1,4 and 1,5.

- number of the relevant IEC standard immediately adjacent to the symbol (IEC 60832-2).

The marking shall be durable, clearly visible and legible to a person with normal or corrected vision without additional magnification.

Other characteristics or information not needed at the work location, like the year of publication of the standard, shall be associated to the product item by other means, such as coded information (bar codes, microchips, etc.), or shall be associated to its packaging.

4.6 Instructions for use

Each device shall be supplied with the manufacturer's written instructions for use and care.

These instructions shall be prepared in accordance with the general provisions given in IEC 61477.

These instructions shall include as a minimum, recommendations for maximum mechanical load (see 4.2.2), cleaning, storage and transportation, periodic testing, possible repair and disposal of the device.

5 Tests

5.1 General

The present standard provides testing provisions to demonstrate compliance of the product to the requirements of Clause 4. These testing provisions are primarily intended to be used as type tests for validation of the design input. Where relevant, alternative means (calculation, examination, tests, etc.), are specified within the test subclauses for the purpose of devices having completed the production phase.

To show compliance with this part of the standard, the manufacturer shall prove that the type tests referred to in Tables C.1 and C.2 have been successfully carried out on at least three devices of each type.

However, when differences between various types of devices are limited in number, tests that are unaffected by the differing characteristics of the device can be carried out on a single type of device and the results can be used for the other types of device.

The tests referred to in Tables C.1 and C.2 shall be performed in the specified numbered order.

The required values of mechanical forces specified in Clause 5 shall be reached using a rate of increase between 1 % and 10 % of the rated force per second. The forces shall be applied with an accuracy of ±5 %.

NOTE For example, if the rated tensile force stated by the manufacturer for a given tool is F_{TN} = 100 N, the rate of increase will be between 1 N/s and 10 N/s and the applied force to the device will be between 95 N and 105 N.

The dimensions specified in mm in Clause 5 shall be verified with an accuracy of ±2 %.

Unless otherwise specified, room temperature shall be (25 ± 10) °C.

When visual inspection is specified, it shall be understood to be visual inspection by a person with normal or corrected vision without additional magnification.

5.2 Visual inspection

Each device shall be visually inspected to detect manufacturing defaults and to check proper functioning and compliance with requirements included in 4.3, 4.4 and 4.5 where applicable.

5.3 Dimensional check

Each device shall be measured to ensure that its dimensions match the manufacturer's rated dimensions.

5.4 Compatibility check

It shall be verified by attaching each attachment system that each type fits properly and securely on the stick for which it has been designed for.

5.5 Durability of marking

The durability of the marking shall be verified by thoroughly cleaning the marking for at least 1 min with a piece of lint-free cloth dampened with water and then rubbing it vigorously for a further minimum of 1 min with a piece of lint-free cloth dampened with isopropanol (CH_3-CH(OH)-CH_3).

NOTE 1 It is the employer's duty to ensure that any relevant legislation and any specific safety instructions regarding the use of isopropanol are fully observed.

The test shall be considered as passed if the marking remains legible and the letters do not smear.

The surface of the tool may change. No signs of loosening shall be present for labels.

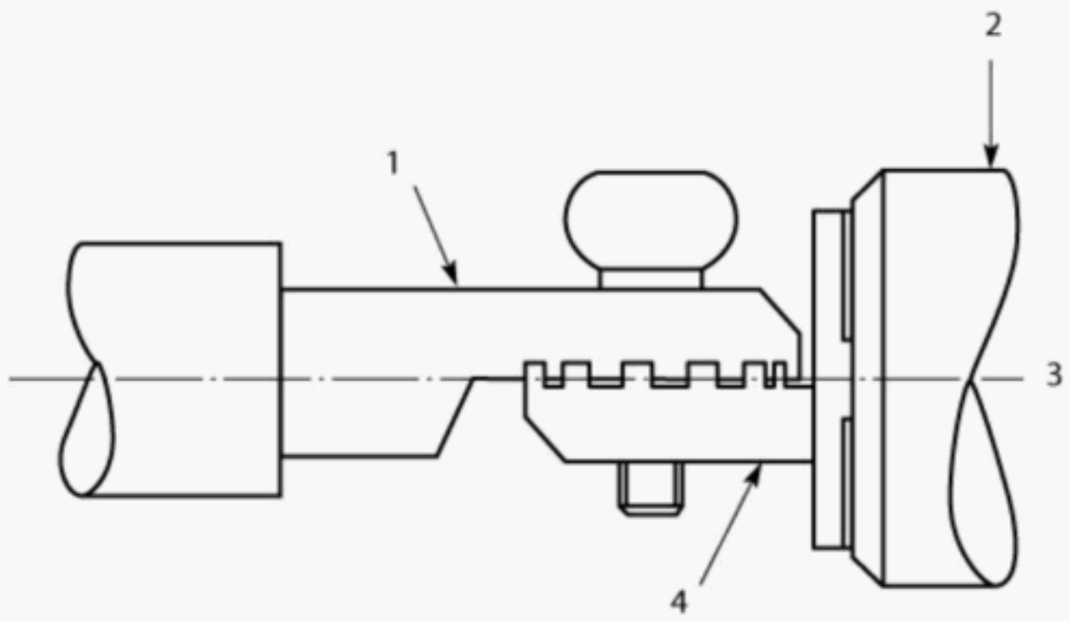
NOTE 2 Markings made by moulding or engraving need not be subjected to this test.

5.6 Mechanical tests and specific tests

5.6.1 Universal adaptor and hook stick adaptor

5.6.1.1 Torsion of the adaptor

The adaptor shall be fitted to a stick for which it is designed, and the assembly shall be fitted to the test part shown in Figure 1. The wing screw shall be tightened with a torque of 3 N·m.



Key

1 test part

2 head of hook stick

3 direction of tension / axis of torque

4 adaptor

Figure 1 – Test set-up for a hook stick adaptor – Torsion and tension of the adaptor

A torque shall be applied around the axis of the universal hand stick or hook stick and progressively increased up to a value of 1,25 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

The torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.1.2 Tension of the adaptor

The adaptor shall be fitted to a stick for which it is designed, and the assembly shall be attached to the test part shown in Figure 1. The wing screw shall be tightened with a torque of 3 N·m.

A tensile force shall be applied along the axis of the universal hand stick or retractable hook stick and progressively increased up to a value of 1,25 F_{TN} and then maintained at this value for a period of not less than 1 min.

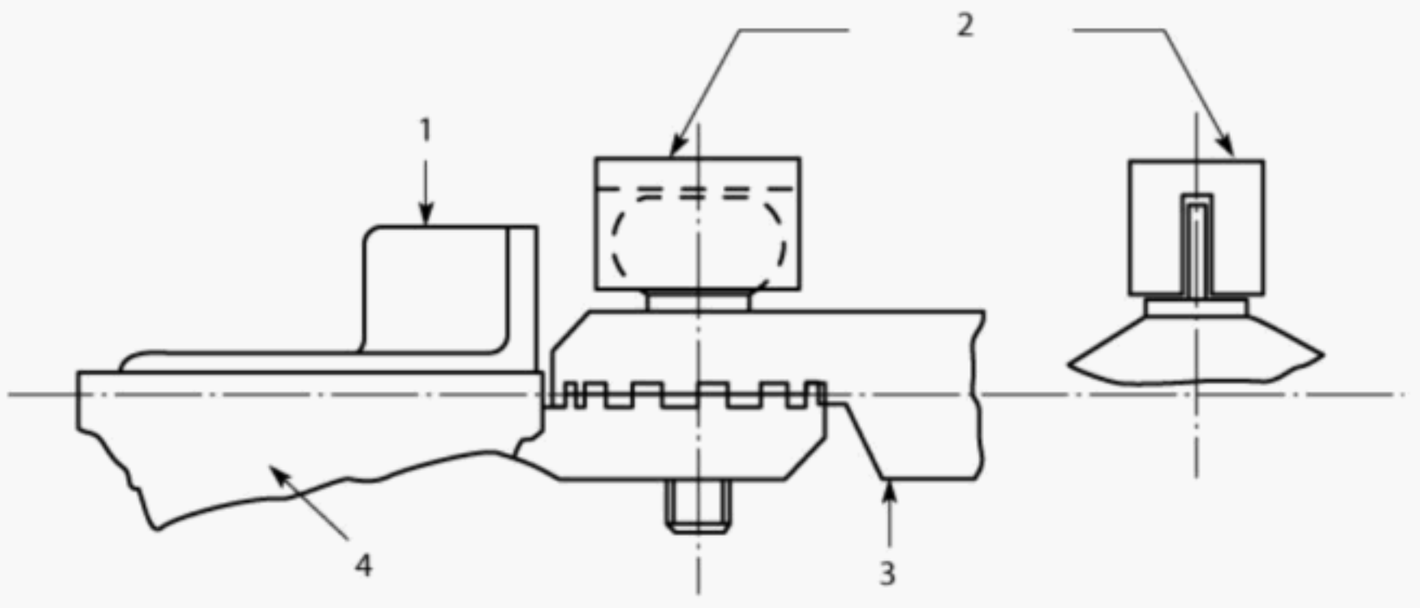
The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A tensile force shall be applied again in the same manner as above using a maximum value of tensile force of 2,5 F_{TN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.1.3 Torsion of the wing screw

The adaptor shall be fitted to the test part (see Figure 2).



Key

1 fixed adaptor

2 test cap piece on the head

3 universal end fitting to ensure the clamping

4 vice

Figure 2 – Universal adaptor and hook stick adaptor – Torsion of the wing screw

A torque shall be applied to the wing screw up to a value of 1,25 times the rated torque of 3 N·m and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is observed after the test.

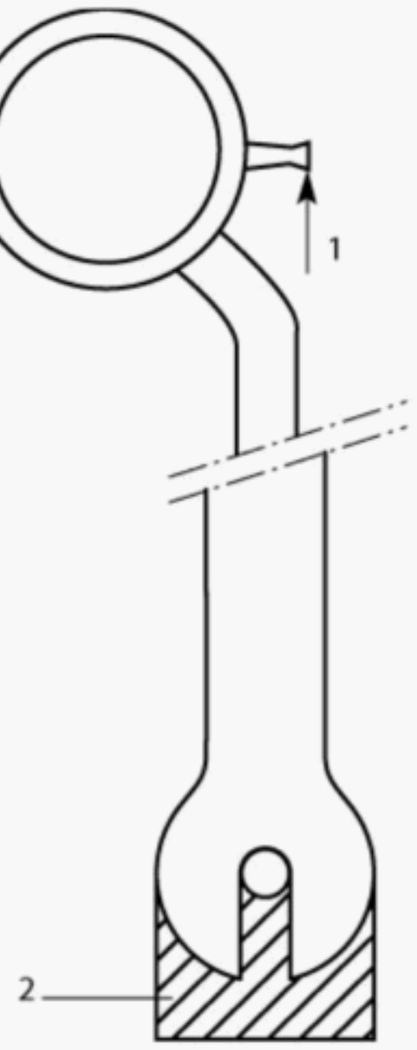
The torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 times the rated torque of 3 N·m and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.2 Formed-wire ring – Tension of the spigot

A ring shall be fixed by means of its attachment system (on a universal hand stick for example).

A tensile force shall be applied to the spigot and progressively increased (see Figure 3) up to a value of 1,25 times the tension strength of the spigot supplied by the manufacturer, and then maintained at this value for a period of not less than 1 min.



IEC 178/10

Key

1 spigot

2 support

Figure 3 – Formed-wire ring – Tension of the spigot

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A tensile force shall be again applied in the same manner as above using a maximum value of tensile force of 2,5 times the tension strength of the spigot supplied by the manufacturer, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.3 Locating drift – Bending test

The locating drift shall be placed in the test device shown in Figure 4.

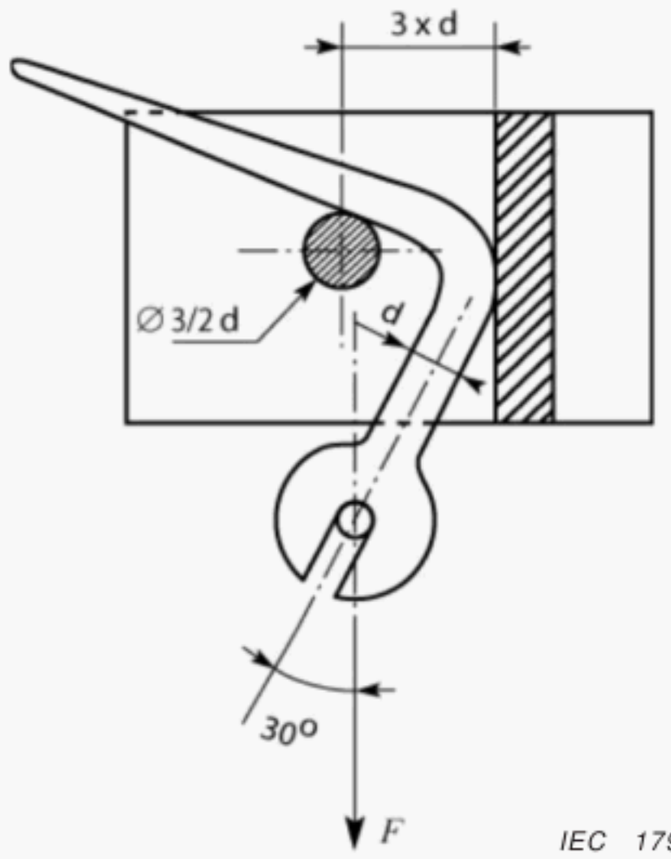


Figure 4 – Locating drift – Bending test

A bending force shall be applied and progressively increased along the axis of the attachment system up to a value of 1,25 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A bending force shall be applied again in the same manner as above using a maximum value of bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

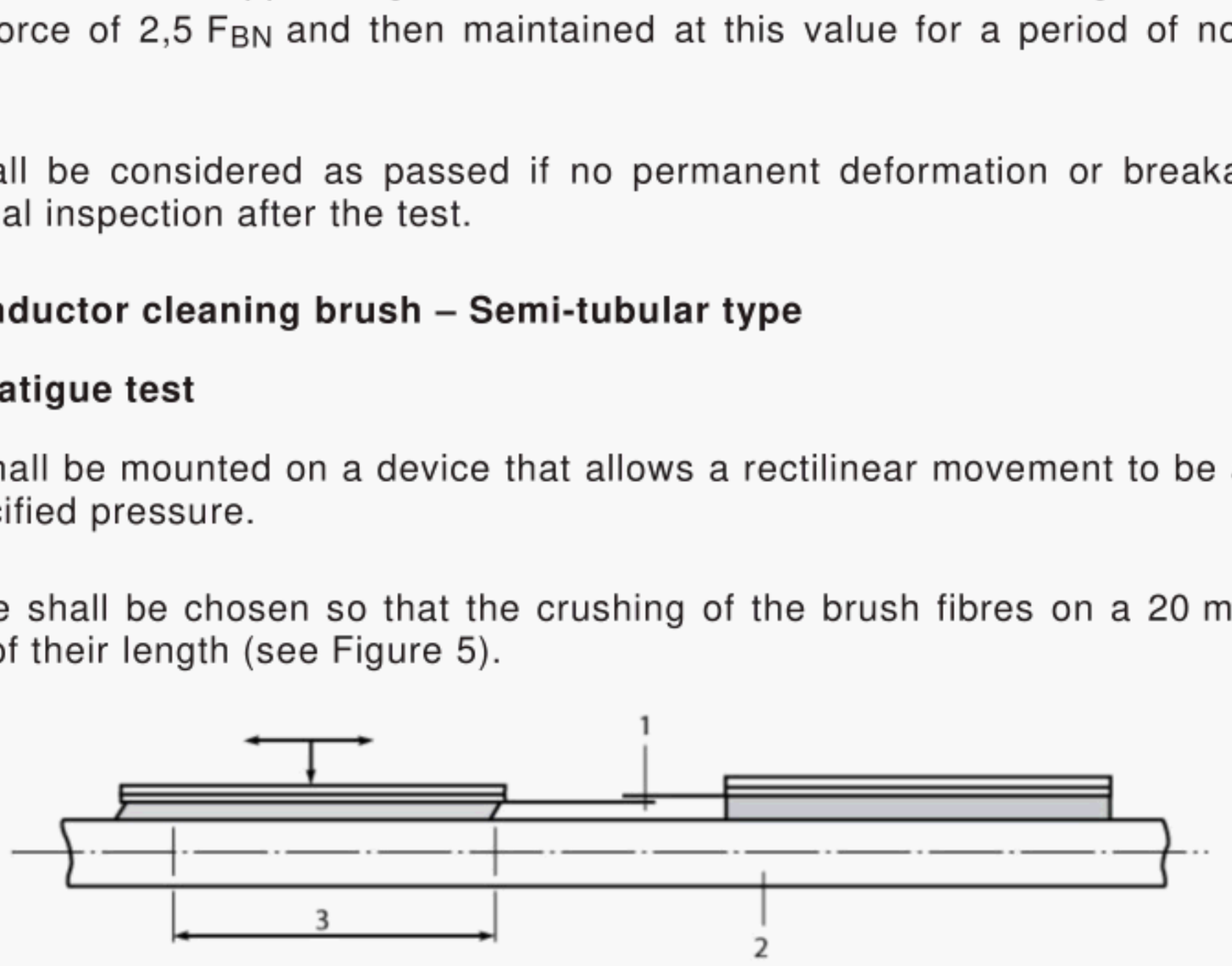
The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.4 Conductor cleaning brush – Semi-tubular type

5.6.4.1 Fatigue test

The brush shall be mounted on a device that allows a rectilinear movement to be applied to it under a specified pressure.

The pressure shall be chosen so that the crushing of the brush fibres on a 20 mm diameter bar is 10 % of their length (see Figure 5).



Key

1 crushing

2 metal bar

3 stroke 100 mm

Figure 5 – Conductor cleaning brush – Fatigue test on semi-tubular type

3 000 movement cycles shall be applied to the brush: each cycle shall be a complete movement to-and-fro.

Stroke: 100 mm ± 10 mm

Frequency: (50 ± 2) movement cycles/min.

The test shall be performed with a brass bar, then with a copper bar (3 000 cycles each time).

The test shall be considered as passed if the brush fibres and the brush keep their efficiency.

5.6.4.2 Articulation test

The body of the brush shall be fixed. Force shall be applied and increased progressively on the attachment system until it rotates in relation to the body of the brush.

The test shall be considered as passed if this rotation occurs at a value of force between 0,1 N·m and 0,15 N·m.

5.6.4.3 Crushing tests

5.6.4.3.1 Cold crushing test

The conditioning details shall comply with IEC 60212. The brushes shall be placed in a conditioning chamber (code 6h/–10C).

