IS 13961 (1994): Insulating Poles (Insulating Sticks) and Universal Tool Attachments (Fittings) for Live Working [ETD 36: Tools and Equipment for Live Working]

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भारतीय मानक

(Reaffirmed 1999)

खुले विद्युन्मय के लिये विद्युत रोधन खम्बों (विद्युत रोधित छड़ों) और यूनिवर्सक और अनुव्यनक फिटिंग

Indian Standard

INSULATING POLES (INSULATING STICKS) AND UNIVERSAL TOOL ATTACHMENTS (FITTINGS) FOR LIVE WORKING

UDC 621.315-783:621.88

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Indian Standard

INSULATING POLES (INSULATING STICKS) AND UNIVERSAL TOOL ATTACHMENTS (FITTINGS) FOR LIVE WORKING

NATIONAL FOREWORD

This Indian Standard which is identical with IEC Pub 832 (1988) issued by the International Electrotechnical Commission was adopted by the Bureau of Indian Standards on the recommendation of the Tools and Equipment for Live Working Sectional Committee (ET 36) and approval of the Electrotechnical Division Council.

The text of IEC Standard has been approved as suitable for publication as Indian Standard without deviation. In the Indian context, the National Committee, ET 36, has however decided to add the visible discharge test on universal tool attachments (fittings). The requirement and method of this test is given in the National Annex.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC Pub 50 (151) (1978)	IS 1885 (Part 74) : 1993 Electrotechnical vocabulary : Part 74 Electrical and magnetic devices	Identical
IEC Pub 60	IS 2071 Methods of high voltage testing	Technically equivalent
IEC Pub 410 (1973)	IS 2500 (Part 1) : 1992 Sampling inspection tables : Part 1 Inspection by attributes and by count of defects (*first revision*)	do
IEC Pub 855 (1985)	IS 13770 : 1993 Insulating foam-filled tubes and solid rods for live working	Identical
IEC Pub 743 (1983)	IS 13985 : 1994 Terminology for tools and equipment to be used in live working	do

The concerned technical committee has reviewed the provisions of IEC Pub 212 (1971) referred in this adopted standard and has decided that it is acceptable for use in conjunction with this standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Only the English language text in the International Standard has been retained while adopting it in this Indian Standard.

INTRODUCTION

This standard covers general matters. It should not be considered complete in itself and it leaves to each customer the task of establishing his own detailed requirements. These will cover, for example, required mechanical performance and conditions of interchangeability with equipment already in service.

1. Scope

This standard is applicable to insulating poles (insulating sticks) and tool attachments (fittings) and is divided into three chapters.

Chapter I: Specifies the required characteristics for insulating poles with permanently attached fittings and the tests (electrical and mechanical) which shall be satisfied by these tools.

Chapter II: Specifies the required characteristics for parts which may be attached to and detached from the ends of poles described in Chapter I, and the tests which shall be satisfied by these tools.

Chapter III: Specifies the special clauses applicable to insulating poles and universal tool attachments.

The insulating poles mentioned in this standard shall be built with insulating tubes and rods in accordance with IEC Publication 855.

2. Definitions

2.1 *IEV Definitions*

The following terms are defined in accordance with IEC Publication 50 (151) and IEC Publication 410.

Type test

A test of one or more devices made to a certain design to show that the design meets certain specifications (IEV 151-04-15).

Routine test

A test to which each individual device is subjected during or after manufacture to ascertain whether it complies with certain criteria (IEV 151-04-16).

Sampling test

A test on a number of devices taken at random from a batch (IEV 151-04-17).

Acceptance test

A contractual test to prove to the customer that the device meets certain conditions of its specification (IEV 151-04-20).

Rated value

A quantity value assigned, generally by a manufacturer, for a specified operating condition of a component, device or equipment (I E V 151-04-03).

Minor defect

A minor defect is a defect that is not likely to reduce materially the usability of the unit of product for its intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the unit (I E C Publication 410, Sub-clause 2.1.3).

Major defect

A major defect is a defect, other than critical, that is likely to result in failure, or to reduce materially the usability of the unit of product for its intended purpose (I E C Publication 410, Sub-clause 2.1.2).