Then a crushing test shall be performed for a period of 1 h at a temperature of 10 °C in the open position (see Figure 6), by applying a force of 2,5 F_{CN} on the body of the brush.

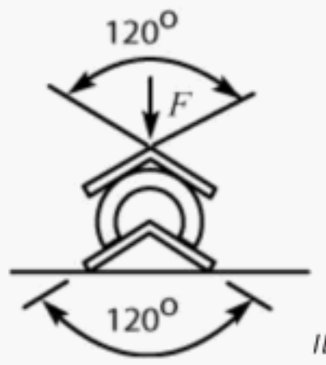


Figure 6 – Conductor cleaning brush – Semi-tubular type – Crushing test

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.4.3.2 Hot crushing test

The conditioning details shall comply with IEC 60212. The brushes shall be placed in a conditioning chamber (code 4h/55C/20 %).

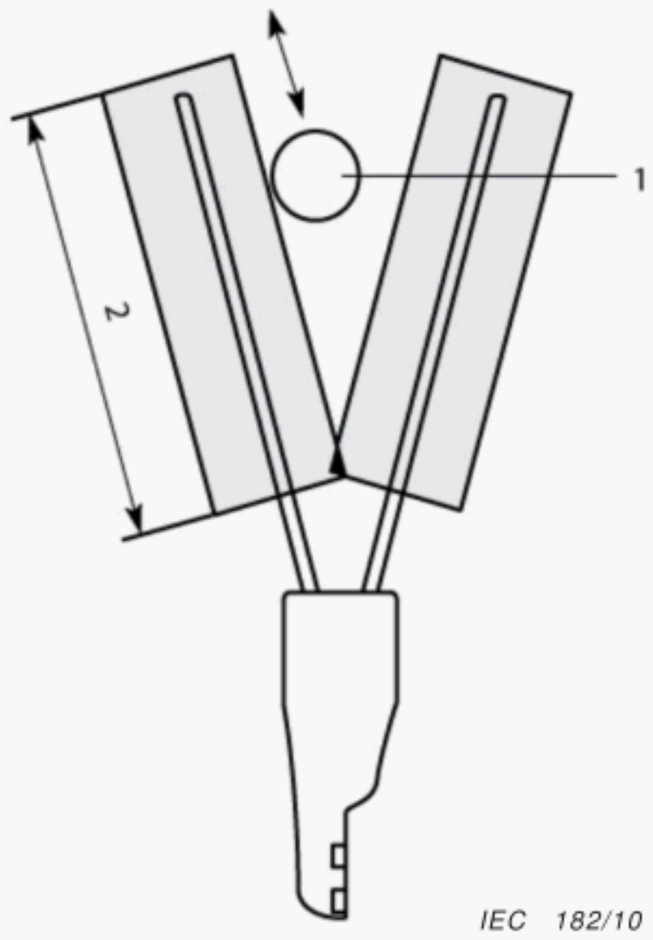
Then a crushing test shall be performed for a period of 1 h at 55 °C and 20 % relative humidity in the open position (see Figure 6), by applying a force of 2,5 F_{CN} on the body of the brush.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

The test shall be considered as passed if when the force is removed, the brush regains its initial size at room temperature (code M/23C/50 %).

5.6.5 Conductor cleaning brush – V-shaped type – Fatigue test

The test shall be identical to the fatigue test for the semi-tubular type brush but as shown in Figure 7.



Key

1 metal bar

2 stroke 100 mm

Figure 7 – Conductor cleaning brush – V-shaped type – Fatigue test

5.6.6 Oilcan – Functioning of the operating lever

The tank shall be filled with oil. The oilcan shall be kept vertical.

A steadily increasing force shall be applied to the end of the operating lever until a jet of oil comes out of the spout.

This shall occur at a value of applied force of between 15 N and 50 N.

A force of 150 N shall be then applied to the lever in the same way as above.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

Then the tank shall be emptied almost entirely using the operating lever, and the operating force shall be measured. The value of the force measured shall remain between 15 N and 50 N.

5.6.7 Ratchet spanner (ratchet wrench) – Friction

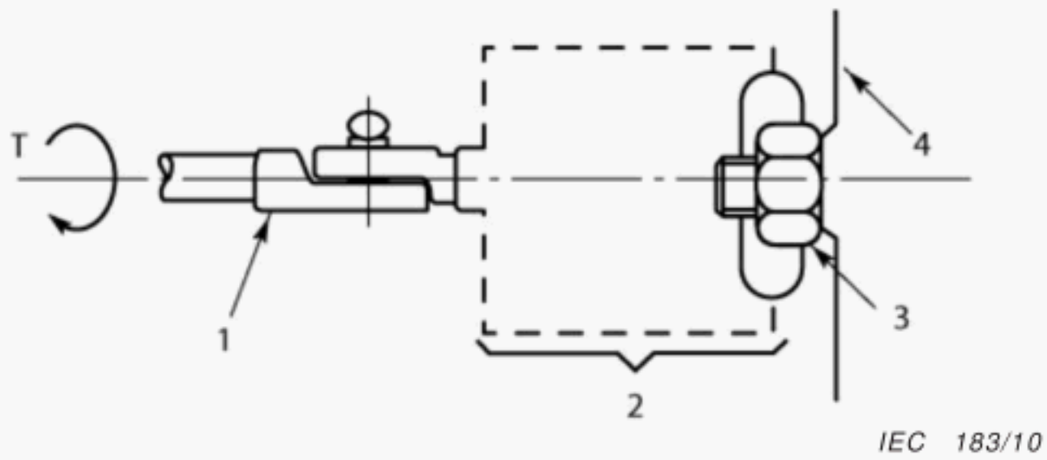
This test applies only to devices without external adjustment.

The body of the ratchet spanner shall be fixed. A force shall be applied to the attachment system and progressively increased until it rotates smoothly.

The test shall be considered as passed if this rotation occurs at a value of torque of between 2 N·m and 3 N·m.

5.6.8 Spanner (wrench) – Torsion test

The spanner shall engage a nut which cannot rotate (see Figure 8). The attachment system of the spanner shall be mounted on the attachment system of a universal hand stick, and the screw shall be tightened with a torque of 10 N·m.



Key

1 stick end fitting

2 spanner

3 nut

4 device for holding lock nut

T torque

Figure 8 – Spanner (wrench) – Torsion test

A torque shall be applied to the attachment system and progressively increased up to a value of 1,25 T_N, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.9 Retaining pin remover

The test provisions applicable to different types of pin removers are given below.

a) Spiral type

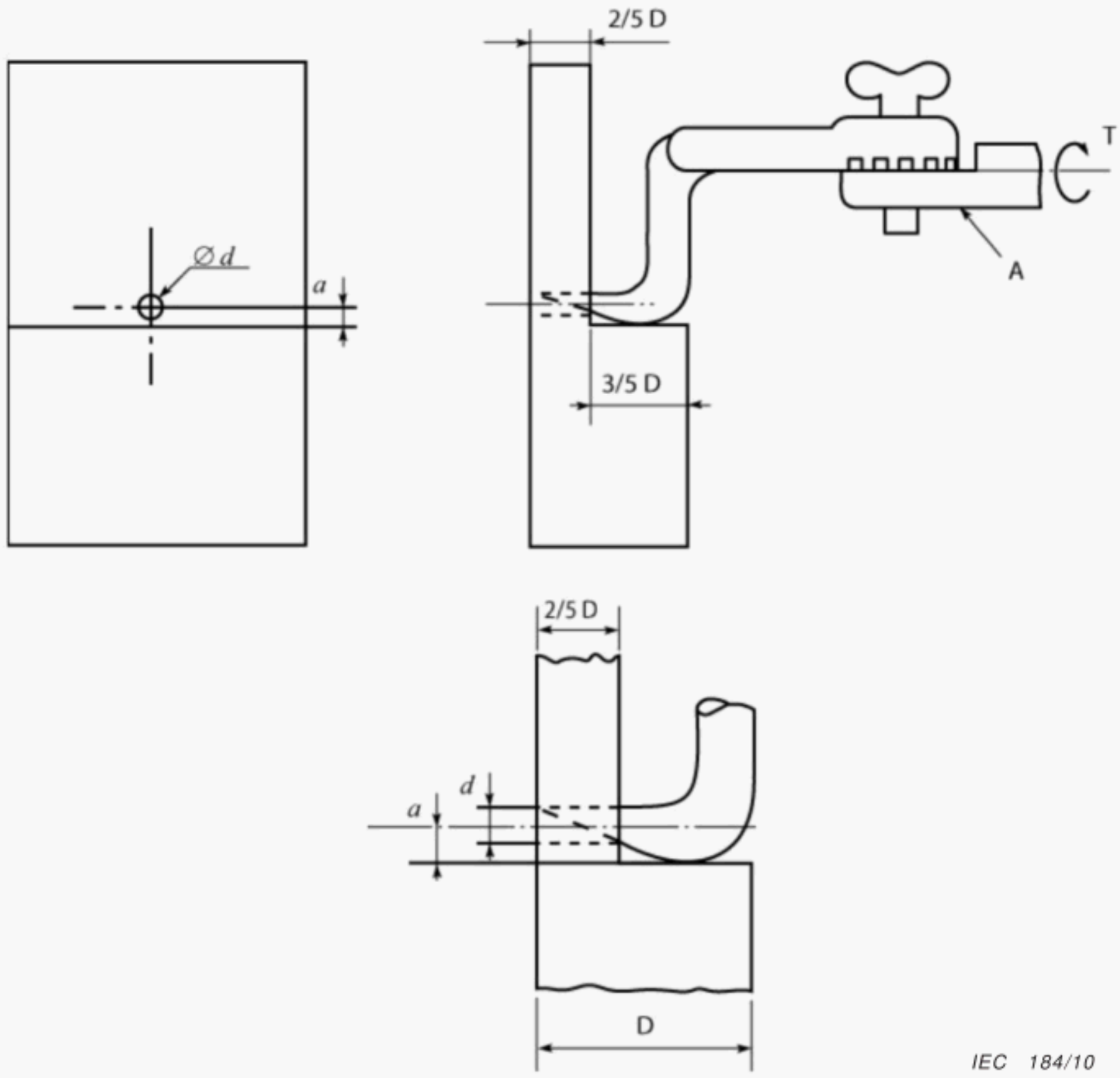
The point of the retaining pin remover shall be inserted into a hole d (mm) in diameter that has been drilled in a plate that has a hardness index greater than that of the device. A metal plate shall be fixed a mm underneath the centre line of the hole, and the device shall be brought into contact with this supporting plate (see Figure 9).

A torque shall be applied to the attachment system using a lever attached to it (an universal hand stick for example) and progressively increased up to a value of 1,25 T_N, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.



Key

A test part

T torque

Figure 9 – Spiral type retaining pin remover – Torsion test

b) Fine point type

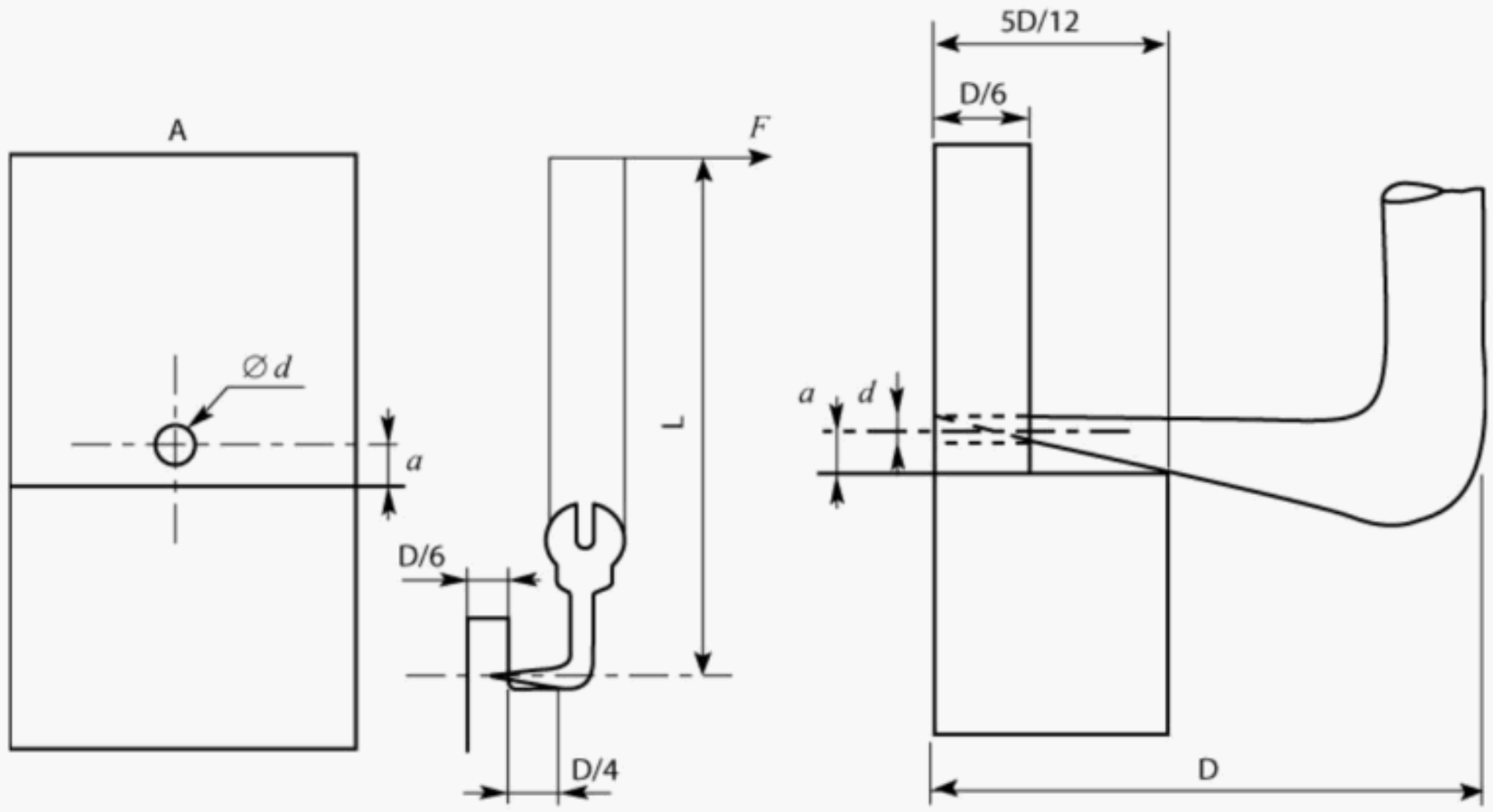
The point of the retaining pin remover shall be inserted into a hole d (mm) in diameter that has been drilled in a plate that has a hardness index greater than that of the device. A metal plate shall be fixed a mm underneath the centre line of the hole; the device shall be brought into contact with this supporting plate (see Figure 10).

A torque shall be applied to the attachment system using a lever attached to it (an universal hand stick for example) and progressively increased up to a value of 1,25 T_N, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.



IEC 185/10

Key

A test part

L lever arm 1 m

Figure 10 – Fine-point type retaining pin remover – Torsion test

c) Cam type (pry type)

Friction

One complete turn of the attachment system shall be used to determine the lowest torque value causing the system to rotate and the maximum value required to maintain this rotation.

The test shall be considered as passed if rotation occurs at a value of torque of between 0,5 N·m and 1,5 N·m.

Bending

Let “a” be the manufacturer’s distance rating (see Figure 11). The point of the retaining pin remover shall be inserted into a hole d (mm) in diameter that has been drilled in a plate with a hardness index greater than that of the device. A supporting plate shall be fixed to this plate so that the cams are put in contact with the supporting plate (see Figure 11).

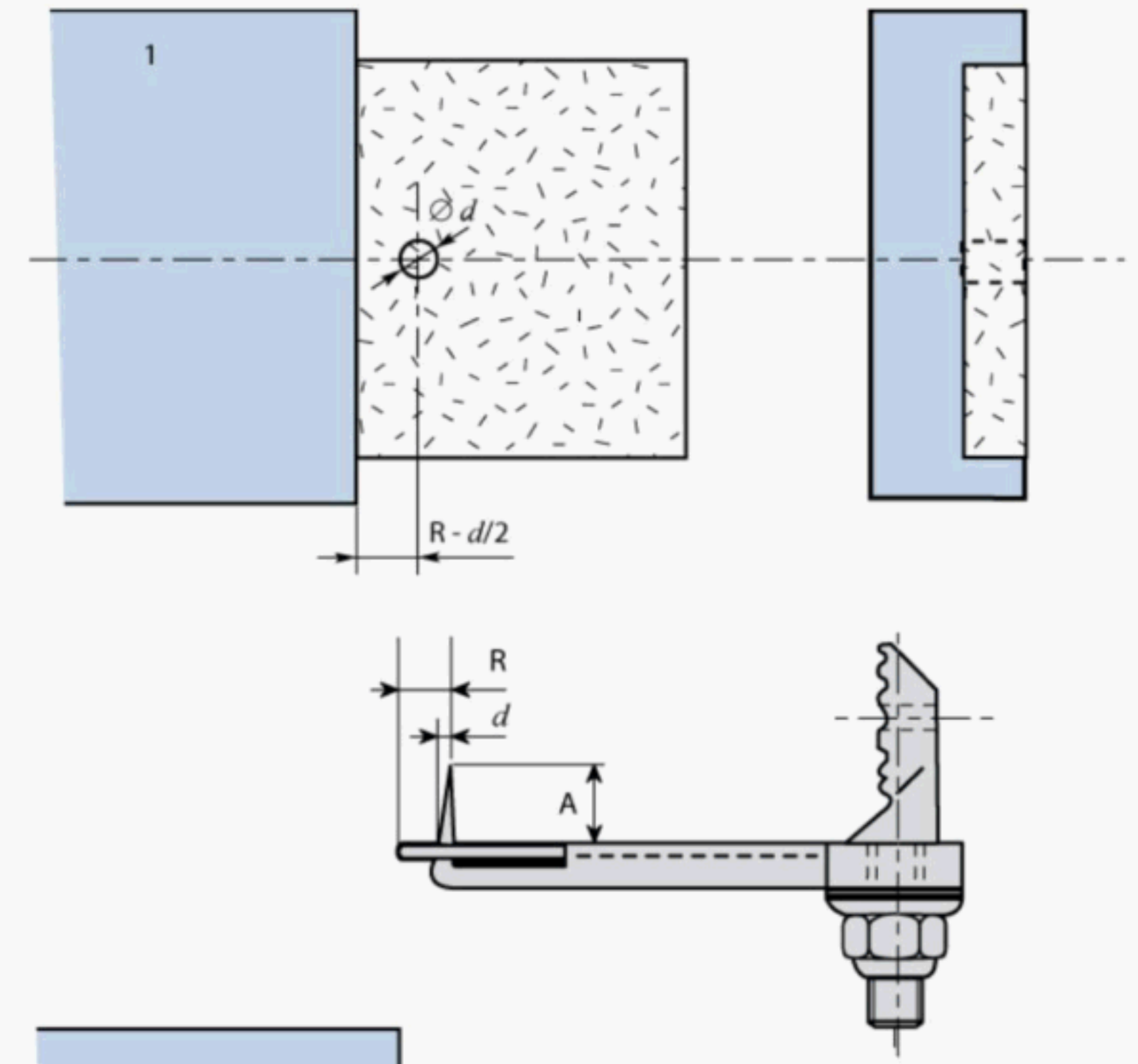
A bending force shall be applied at the rated distance a mm from the point of the device and progressively increased up to a value of 1,25 F_{BN} and then maintained at this value for a period of not less than 1 min.

The point of the device shall not come out of the hole.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A bending force shall be applied again from a distance of a mm in the same manner as above using a maximum value of bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.



Key

1 supporting plate

Figure 11 – Cam type (pry type) retaining pin remover – Bending test

d) Snap-out type

Measuring the return force:

Let F_R be the rated return force value for the spring specified by the manufacturer. The minimum force required to bring the device to the end of its travel shall be measured.

The test shall be considered as passed if the measured value is within the values of $F_R \pm 20$ %.

Tension:

The snap-out type retaining pin remover shall be attached to a test part made with an attachment system.

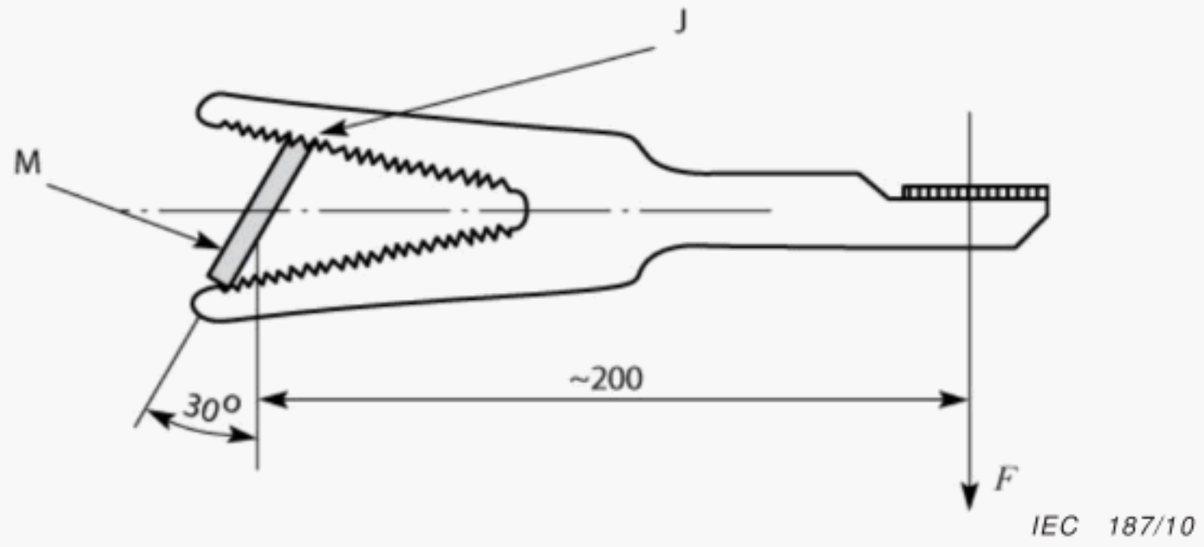
A force of 2,5 F_{TN} shall be applied to the conical point of the device using an axis 8 mm in diameter.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.10 Holding fork – Bending test

A flat metal plate shall be held firmly in place. The flat metal plate is jammed between the jaws of the holding fork, as show in Figure 12.

Dimensions in millimetres



Key

M flat metal plate measuring 39 mm × 5 mm held firmly in place

J jammed between the jaws

Figure 12 – Holding fork – Bending test

A bending force shall be applied and progressively increased in the axis of the attachment system up to a value of 1,25 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test. The fork shall neither open nor slip.

A bending force shall be applied again in the same manner as above using a maximum bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.11 Retaining device installer/remover – Bending test

5.6.11.1 Test on the removing part

The device shall be mounted on an attachment system which shall be securely fixed in place. The wing screw shall be tightened with a torque of 3 N·m. The device shall be positioned as shown in Figure 13a.

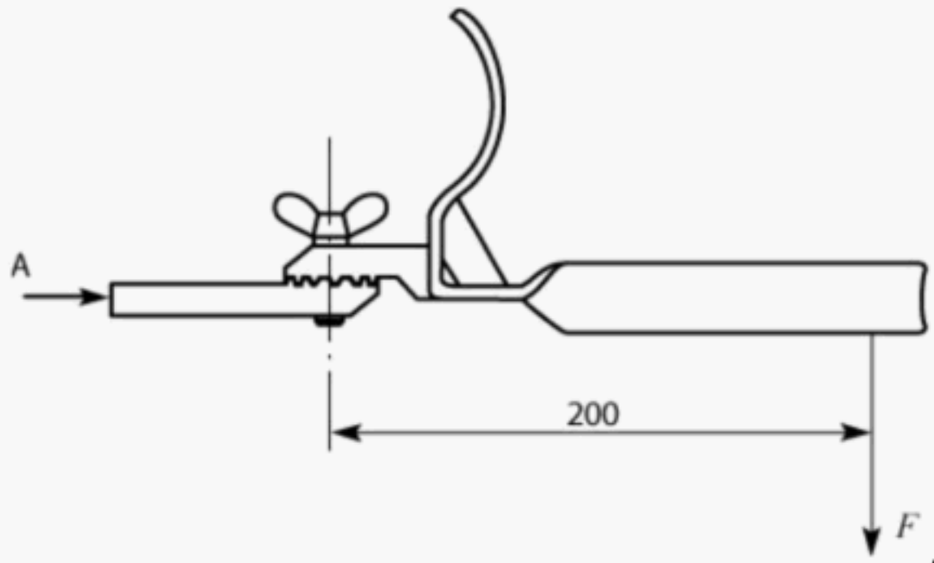
A bending force shall be applied 200 mm from the axis of the attachment system and progressively increased up to a value of 1,25 F_{BN}, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

5.6.11.2 Test on the installing part

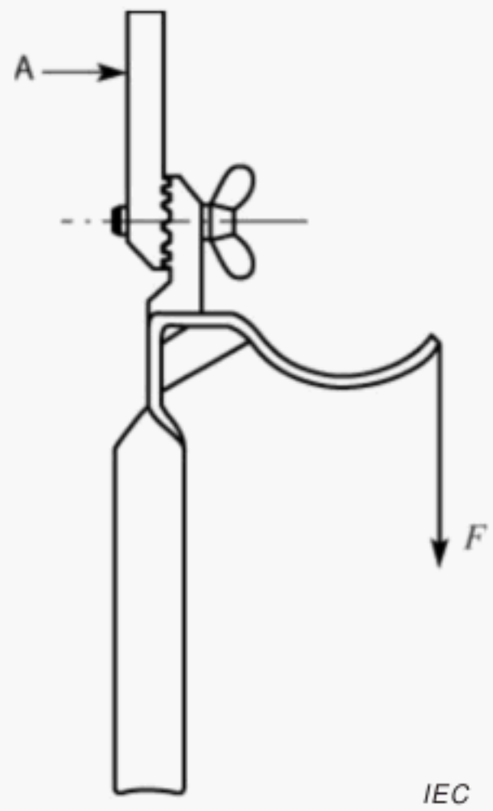
Another device shall be attached as shown in Figure 13b.

Dimensions in millimetres



IEC 188/10

Figure 13a – Bending test for removing part



IEC 189/10

Figure 13b – Bending test for installing part

Key

A attachment system

Figure 13 – Retaining device installer/remover – Bending test

A bending force shall be applied to the end of the "installing" part of the device and progressively increased up to a value of 1,25 F_{BN}, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

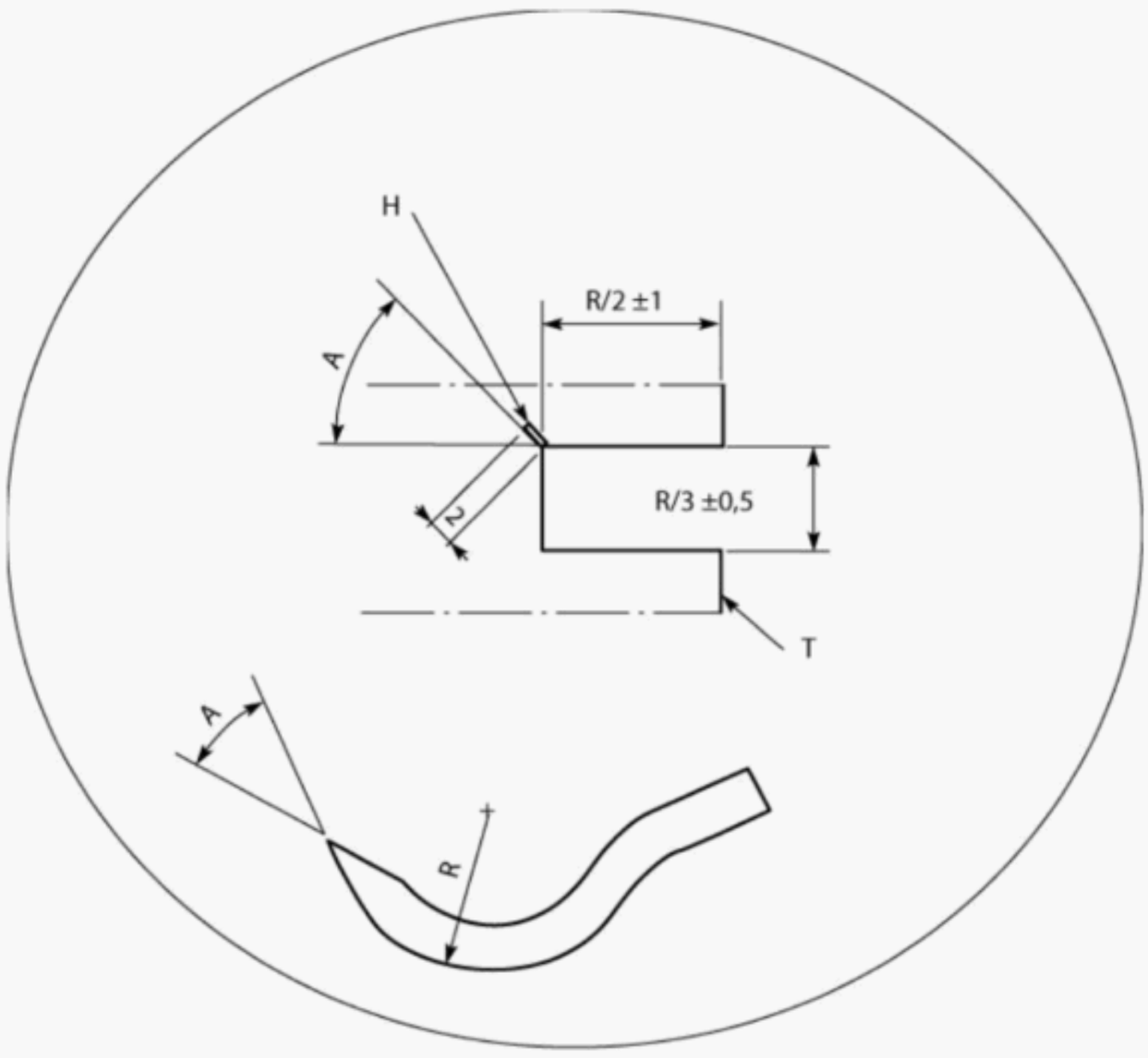
A bending force shall be applied again in the same manner as above using a maximum value of bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage occurs or is seen during a visual inspection after the test.

5.6.12 Binding wire cutter blade (tie wire cutter) – Bending test

The device shall be fitted to a stick for which it is designed and the tie wire cutter blade shall be inserted into the notch of the test device (see Figure 14).

A bending force shall be applied to it (see Figure 14) and progressively increased up to a value of 1,25 F_{BN} and then maintained at this value for a period of not less than 1 min.



Key

T test device (R/2 mm thick) tightly clamped

H hack saw mark

C tie wire cutter inserted in the notch

Figure 14 – Binding wire cutter blade (tie wire cutter) – Bending test

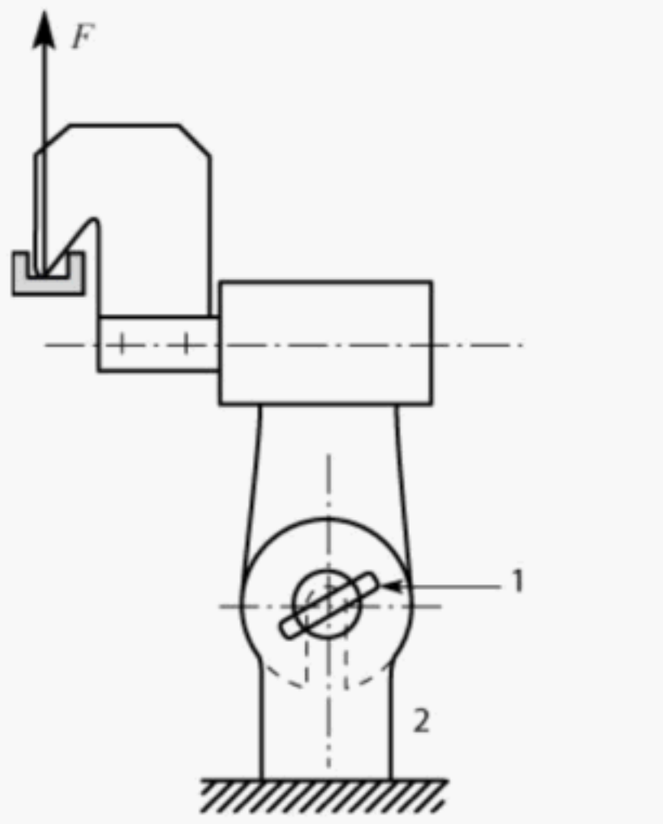
The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A bending force shall be applied again in the same manner as above using a maximum value of bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage occurs or is seen during a visual inspection after the test.

5.6.13 Rotary blade – Tension test

With the attachment system of the rotary blade attached to the attachment system of the test device, tensile force shall be applied to the blade (see Figure 15), and progressively increased up to a value of 1,25 F_{TN}, and then maintained at this value for a period of not less than 1 min.



IEC 191/10

Key

1 tightening screw

2 attachment system of the test device

Figure 15 – Rotary blade – Tension test

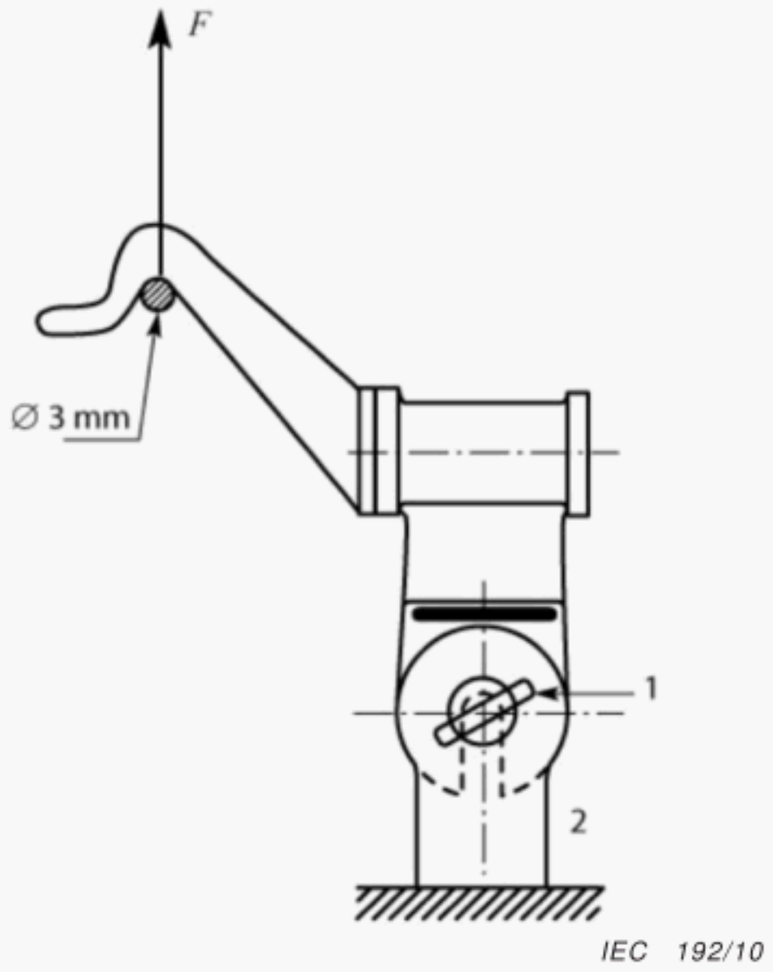
The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test. The rotary blade shall rotate without difficulty.

A tensile force shall be applied again in the same manner as above using a maximum value of tensile force of 2,5 F_{TN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage occurs or is seen during a visual inspection after the test.

5.6.14 Rotary prong – Tension test

The same test shall be used as for the rotary blade, but applied as shown in Figure 16.



Key

1 tightening screw

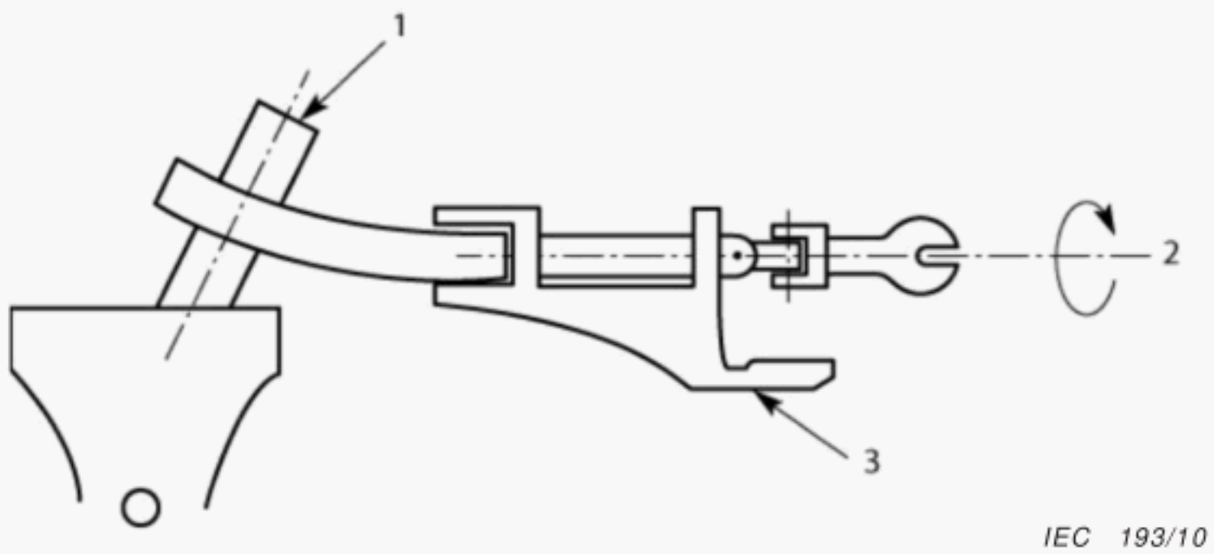
2 attachment system of the test device

Figure 16 – Rotary prong – Tension test

5.6.15 Adjustable pliers

5.6.15.1 Tightening capability

A metal rod 20 mm in diameter shall be placed between the jaws of the pliers under test as shown in Figure 17.



Key

1 tightly clamped rod 20 mm diameter

2 coupling force exerted horizontally

3 horizontal part

Figure 17 – Adjustable pliers – Tightening capability

A torque shall be applied to the attachment system that is interdependent with the gear in the longitudinal axis of the pliers and progressively increased up to a value of 1,25 T_N, and then maintained at this value for a period of not less than 1 min.

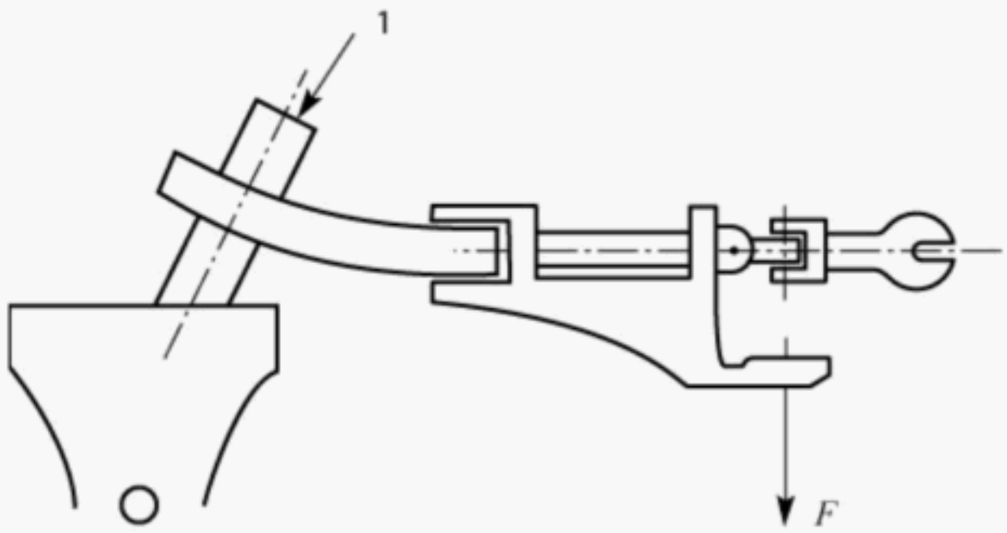
The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.15.2 Bending test

A metal rod 20 mm in diameter shall be clamped firmly between the jaws of the pliers, as shown in Figure 18, using a torque of 35 N·m.



Key

1 tightly clamped rod 20 mm diameter

Figure 18 – Adjustable pliers – Bending test

A bending force F shall be applied to the attachment system and progressively increased up to a value of 1,25 F_{BN}, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

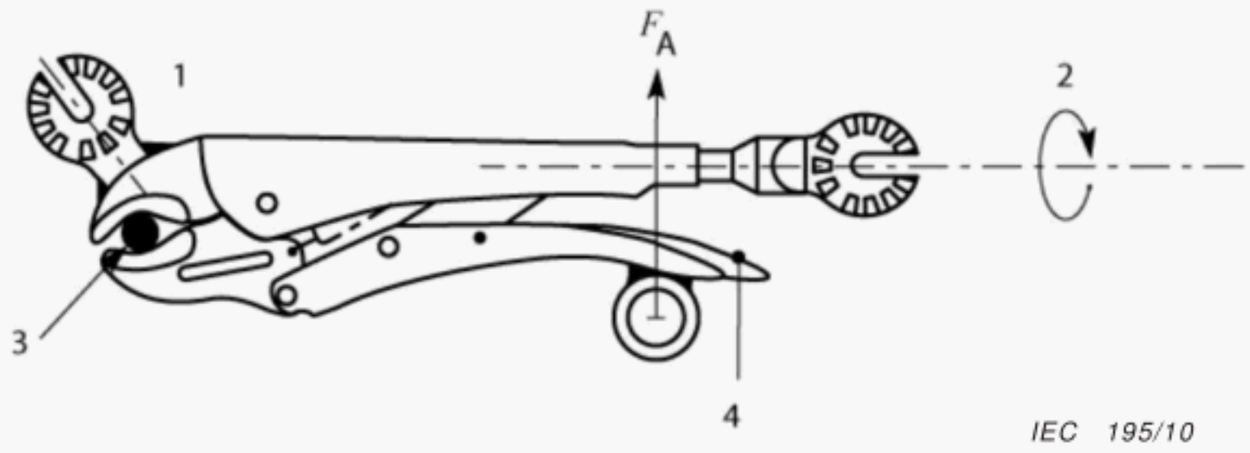
A bending force F shall be applied again in the same manner as above using a maximum value of bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.16 Vice-grip pliers

5.6.16.1 Tightening capability

A metal rod 20 mm in diameter shall be placed between the jaws of the pliers (see Figure 19).



Key

FA blocking force for the handle

1 vice-grip pliers

2 coupling force axis

3 metal rod 20 mm in diameter

4 point of application of force to unblock the handle

Figure 19 – Vice-grip pliers – Tightening capability – Blocking and unblocking of the handle

A torque shall be applied to the screw end of the vice-grip pliers in its longitudinal axis and progressively increased up to a value of 1,25 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.16.2 Blocking the handle

A metal rod 20 mm in diameter shall be placed between the jaws of the pliers (see Figure 19). The screw shall be tightened using a torque of 0,25 T_N, with the cam tightening handle in the open position.

The cam tightening handle shall be then tightened with a clamp so as to apply the force required to close it, (see Figure 19). The force F_A exerted by this clamp required to close the jaws until they are blocked (beyond the tip of the cam) shall be measured.

The test shall be considered as passed if the measured force does not exceed 200 N.

5.6.16.3 Unblocking the handle

When the handle blocking test is over, the clamp shall be removed. Separating pliers shall be placed as shown in Figure 19, to allow the vice-grip pliers to be opened by operating the cam tightening handle and the force required to achieve this shall be measured.

The test shall be considered as passed if the measured force on the cam tightening handle to free the grip of the jaws on the metal rod is less than 100 N.

5.6.16.4 Bending test

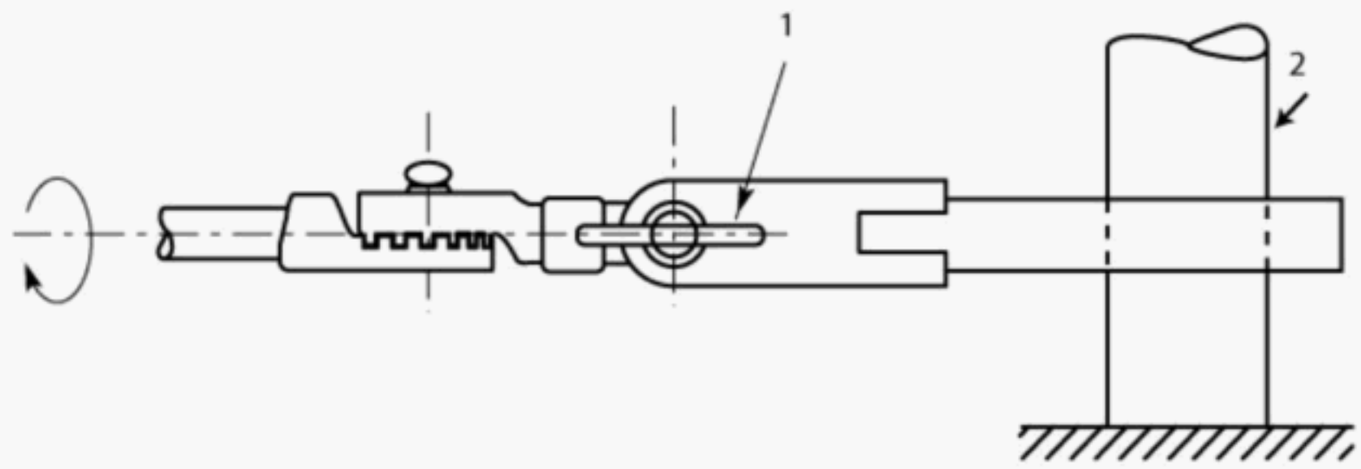
The vice-grip pliers shall be installed again on the 20 mm diameter metal rod that has now been positioned in a fixed support using a screw torque of T_N and over-centre handle force to close the pliers. The test shall be continued in the same manner as that for adjustable pliers described in 5.6.15.2.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.17 Adjustable insulator fork

5.6.17.1 Torsion of the attachment system

A tube of suitable diameter shall be clamped in the fork. The attachment system of the device shall be securely mounted in line with the fork on a stick for which it is designed. In case of a universal hand stick, the wing screw shall be tightened with a torque of 10 N·m (see Figure 20).



IEC 196/10

Key

1 flat-fork clamped on the tube

2 tube

Figure 20 – Adjustable insulator fork – Torsion of the attachment system

A torque shall be applied and progressively increased up to a value of 1,25 T_N and then maintained at this value for a period of not less than 1 min.

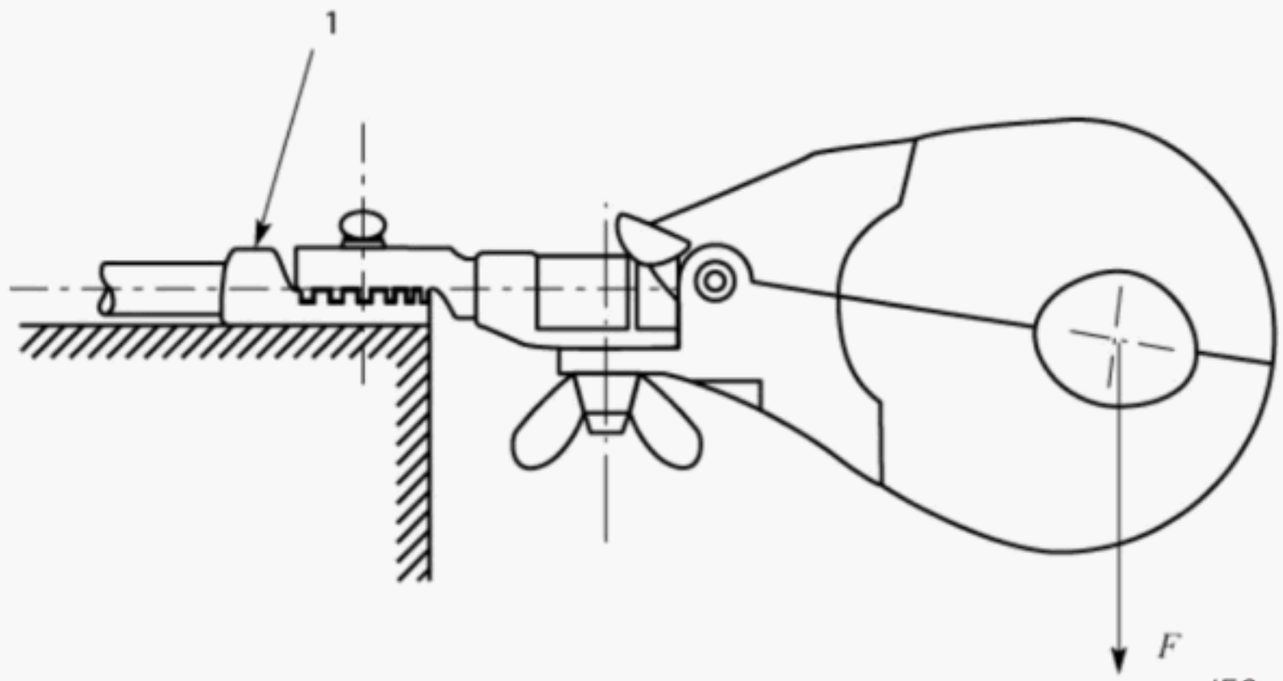
The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.17.2 Bending test

The attachment system of the device shall be securely attached horizontally to a hand stick for which it is designed (see Figure 21).



Key

1 attachment system of the hand stick held firmly in place horizontally

Figure 21 – Adjustable insulator fork – Bending test

A bending force F shall be applied and progressively increased up to a value of 1,25 F_{BN}, and then maintained at this value for a period of not less than 1 min.

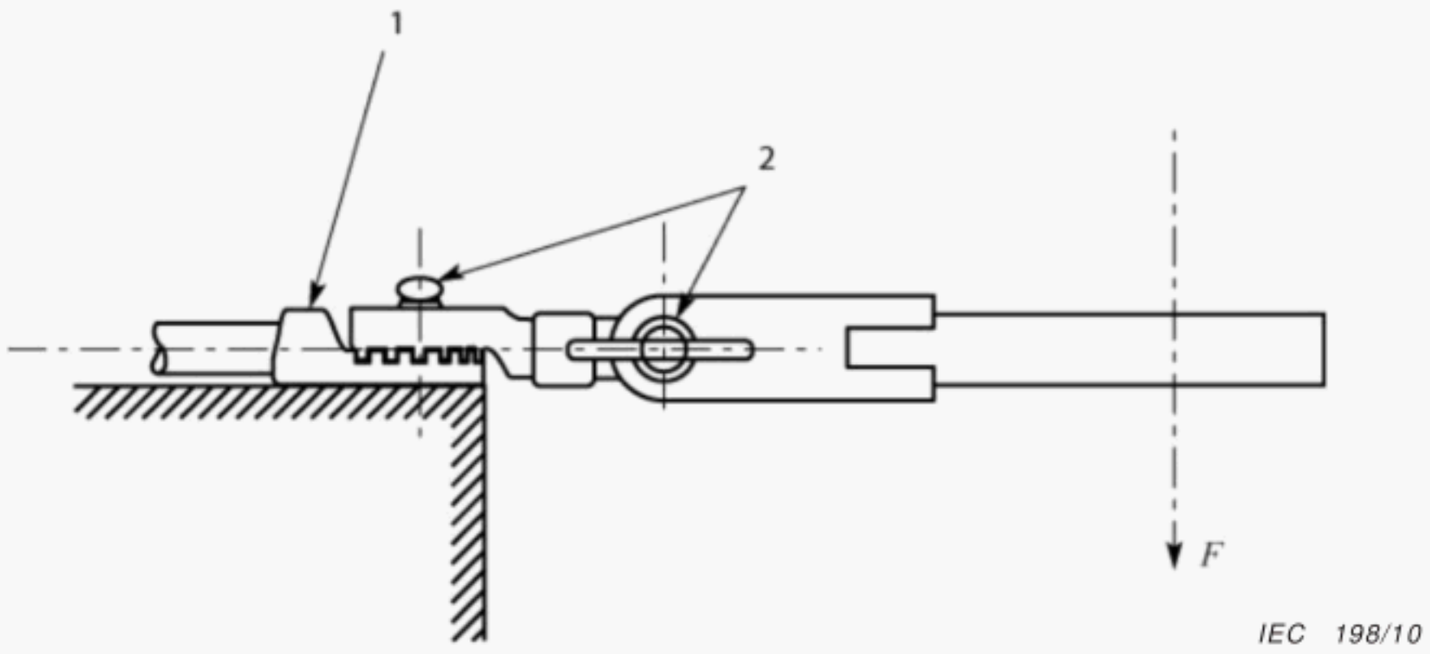
The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A bending force F shall be applied again in the same manner as above using a maximum value of bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.17.3 Articulation test

The attachment system of the fork shall be securely attached as for the bending test (see Figure 22). In case of a universal hand stick, the wing screw for tightening the splined articulation shall be tightened using a torque of 10 N·m.



Key

1 attachment system of the hand stick held firmly in place horizontally

2 tightened with a force of 10 N·m

Figure 22 – Adjustable insulator fork – Articulation test

A tensile force F shall be applied along the axis of the jaws of the fork and progressively increased with the fork being kept flat up to a value of 1,25 F_{TN}, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

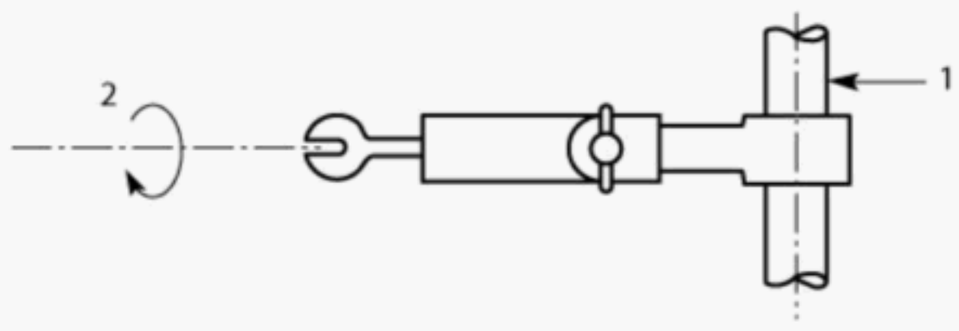
A tensile force F shall be applied again in the same manner as above using a maximum value of tensile force of 2,5 F_{TN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.18 All-angle pliers

5.6.18.1 Tightening capability

A metal rod 20 mm in diameter shall be placed between the jaws of the pliers as shown in Figure 23.



Key

1 20 mm diameter metal rod tightly clamped in a vice

2 coupling force exerted horizontally

Figure 23 – All-angle pliers – Tightening capability

A torque shall be applied to the attachment system along the longitudinal axis of the pliers and progressively increased up to a value of 1,25 T_N and then maintained at this value for a period of not less than 1 min.

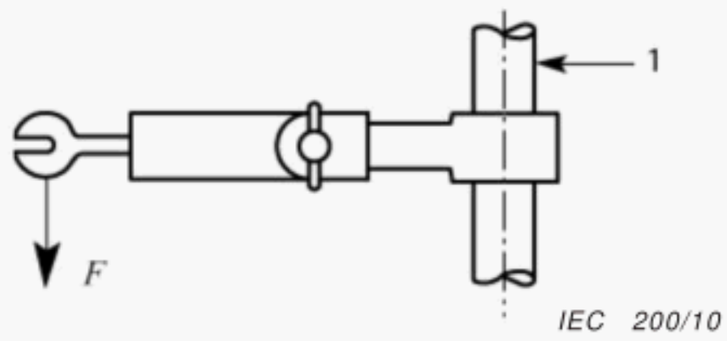
The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.18.2 Bending test

A metal rod 20 mm in diameter shall be clamped between the jaws of the pliers using a torque of 35 N·m, as shown in Figure 24.



Key

1 20 mm diameter metal rod tightly clamped in a vice

Figure 24 – All-angle pliers – Bending test

A bending force shall be applied to the attachment system and progressively increased up to a value of 1,25 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A bending force shall be applied again in the same manner as above using a maximum value of bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

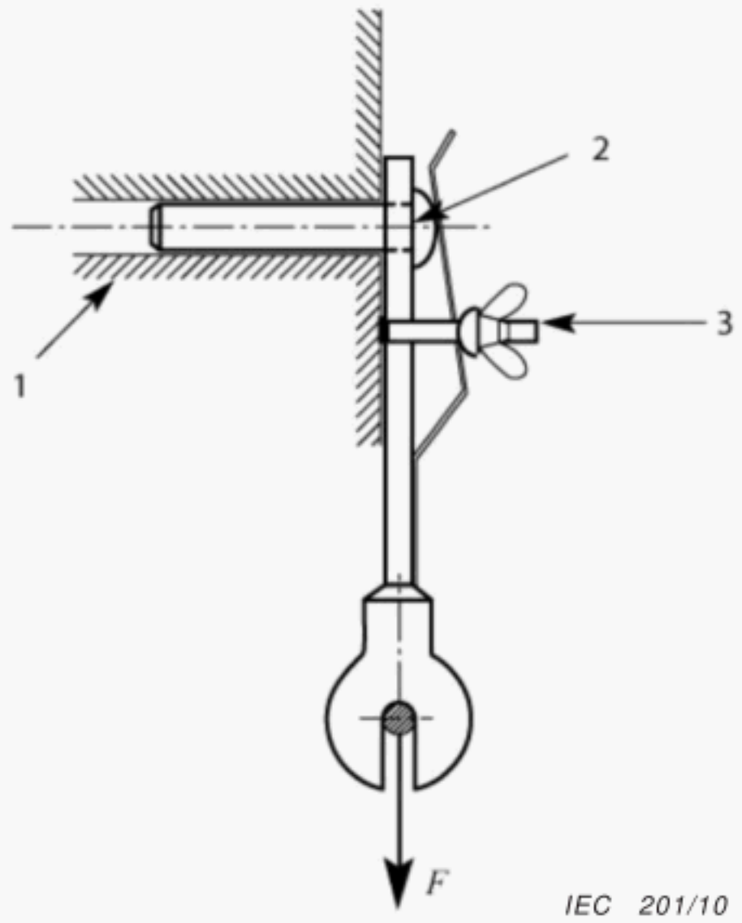
The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.19 Pin holder

5.6.19.1 Resistance of the spring

A rivet head pin corresponding to the type of pin holder being tested shall be used. The pin shall be placed in the notch of the pin holder; it shall be maintained in place solely by the spring blade. The adjusting device shall not be used (see Figure 25). A tensile force shall be applied between the fixed pin and the attachment system and progressively increased until the pin slips out of the notch.

The test shall be considered as passed if this slipping occurs at a value of tensile force of between 10 N and 15 N.



Key

1 supporting part

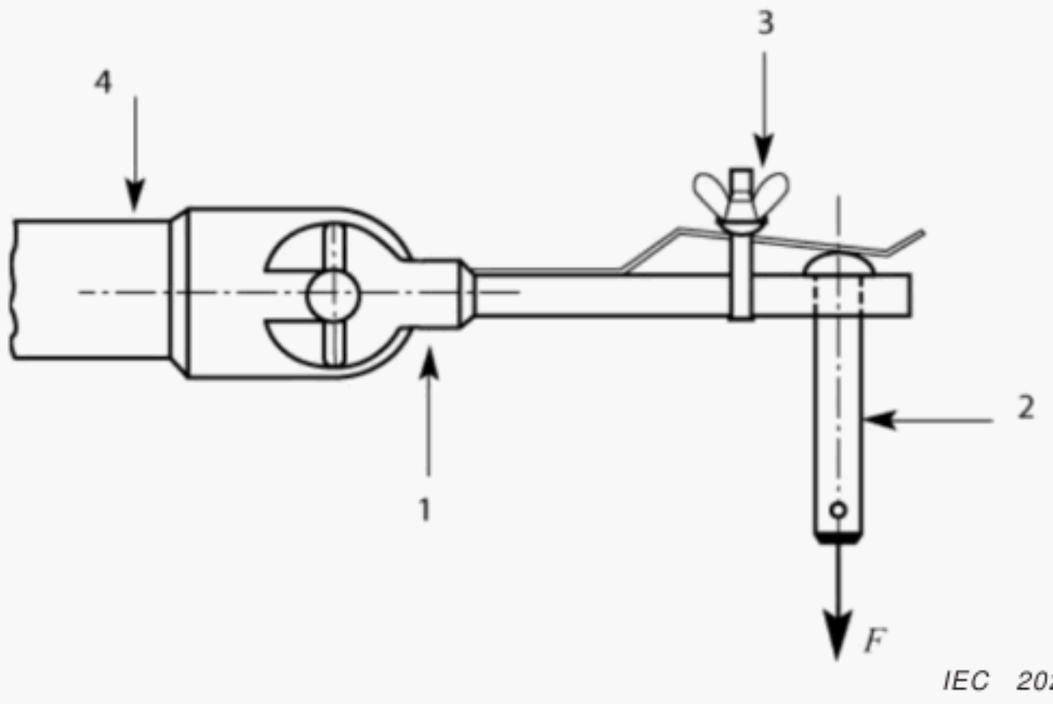
2 rivet head pin

3 loose screw (not tightened)

Figure 25 – Pin holder – Resistance of the spring

5.6.19.2 Bending test

A rivet head pin corresponding to the type of pin holder being tested shall be used. The pin holder shall be fixed and maintained in a horizontal position; the rivet head pin shall be inserted into the notch of the rigid blade, pointing downwards (see Figure 26). The adjusting device shall not be used.



Key

1 attachment system of the device

2 rivet head pin

3 loose screw (not tightened)

4 hand stick

Figure 26 – Pin holder – Bending test

A bending force F shall be applied to the end of the rivet head pin and progressively increased up to a value of 1,25 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test. The pin shall not slip out of the notch.

A bending force shall be applied again in the same manner as above using a maximum value of bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test. The pin shall not slip out of the notch.

5.6.20 Flexible spanner head (flexible wrench head) – Torsion test

A torque shall be applied to the attachment system of the device with the other end of the device being secured in a fixed position, and progressively increased up to a value of 1,25 T_N, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

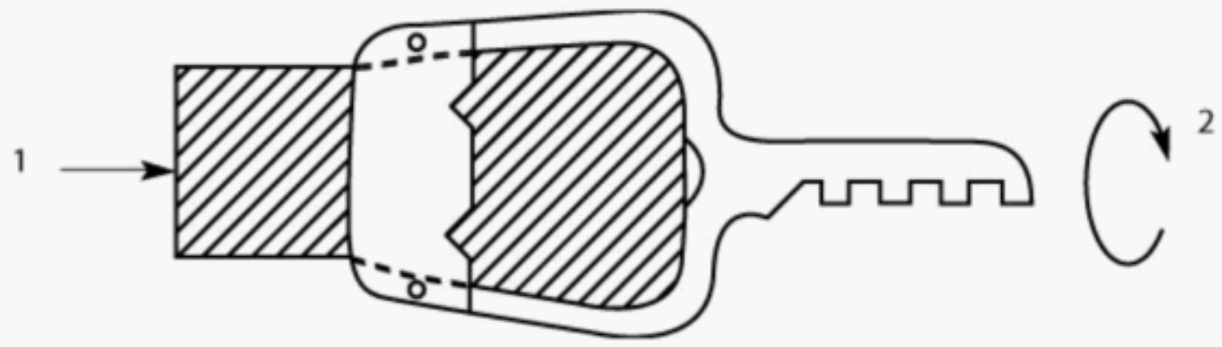
A torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.21 Ammeter holder

5.6.21.1 Torsion test

The body of the ammeter holder shall be fixed rigidly (see Figure 27).



IEC 203/10

Key

1 support part

2 coupling force

Figure 27 – Ammeter holder – Torsion test

A torque shall be applied to the attachment system and progressively increased up to a value of 1,25 T_N, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A torque shall be applied again in the same manner as above using a maximum value of torque of 2,5 T_N and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

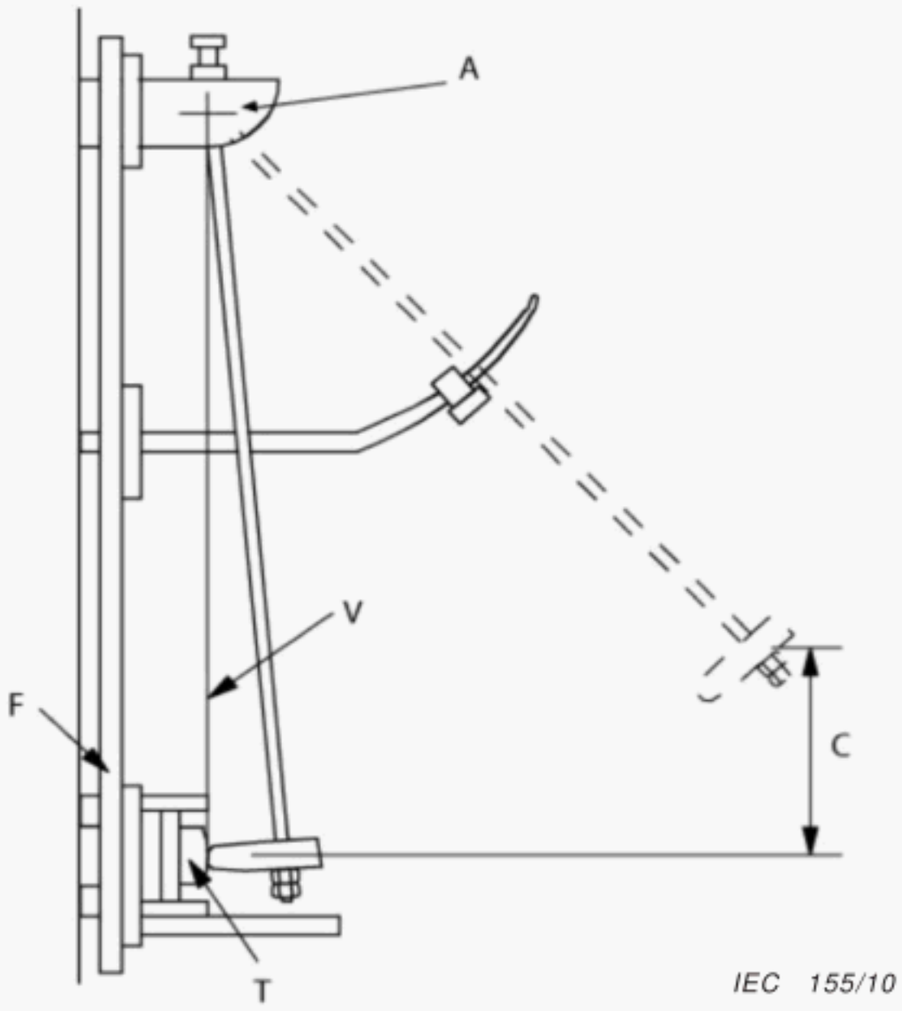
5.6.21.2 Shock test

The shock test shall be performed using the pendulum hammer test method. The ammeter-holder shall be fastened to the rigid frame so that the point of impact for each shock coincides with the location where the trajectory of the hammer meets the vertical plane through the axis of the swing. This swing shall coincide with the tangent plane at the point of impact for a curved surface (see Figure 28). The hammer shall weigh 0,5 kg, and the height of falls shall be 0,5 m. The hammer shall have a minimum hardness of 20 HRC.

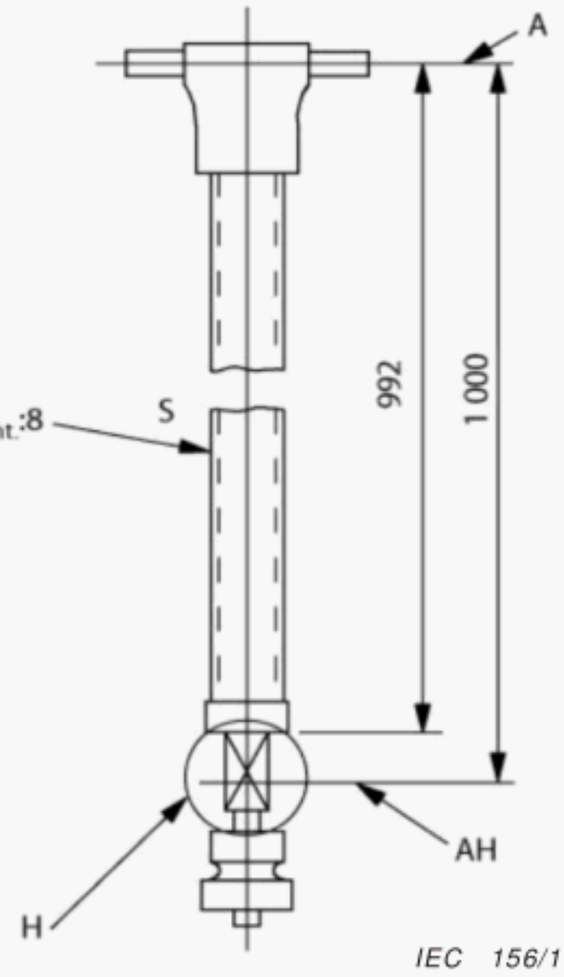
Three separate points of impact shall be located on the ammeter-holder. They shall be selected as being points that are likely to be damaged when the ammeter-holder falls on a flat surface. The same location shall be tested only once.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

Dimensions in millimetres

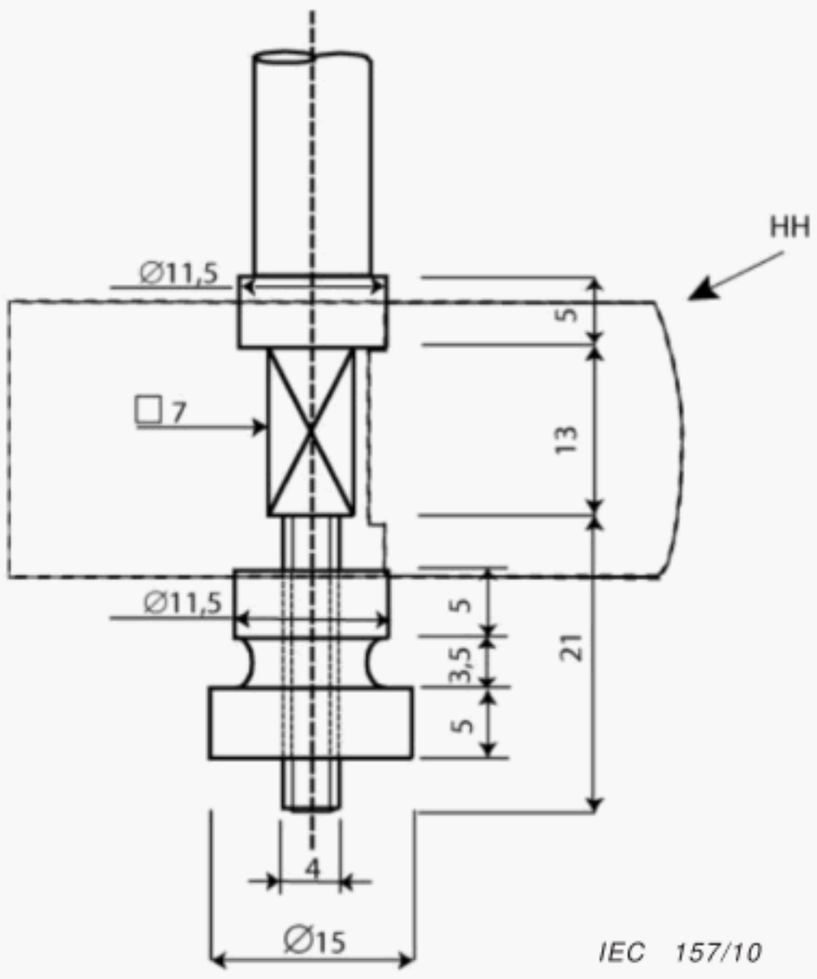


Side view

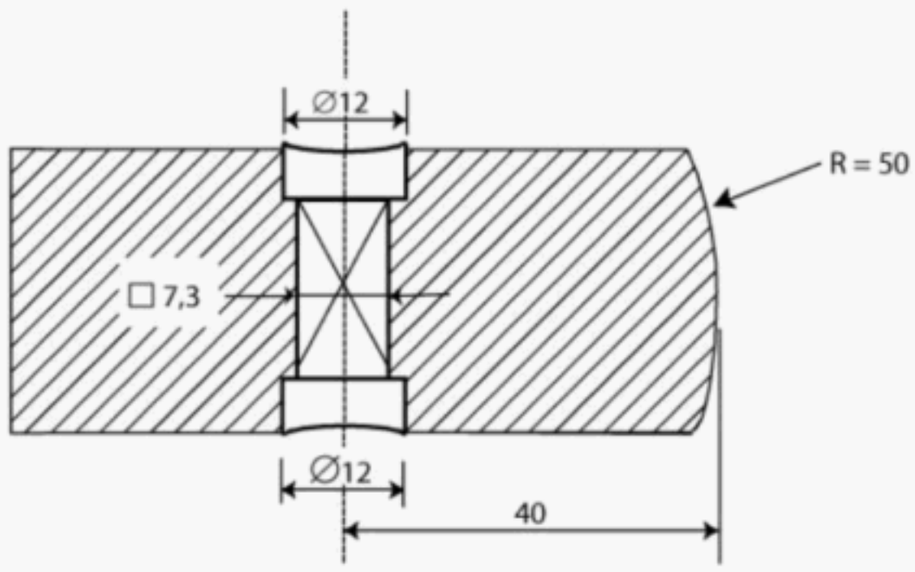


Front view

Dimensions in millimetres



Detail of the assembly of hammer



Detail of hammer head

Key

A	axis of swing adjustable	HH	hammer head – rockwell hardness of material ≥ 20 HRC
AH	axe of hammer	S	metal tube
C	fall height	T	test piece
F	frame	V	vertical plane through axis of pendulum
H	hammer		

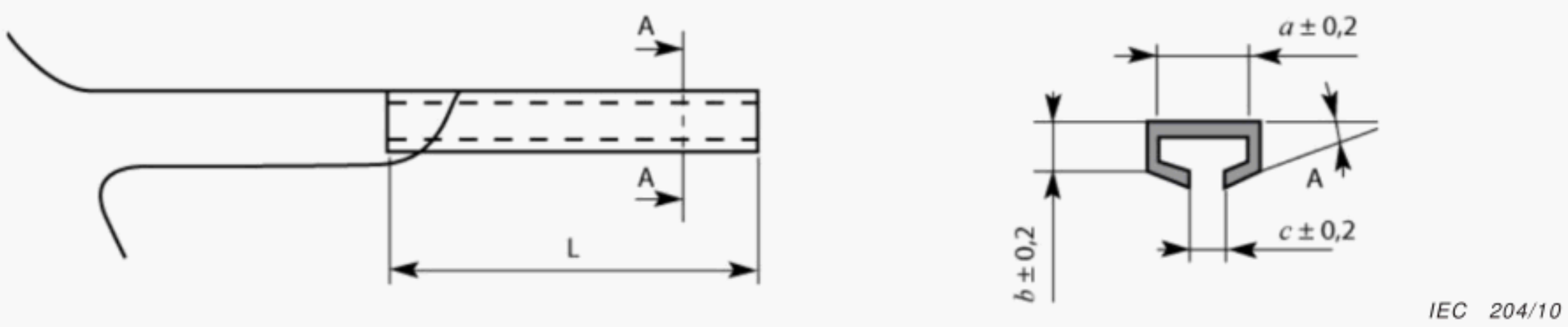
Figure 28 – Ammeter holder – Shock test

5.6.22 Anti-interference braid applicator

5.6.22.1 Controlling the sliding rod

The section profile of each sliding rod shall be checked using the appropriate gauge (see Figure 29). It shall be possible to engage the gauge into the sliding rod (at the smallest section end) right up to the stop, and it shall not be possible to engage it into the other sliding rod.

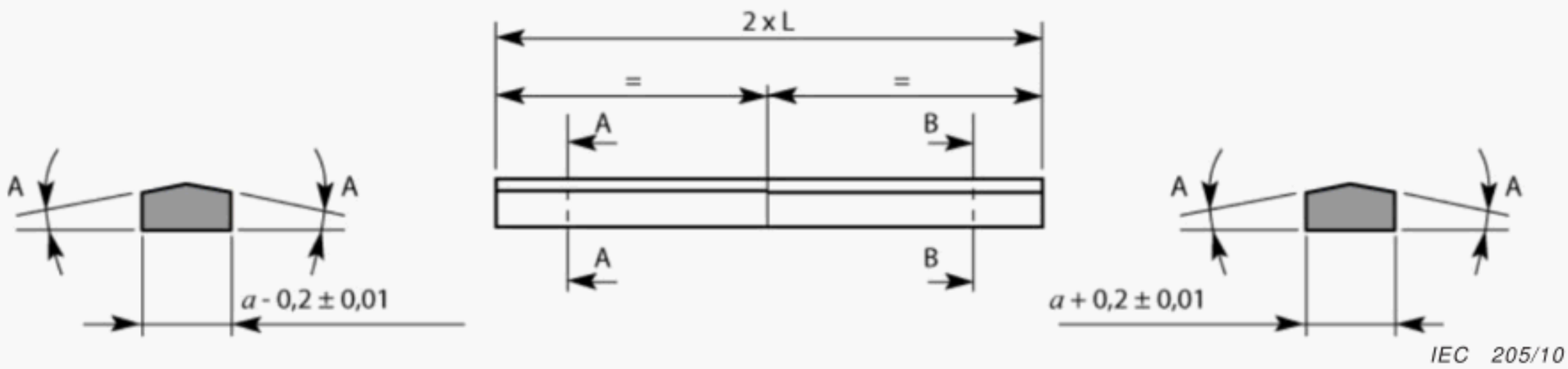
Dimensions in millimetres



A-A section

Figure 29a – Sliding rod

Dimensions in millimetres



A-A section **B-B section**

Figure 29b – Sliding rod maximum-minimum gauge

Key

L = maximum – minimum gauge

Figure 29 – Anti-interference braid applicator – Controlling the sliding rod

5.6.22.2 Bending test

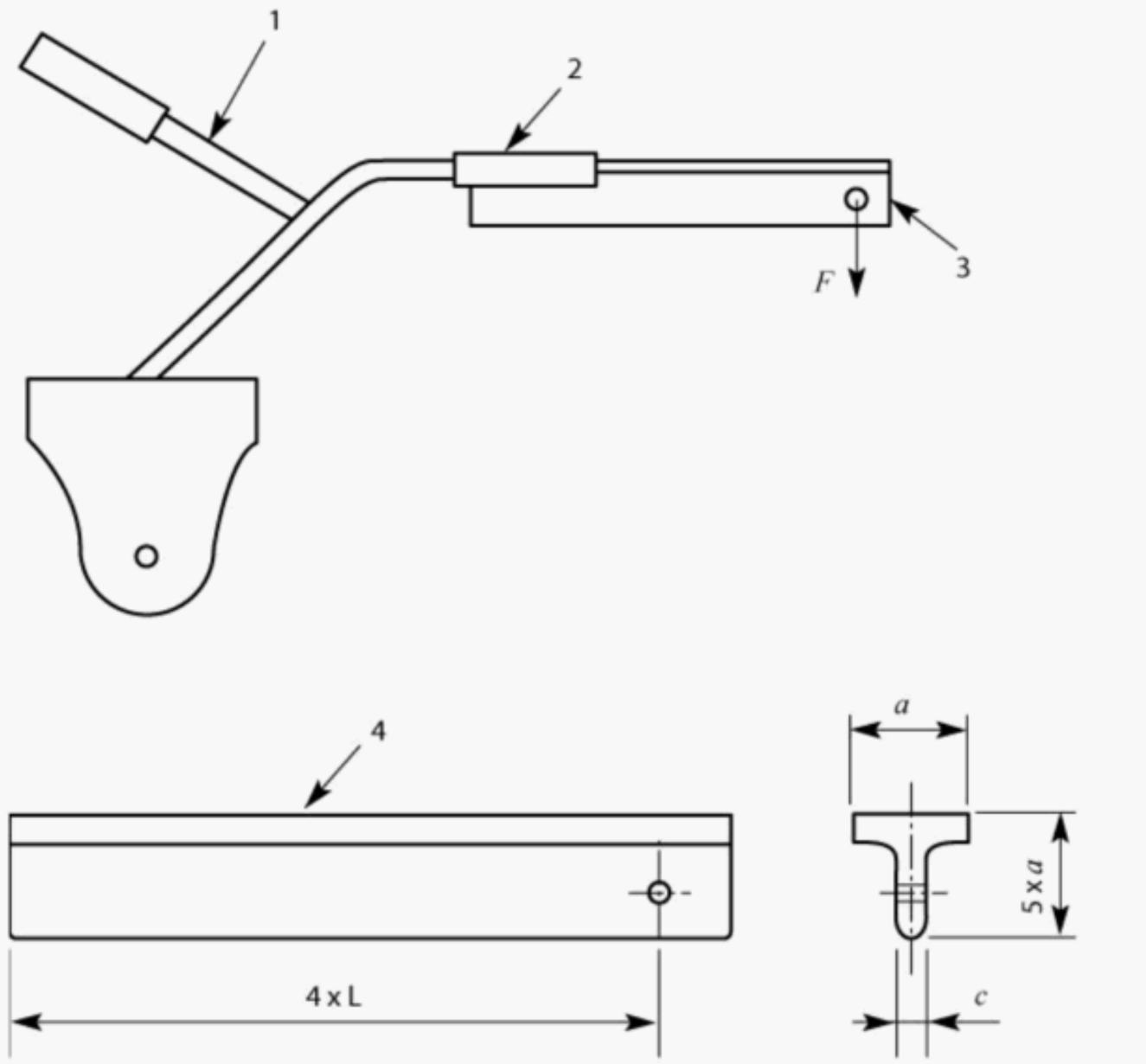
This test shall be carried out on each of the sliding rods of the device. The test device (see Figure 30) shall be engaged in the sliding rod up to the stop. The device shall be held firmly in place so that the sliding rod is horizontal, with its opening facing downwards (see Figure 30).

A bending force F shall be applied to the end of the test device and progressively increased up to a value of 1,25 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A bending force shall be applied again in the same manner as above using a maximum value of bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.



Key

1 braid applicator clamped tightly

2 horizontal sliding rod

3 test part

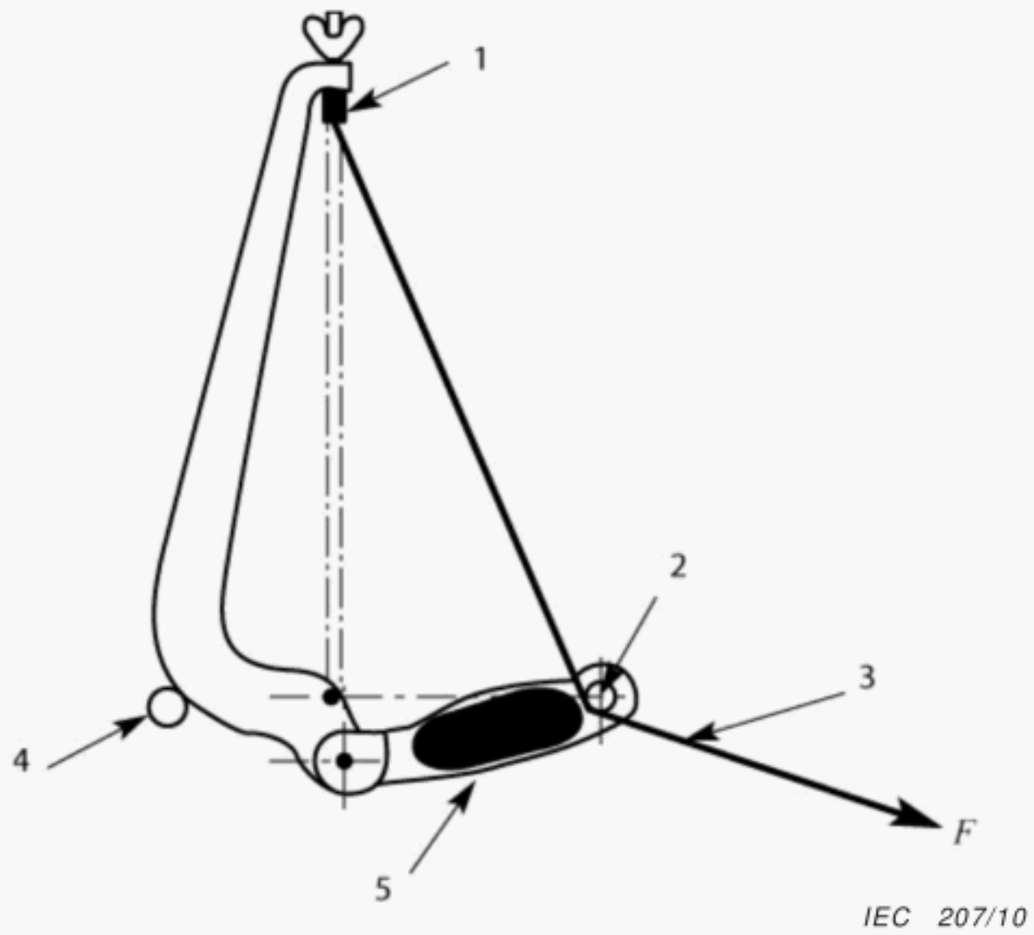
4 t-shaped metal section, its base measuring a

Figure 30 – Anti-interference braid applicator – Bending test

5.6.23 Hack saw – Bending test

A removable handle shall be mounted to the saw in such a way that its axis is perpendicular to that of the blade. The wing screw shall be tightened with a torque of 3 N·m. A pin of appropriate diameter shall be inserted into the hole in the handle. The angled part of the saw mounting shall rest on a rod.

A bending force F shall be applied using a cable between the blade turnbuckle and the pin in the hole of the handle and progressively increased up to a value of 1,25 F_{BN}, and then maintained at this value for a period of not less than 1 min (see Figure 31).



Key

1 blade guide (point of application of force)

2 pin 19 mm in diameter

3 cable transmitting the force

4 spread point

5 removable handle

Figure 31 – Hack saw – Bending test mounting

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A bending force F shall be applied again in the same manner as above using a maximum value of bending force of 2,5 F_{BN} and then maintained at this value for a period of not less than 1 min.

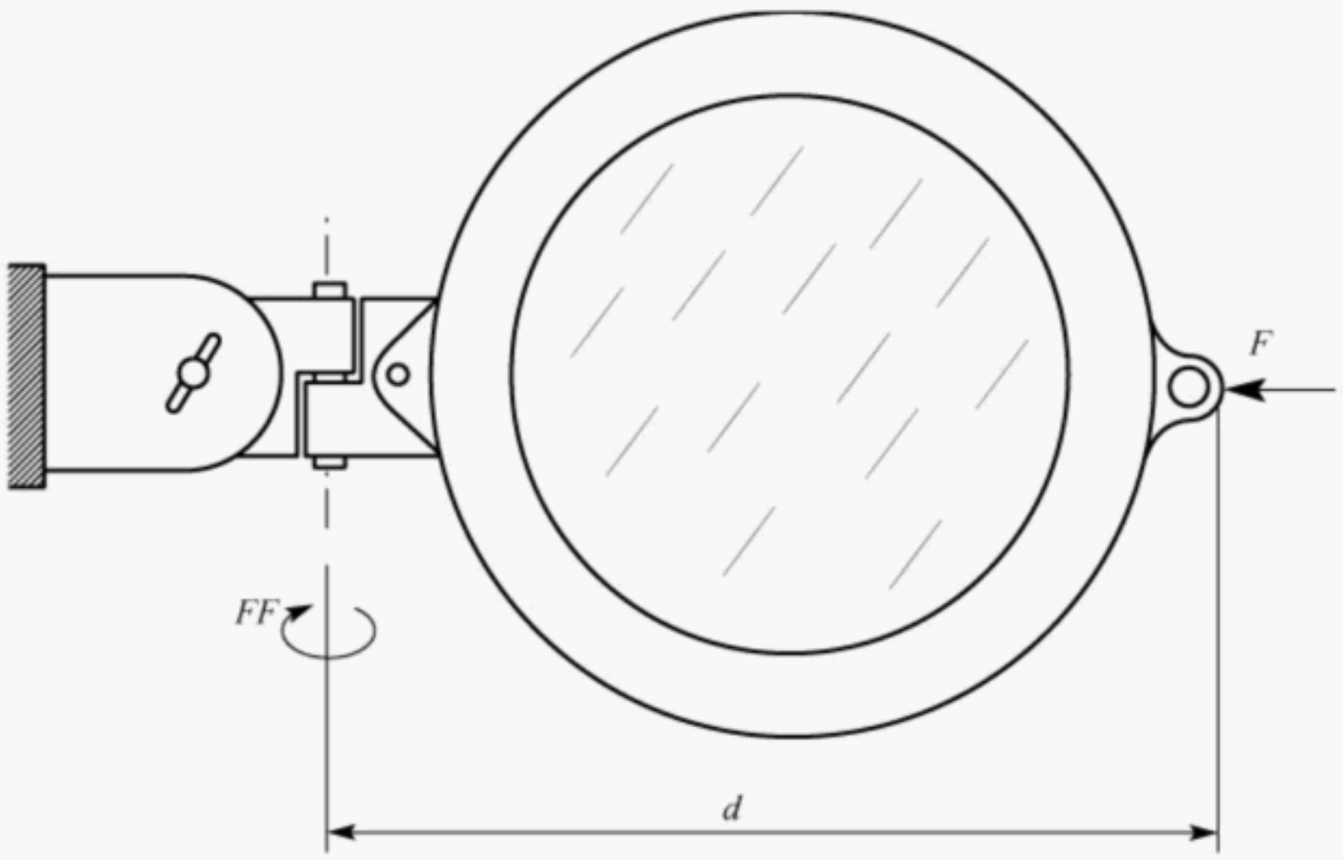
The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.24 Mirror

5.6.24.1 Friction test

The attachment system of the mirror shall be fitted to the attachment system of the test device (see Figure 32) in such a way that the optical axis is horizontal. The torque required to cause the mirror to rotate around the friction articulation shall be then measured.

The test shall be considered as passed if the value of the measured torque is between 0,3 N·m and 0,6 N·m.



IEC 208/10

Key

F force applied in a perpendicular plane

d distance between the point of application of the force F, and the rotation point

FF friction force = F x d

Figure 32 – Mirror – Friction test

5.6.24.2 Testing mechanical protection

The mirror shall be dropped flat once onto a hard flat surface, the mirror facing the ground (horizontal plane), and once on its side (vertical plane) from a height of 1 m.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.25 Conductor gauge

5.6.25.1 Measuring the diameter

Three different diameters (known with an accuracy to within 1 %) of reference rods shall be measured using the conductor gauge.

The test shall be considered as passed if the difference between the readings taken and the corresponding known values does not exceed 5 %.

5.6.25.2 Testing the slide

The movable slide shall be placed in its minimum position. A force F shall be applied to the cursor to cause the slide to move in its housing as shown in Figure 33.

The test shall be considered as passed if the slipping occurs at a value of measured force of between 2,5 N and 5 N.

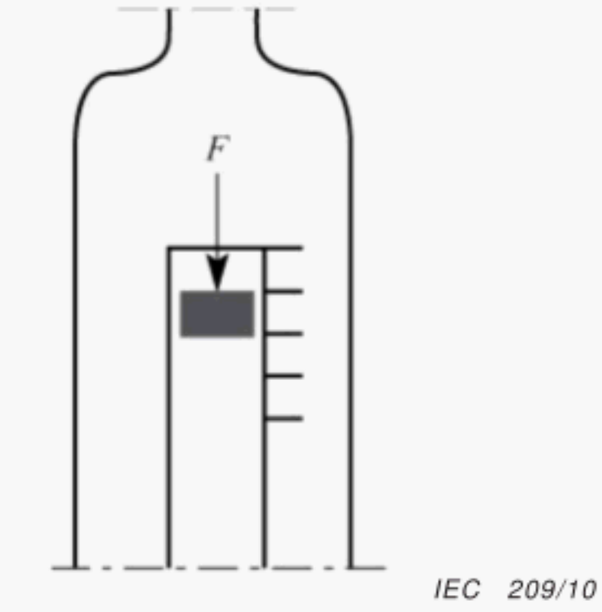
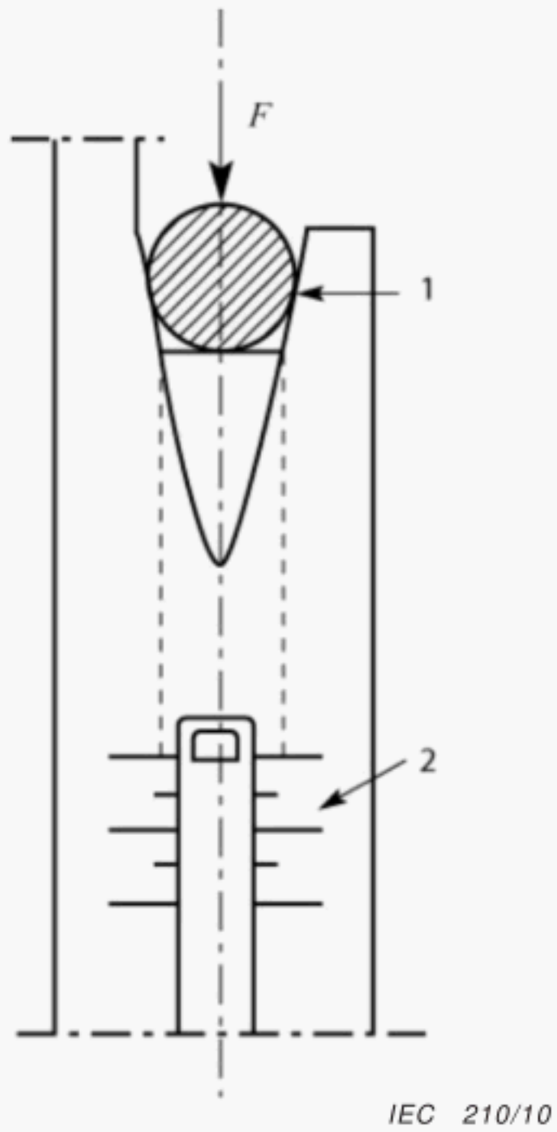


Figure 33 – Conductor gauge – Testing the slide

5.6.25.3 Distortion of the gauge body

The gauge shall be held firmly in place; then a metal rod 16 mm ± 0,1 mm in diameter shall be placed in the measuring “V” (see Figure 34).



Key

1 metal rod 16 mm in diameter

2 direct reading of distortion

Figure 34 – Conductor gauge – Distortion of the gauge body

A compression force F shall be applied on the rod in the axis of the gauge and progressively increased up to a value of 1,25 F_{CN}, and then maintained at this value for a period of not less than 1 min.

The distortion measured on the slide shall not exceed 5 mm.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test. After stopping the applied force, there shall be no more distortion.

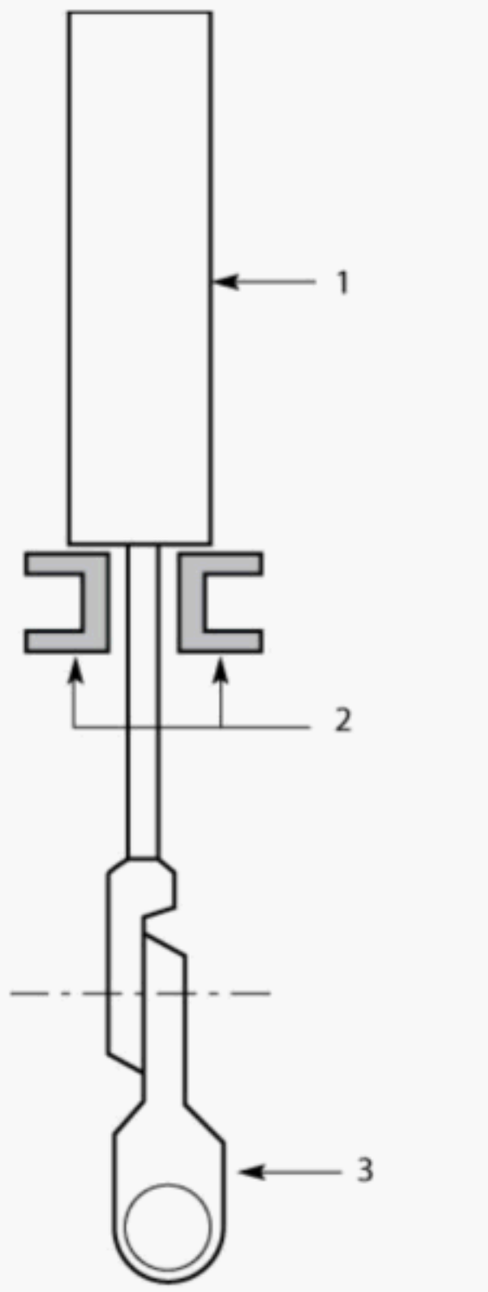
A compression force shall be applied again in the same manner as above using a maximum value of compression force of 2,5 F_{CN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.26 Gap gauge

5.6.26.1 Tension test

The gap gauge shall be placed in a test device (see Figure 35).



Key

1 gauge being tested

2 two iron sections used for support

3 attachment for retractable hook stick

Figure 35 – Gap gauge – Tension test

A tensile force shall be applied to the attachment system using a retractable hook stick adaptor and progressively increased up to a value of 1,25 F_{TN}, and then maintained at this value for a period of not less than 1 min.

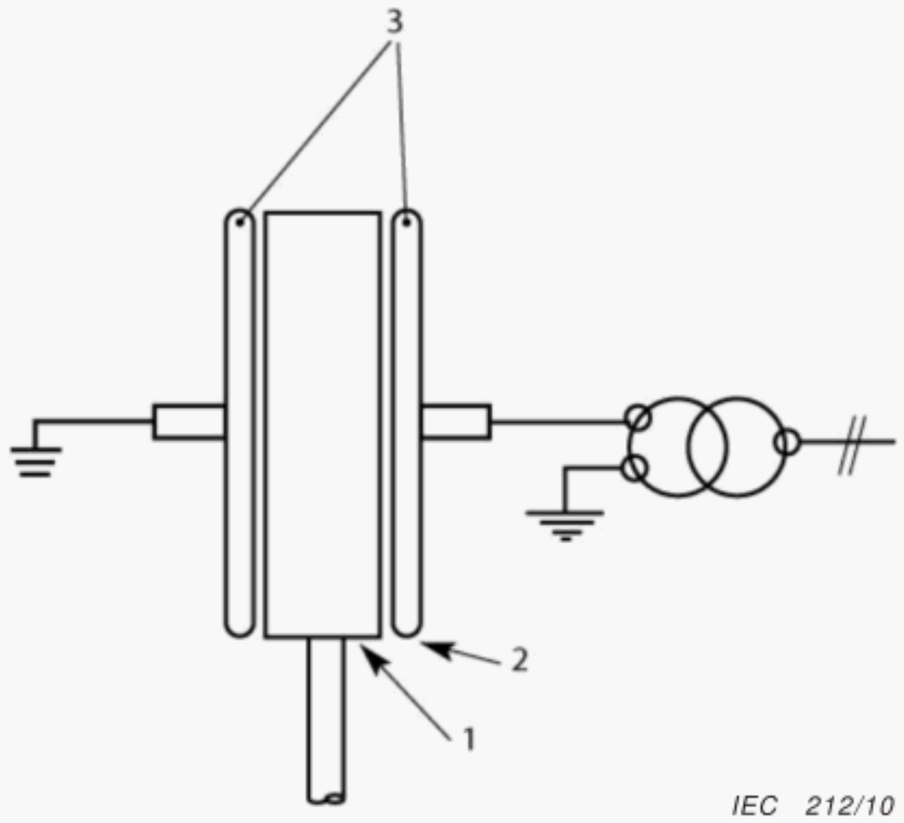
The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A tensile force shall be applied again in the same manner as above using a maximum value of tensile force of 2,5 F_{TN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.6.26.2 Electrical test

The gauge shall be immersed and conditioned in water at least 24 h (Code 24h/23 ± 0,5C/water of IEC 60212) then wiped and left in free air for not less than 1 h (Code 1h/18-28C/45-75 % of IEC 60212). The electrodes shall be placed on either side of the gauge and kept in place with a little pressure (see Figure 36). An alternating voltage at power frequency shall be applied between the two electrodes according to IEC 60060-1 (the client shall specify the thickness for the gauge and the corresponding test voltages that meet the safety rules for his network).



Key

1 gauge being tested

2 rounded edges

3 electrodes

Figure 36 – Gap gauge – Electrical test

The test shall be considered as passed if no puncture or flashover occurs or is seen during a visual inspection after the test.

5.6.27 Clevis and tongue stick devices – Tension test

The device shall be placed on a tensile force test bench between two suitable axes.

A tensile force shall be applied and progressively increased up to a value of 1,25 F_{TN}, and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no visible sign of damage is seen during a visual inspection after the test.

A tensile force shall be applied again in the same manner as above using a maximum value of tensile force of 2,5 F_{TN} and then maintained at this value for a period of not less than 1 min.

The test shall be considered as passed if no permanent deformation or breakage is seen during a visual inspection after the test.

5.7 Instructions for use

5.7.1 Type test

A visual check shall be performed to verify that all the requirements of 4.6 are fulfilled.

5.7.2 Alternative test in case of attachable devices having completed the production phase

At the production level, it is only needed to check for the availability of the instructions for use.

6 Conformity assessment of devices having completed the production phase

For conducting the conformity assessment during the production phase, IEC 61318 shall be used in conjunction with the present standard.

Annex D issued of a risk analysis on the performance of the devices provides the classification of defects and identifies the associated tests applicable in case of production follow-up.

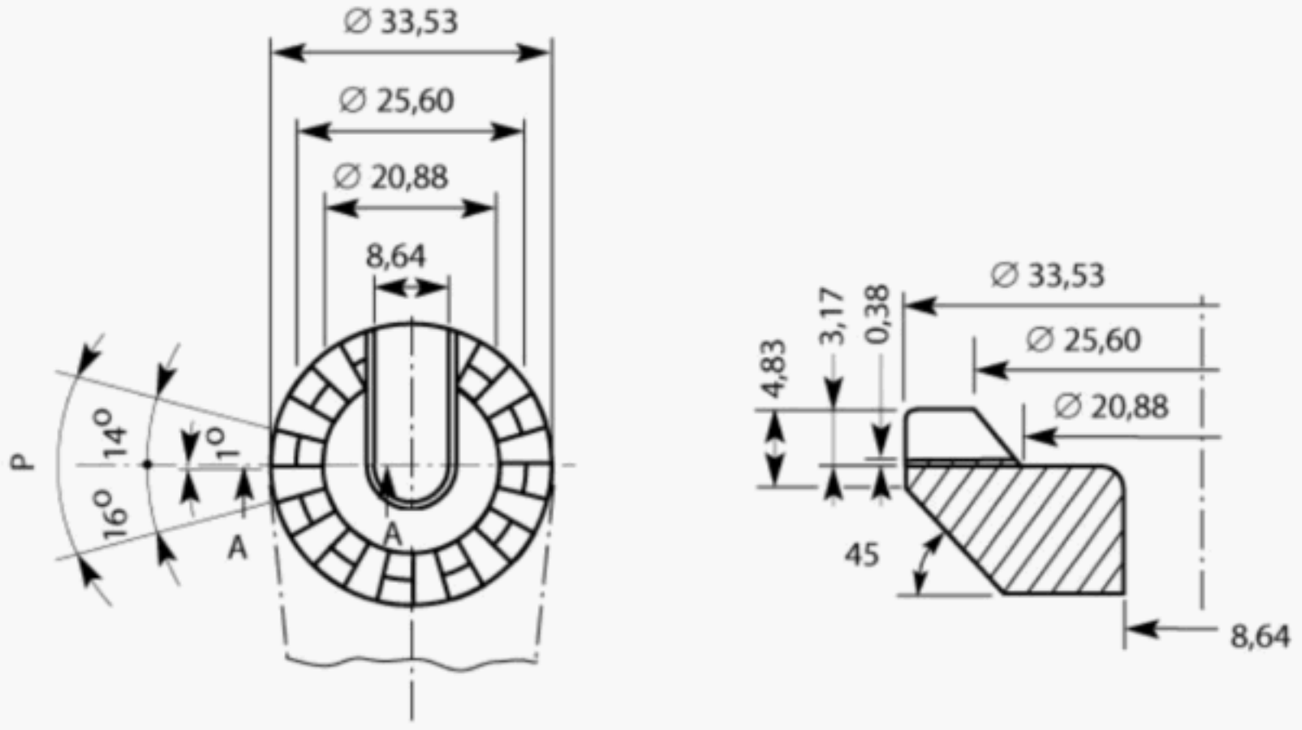
7 Modifications

Any modification of the device shall require the type tests to be repeated, in whole or in part (if the degree of modification so justifies), as well as a change in device reference literature.

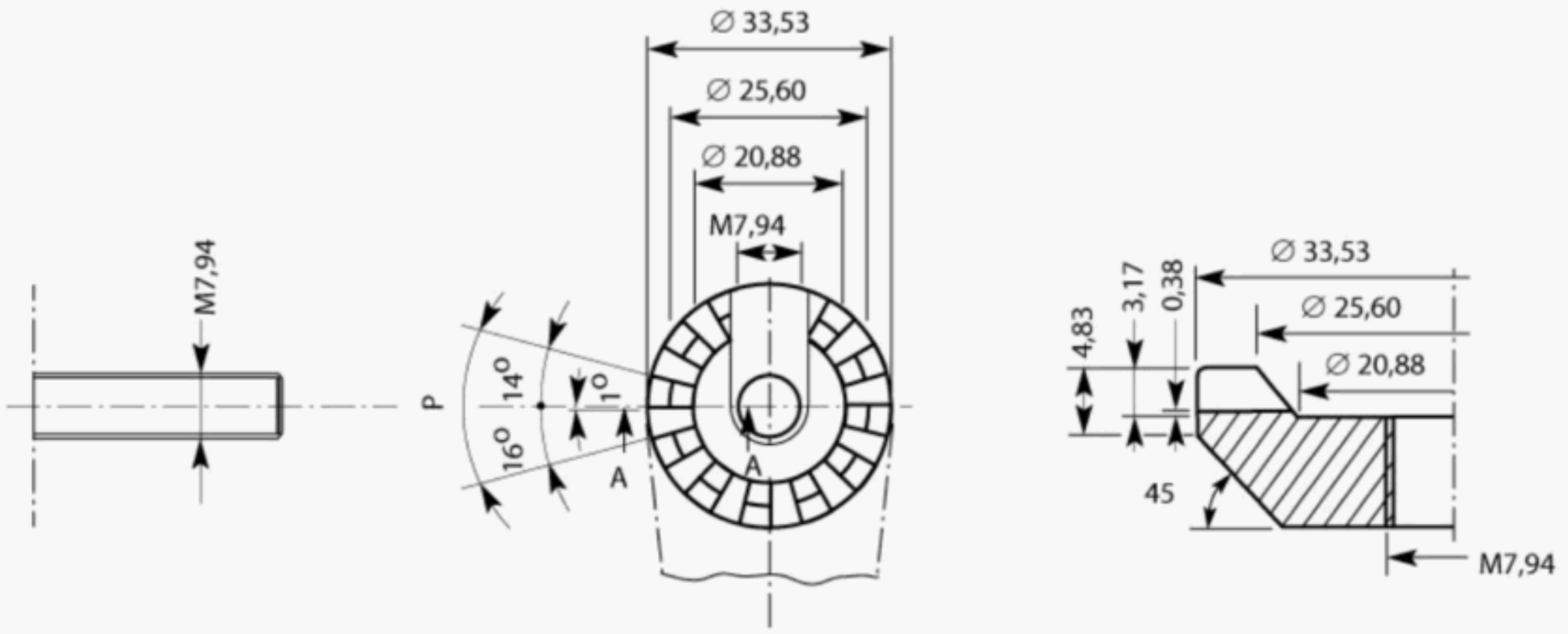
Annex A
(informative)

Attachment system of sticks – Examples

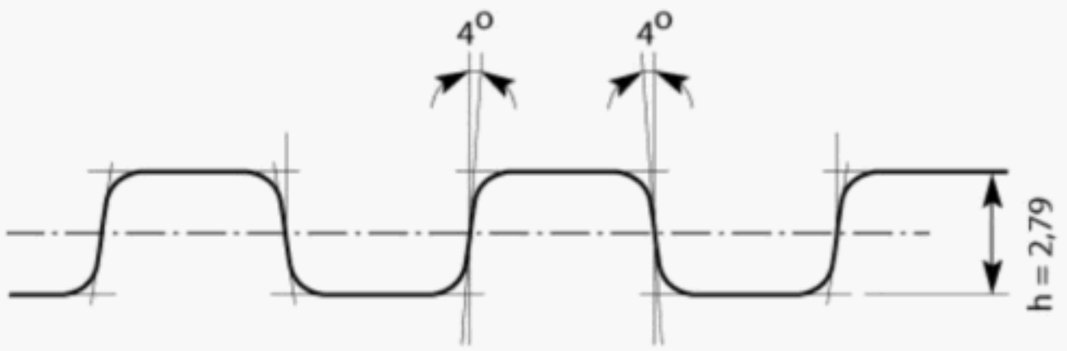
Dimensions in millimetres



A-A section



A-A section



Key

IEC 213/10

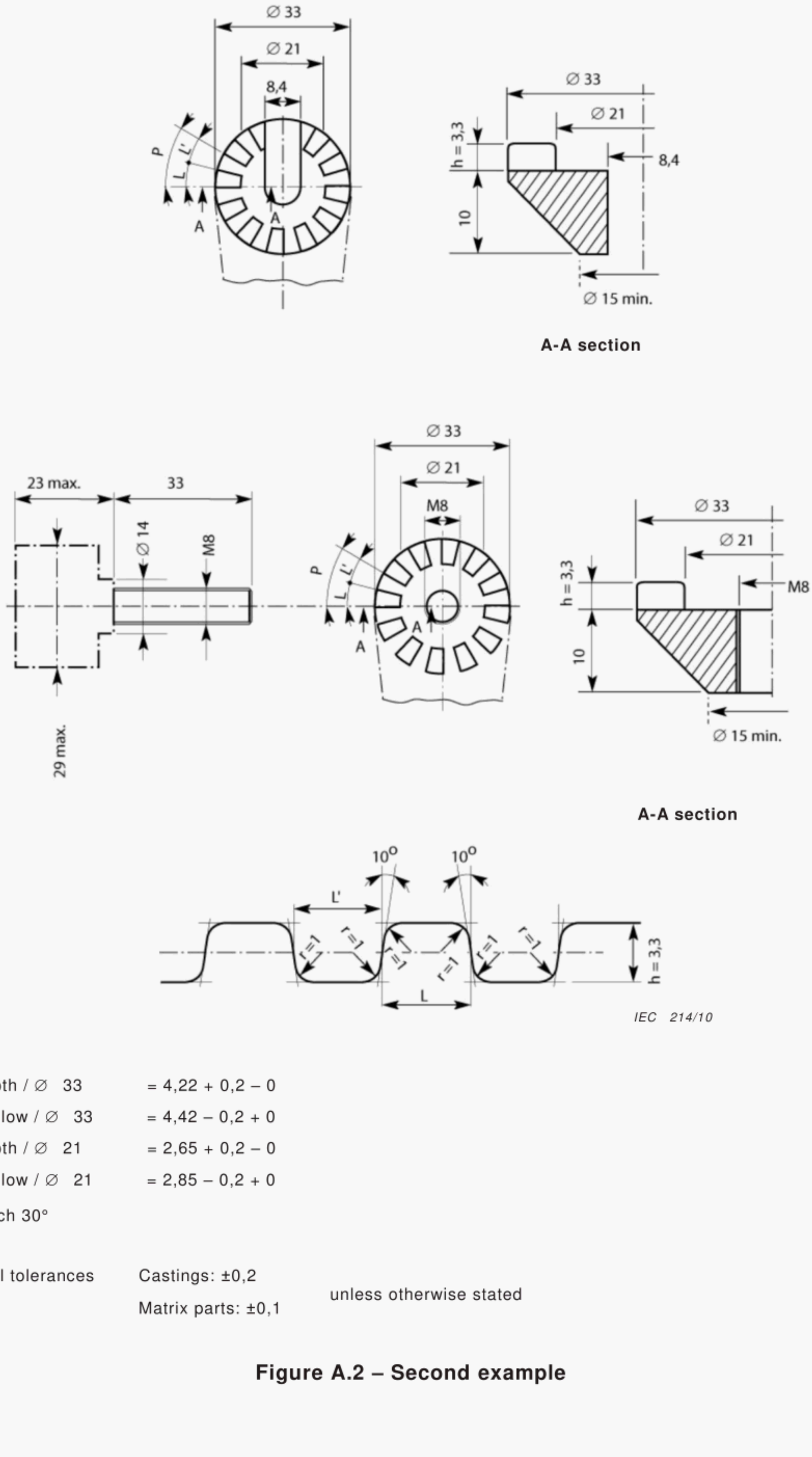
P pitch, 30°

General tolerances Dimensions : ± 0,4

Angles : ±0,5°

Figure A.1 – First example

Dimensions in millimetres



Key

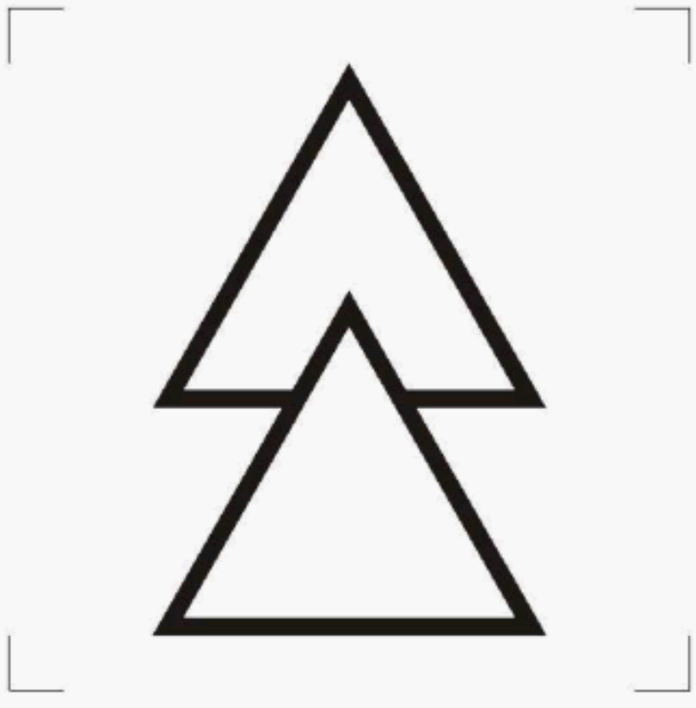
L	tooth / ∅ 33	= 4,22 + 0,2 – 0
L′	hollow / ∅ 33	= 4,42 – 0,2 + 0
L	tooth / ∅ 21	= 2,65 + 0,2 – 0
L′	hollow / ∅ 21	= 2,85 – 0,2 + 0
P	pitch 30°	

General tolerances Castings: ±0,2
Matrix parts: ±0,1
unless otherwise stated

Figure A.2 – Second example

Annex B
(normative)

Suitable for live working ; double triangle
(IEC 60417–5216 (2002-10))



Annex C
(normative)

Chronology of type tests

In Tables C.1 and C.2, every reference to the subclauses where the tests are explained is contained within parenthesis. Some columns for certain types of devices are divided into as many sub-columns as there are specified destructive mechanical tests. The sequential number for each test is given in these sub-columns. Tests with the same sequential number can be performed in the more convenient order. Within a test group, type tests out of sequence are performed on the same three devices. Test groups do not have to be performed in the given order.

Table C.1 – Type tests for splined end devices

Type tests	Type of devices										
	Universal adaptor and hook stick adaptor			Formed-wire ring	Locating drift	Conductor cleaning brush		Oilcan	Ratchet spanner	Spanner	Positive grip clamp stick head
						Semi-tubular	V-shaped				
	Group 1	Group 2	Group 3	Group 1	Group 1	Group 1	Group 1	Group 1	Group 1	Group 1	Group 1
Visual inspection (5.2)	1	1	1	1	1	1	1	1	1	1	1
Dimensional check (5.3)	1			1	1	1	1	1	1	1	1
Compatibility check (5.4)	2			2	2	2	2	2	2	2	2
Torsion	(5.6.1.1) 3									(5.6.8) 3	
Bending					(5.6.3) 3						
Tension			(5.6.1.2) 2								
Specific tests		(5.6.1.3) 2		(5.6.2) 3		(5.6.4.1) 3 (5.6.4.2) 4 (5.6.4.3) 5	(5.6.5) 3	(5.6.6) 3	(5.6.7) 3		
Type tests out of sequence											
Durability of marking (5.5)	X			X	X	X	X	X	X	X	X
Instructions for use (5.7.1)	X			X	X	X	X	X	X	X	X

Table C.1 – Type tests for splined end devices *(continued)*

	Type of devices												
	Type tests	Shepherd's hook	Spiral type	Retaining pin remover Fine point type	Cam type	Snap-out type	Ball socket adjuster	Holding fork	Fixed double-prong head	Retaining device installer	Retaining device installer/ remover	Binding wire cutter blade
		Group 1		Group 1		Group 1	Group 1	Group 1	Group 1	Group 1 a		
		Group 1								Group 1		
Visual inspection (5.2)	1	1										
	1	1										
	1	1										
	1	1										
Dimensional check (5.3)	1	1										
	1	1										
	1	1										
	1	1										
	1	1										
	1	1										
Compatibility check (5.4)	2	2										
	2	2										
	2	2										
	2	2										
	2	2										
	2	2										
	2	2										
Torsion (5.6.9a)	(5.6.9b) 3											
Bending (5.6.9c)	(5.6.10) 3			(5.6.11) b 3		(5.6.11) 3			(5.6.12) 3			
Tension					(5.6.9d) 4							
Specific tests				(5.6.9c) 3	(5.6.9d) 3							
Type tests out of sequence												
Durability of marking (5.5)	X	X	X	X	X	X	X	X	X	X	X	
Instructions for use (5.7.1)	X	X	X	X	X	X	X	X	X	X	X	

a Three devices for "installer tests" and three devices for "remover tests".
b Only bending test for installing part.

Table C.1 – Type tests for splined end devices *(continued)*

Type tests	Type of devices									
	Rotary blade	Rotary prong	Insulator ball guide	Hammer	Self-aligning fuse puller	Screw clamp	Adjustable pliers		Vice-grip pliers	
	Group 1	Group 1	Group 1	Group 1	Group 1	Group 1	Group 1	Group 2	Group 1	Group 2
Visual inspection (5.2)	1	1	1	1	1	1	1	1	1	1
Dimensional check (5.3)	1	1	1	1	1	1	1		1	
Compatibility check (5.4)	2	2	2	2	2	2	2		2	
Bending							(5.6.15.2) 3		(5.6.16.4) 3	
Tension	(5.6.13) 3	(5.6.14) 3								
Specific tests								(5.6.15.1) 2		(5.6.16.2) 2; (5.6.16.3) 3; (5.6.16.1) 4
Type tests out of sequence										
Durability of marking (5.5)	X	X	X	X	X	X	X		X	
Instructions for use (5.7.1)	X	X	X	X	X	X	X		X	

Table C.1 – Type tests for splined end devices *(continued)*

Type tests	Type of devices									
	Adjustable insulator fork			All-angle pliers		Pin holder	Flexible spanner head	Ammeter holder		Anti-interference braid applicator
	Group 1	Group 2	Group 3	Group 1	Group 2	Group 1	Group 1	Group 1	Group 2	Group 1
Visual inspection (5.2)	1	1	1	1	1	1	1	1	1	1
Dimensional check (5.3)	1			1		1	1	1		1
Compatibility check (5.4)	2			2		2	2	2		2
Torsion	(5.6.17.1) 3						(5.6.20) 3	(5.6.21.1) 3		
Bending		(5.6.17.2) 2		(5.6.18.2) 3		(5.6.19.2) 4				(5.6.22.2) 4
Specific tests			(5.6.17.3) 2		(5.6.18.1) 2	(5.6.19.1) 3			(5.6.21.2) 2	(5.6.22.1) 3
Type tests out of sequence										
Durability of marking (5.5)	X			X		X	X	X		X
Instructions for use (5.7.1)	X			X		X	X	X		X

Type tests	Type of devices							
	Spiral disconnect	Hack saw	Pruning saw	Screwdriver	Conductor polisher	Mirror	Conductor gauge	Gap gauge
	Group 1	Group 1	Group 1	Group 1	Group 1	Group 1	Group 1	Group 1
Visual inspection (5.2)	1	1	1	1	1	1	1	1
Dimensional check (5.3)	1	1	1	1	1	1	1	1
Compatibility check (5.4)	2	2	2	2	2	2	2	2
Bending		(5.6.23) 3						
Tension								(5.6.26.1) 4
Specific tests						(5.6.24.1) 3	(5.6.25.1) 3	(5.6.26.2) 3
						(5.6.24.2) 4	(5.6.25.2) 4	
							(5.6.25.3) 5	
Type tests out of sequence								
Durability of marking (5.5)	X	X	X	X	X	X	X	X
Instructions for use (5.7.1)	X	X	X	X	X	X	X	X

Table C.2 – Type tests for clevis and tongue stick devices

Type tests	Type of devices					
	Clevis eye attachment	Tension link tongue attachment	Clevis-tongue attachment	Clevis-tongue extension	Roller tongue attachment	Clevis screw attachment
	Group 1	Group 1	Group 1	Group 1	Group 1	Group 1
Visual inspection (5.2)	1	1	1	1	1	1
Dimensional check (5.3)	1	1	1	1	1	1
Compatibility (5.4)	2	2	2	2	2	2
Tension (5.6.27)	3	3	3	3	3	3
Type tests out of sequence						
Durability of marking (5.5)	X	X	X	X	X	X
Instructions for use (5.7.1)	X	X	X	X	X	X

Example of test sequence: Universal adaptor and hook stick adaptor

Group 1 (three devices)

Tests within the sequence:

- first: visual inspection and dimensional check in the more convenient order;
- second: compatibility check;
- third: torsion.

Tests out of sequence: Durability of marking and instruction for use.

Group 2 (three more devices)

– first: visual inspection;
– second: torsion of the wing screw.

Group 3 (three more devices)

– first: visual inspection;
– second: tension of the adaptor.

Annex D
(normative)

Classification of defects and tests to be allocated

This annex was developed to address the type of defects of manufactured devices (critical, major or minor) in a consistent manner (see IEC 61318). For each requirement identified in Tables D.1 and D.2, both the type of defect and the associated test are specified.

Table D.1 – Classification of defects and associated requirements and tests for splined end devices

Requirements	Type of devices									Tests
	Universal adaptor and hook stick adaptor	Formed-wire ring	Locating drift	Conductor cleaning brush		Oilcan	Ratchet spanner	Spanner	Positive grip clamp stick head	
				Semi-tubular	"V" shaped					
	Type of defect									
Dimensional (4.2)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.3
Compatibility (4.2)	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.4
Mechanical: torsion (4.2)	Major (5.6.1.1)							Major (5.6.8)		5.6
Mechanical: bending (4.2)			Major (5.6.3)							5.6
Mechanical: tension (4.2)	Major (5.6.1.2)									5.6
Specific requirements (4.2)	Major (5.6.1.3)	Major (5.6.2)		Minor (5.6.4.1) (5.6.4.2) (5.6.4.3)	Minor (5.6.5)	Major (5.6.6)	Major (5.6.7)			5.6
Mechanical protection (4.3)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.2
Protection against corrosion (4.4)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.2
Marking: items (4.5)	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.2
Marking: durability (4.5)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.5
Instructions for use (4.6)	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.7.2

Table D.1 – Classification of defects and associated requirements and tests for splined end devices *(continued)*

Requirements	Type of devices											Tests
	Shepherd's hook	Retaining pin remover				Ball-Socket Adjuster	Holding fork	Fixed double-prong head	Retaining device installer	Retaining device installer/ remover	Binding wire cutter blade	
		Spiral type	Fine point type	Cam type	Snap-out type							
	Type of defect											
Dimensional (4.2)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.3
Compatibility (4.2)	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.4
Mechanical: torsion (4.2)		Major (5.6.9a)	Major (5.6.9b)									5.6
Mechanical: bending (4.2)				Major (5.6.9c)			Major (5.6.10)			Major (5.6.11)	Major (5.6.12)	5.6
Mechanical: tension (4.2)					Major (5.6.9d)							5.6
Specific requirements (4.2)				Major (5.6.9c)	Major (5.6.9d)							5.6
Mechanical protection (4.3)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.2
Protection against corrosion (4.4)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.2
Marking: items (4.5)	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.2
Marking: durability (4.5)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.5
Instructions for use (4.6)	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.7.2

Table D.1 – Classification of defects and associated requirements and tests for splined end devices *(continued)*

Requirements	Type of devices											Tests
	Rotary blade	Rotary prong	Insulator ball guide	Hammer	Self-aligning fuse puller	Screw clamp	Adjustable pliers	Vice-grip pliers	Adjustable insulator fork	All-angle pliers	Pin holder	
	Type of defect											
Dimensional (4.2)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.3
Compatibility (4.2)	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.4
Mechanical: Torsion (4.2)									Major (5.6.17.1)			5.6
Mechanical: Bending (4.2)							Major (5.6.15.2)	Major (5.6.16.4)	Major (5.6.17.2)	Major (5.6.18.2)	Major (5.6.19.2)	5.6
Mechanical: Tension (4.2)	Major (5.6.13)	Major (5.6.14)										5.6
Specific requirements (4.2)							Major (5.6.15.1)	Major (5.6.16.1) (5.6.16.2) (5.6.16.3)	Major (5.6.17.3)	Major (5.6.18.1)	Major (5.6.19.1)	5.6
Mechanical protection (4.3)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.2
Protection against corrosion (4.4)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.2
Marking: items (4.5)	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.2
Marking: durability (4.5)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.5
Instructions for use (4.6)	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.7.2

Table D.1 – Classification of defects and associated requirements and tests for splined end devices *(continued)*

Requirements	Type of devices											Tests
	Flexible spanner head	Ammeter holder	Anti-interference braid applicator	Spiral disconnect	Hack saw	Pruning saw	Screw-driver	Conductor polisher	Mirror	Conductor gauge	Gap gauge	
	Type of defect											
Dimensional (4.2)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Critical	5.3
Compatibility (4.2)	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.4
Mechanical: torsion (4.2)	Major (5.6.20)	Major (5.6.21.1)										5.6
Mechanical: bending (4.2)			Major (5.6.22.2)		Major (5.6.23)							5.6
Mechanical: tension (4.2)											Major (5.6.26.1)	5.6
Specific requirements (4.2)		Major (5.6.21.2)	Major (5.6.22.1)						Major (5.6.24.1) (5.6.24.2)	Major (5.6.25.1) (5.6.25.2) (5.6.25.3)	Critical (5.6.26.2)[a]	5.6
Mechanical protection (4.3)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.2
Protection against corrosion (4.4)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.2
Marking: items (4.5)	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.2
Marking: durability (4.5)	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	5.5
Instructions for use (4.6)	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	5.7.2

[a] At the production level, the test is performed without water conditioning.

Table D.2 – Classification of defects and associated requirements and tests for clevis and tongue stick devices

Requirements	Type of devices						Tests
	Clevis eye attachment	Tension link tongue attachment	Clevis-tongue attachment	Clevis-tongue extension	Roller tongue attachment	Clevis screw attachment	
	Type of defect						
Dimensional (4.2)	Major	Major	Major	Major	Major	Major	5.3
Compatibility (4.2)	Major	Major	Major	Major	Major	Major	5.4
Mechanical: tension (4.2)	Critical	Critical	Critical	Critical	Critical	Critical	5.6.27 [a]
Mechanical protection (4.3)	Minor	Minor	Minor	Minor	Minor	Minor	5.2
Protection against corrosion (4.4)	Minor	Minor	Minor	Minor	Minor	Minor	5.2
Marking: items (4.5)	Major	Major	Major	Major	Major	Major	5.2
Marking: durability (4.5)	Minor	Minor	Minor	Minor	Minor	Minor	5.5
Instructions for use (4.6)	Major	Major	Major	Major	Major	Major	5.7.2

a At the production level, only the test with 1,25 F_{TN} is performed.

Annex E
(informative)

In-service recommendations

This annex is meant to help users by giving at least the following information.

There are no special in-service recommendations concerning the attachable devices excepting for the mirror and the ammeter holder. These two devices should be stored in a protected location to avoid damaging them.

Bibliography

IEC 60050-151:2001, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*

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