Critical defect

A critical defect is a defect that judgment and experience indicate is likely to result in hazardous or unsafe conditions for individuals using, maintaining or depending upon the product, or a defect that judgment and experience indicate is likely to prevent performance of the function of a major end item (I E C Publication 410, Sub-clause 2.1.1).

Definitions of special terms used in this standard

End fitting

Part (generally metallic) permanently fitted to the ends of insulating tube or rod (I E C Publication 743, Sub-clause 1.2.1).

Type of tool

Tools which have the same design and equal dimensions.

Family of tools

It includes all the types of tools which have the same function (utilization, use, etc.).

MIDCT

"Minor defect control test". It consists of applying a certain force or torque (specified in this standard) to a tool and verifying whether any minor defect has occurred.

MADCT

"Major defect control test". It consists of applying a certain force or torque (specified in this standard) to a tool and verifying whether any major or critical defect has occurred.

T_N: Rated torque given by the manufacturer for a tool and testing purposes.

F_{TN}: Rated tensile force given by the manufacturer for a tool and testing purposes.

F_{CN}: Rated compression force given by the manufacturer for a tool and testing purposes.

F_{BN}: Rated bending force given by the manufacturer for a tool and testing purposes.

CHAPTER I: INSULATING POLES WITH PERMANENTLY ATTACHED FITTINGS

SECTION ONE — TECHNICAL CHARACTERISTICS

3. General

Care shall be taken to ensure that adequate attention is given to minimize the weight and size to optimize the handling of the equipment.

4. Insulation

Insulation shall be obtained by a length of tube or rod in accordance with IEC Publication 855.

5. Dimensional and mechanical characteristics

Dimensional characteristics:

For each type of tool the manufacturer shall indicate the dimensions or operating ranges relating to the specific functions of the tool.

Mechanical characteristics:

For each type of tool the manufacturer shall give rated values corresponding with the characteristics specified in Tables I and II.

TABLE I

Hand poles (hand sticks)

Mechanical tests are not required but only visual inspection (Clause 9) and dimensional checks (Clause 10) on:

- Insulated oiler pole (stick),
- Clip-on ammeter pole (amertong).

Family of tools / Characteristics	Tie pole (tie stick)	Safety hook pole (retractable hook stick)	Hook pole extension (retractable hook stick)	Universal hand pole (universal hand stick)	Wire holding pole (wire holding stick)	Cotter-key plier pole	Wire-cutter
F_{BN}		X	X			X	
F_{TN}		X		X	X	X	
T_{N}		X	X	X	X	X	
Other special characteristics	Tensile strength of the rotary blade and prong		Tensile strength of the connecting clamp	Torsion strength of the wing screws	Holding capability	Holding capability Torsion strength of the support-handle Torsion strength of the operating handle	Cutting capability

Family of tools / Characteristics	All-angle cog spanner (wrench)	Flexible insulated spanner (wrench)	Extendable universal hand pole (stick)	Measuring pole or rod (stick)
F_{BS}			X	
F_{TS}			X	
T_S	X	X	X	
Other special characteristics			Torsion strength of the wing screws	Torsion strength of the wing screws

TABLE II

Conductor support poles (wire support sticks)

Family of tools / Characteristics	Conductor (wire) support pole (support stick)	Tension pole (strain stick)	Tension puller (dead-end tool)
F_{TS}	X	X	X
F_{CS}	X		

6. Ends of insulating poles (sticks)

The ends of every pole shall be constructed to prevent the ingress of water or other contaminant into the fitting or the end of the tool or equipment.

6.1 *Mechanical protection*

When necessary the ends of each pole shall have adequate means provided for mechanical protection such as an end-fitting or cap. When metallic fittings are used care shall be taken in their design to ensure that all edges are rounded where this does not impair the function of the tool.

6.2 *Corrosion protection*

Metallic parts shall be incorrodible either by their inherent composition or by a suitable treatment.

6.3 *Conducting parts*

It shall be made apparent that conductive parts fixed to the tube or to the rod are conducting.

Where this is not technically possible the outside of the tube or rod shall be clearly marked to indicate that a conducting item is included.

There shall be no external marking on the pole other than a band indicating the extent of the internal metallic parts and arrows.

All conducting parts fixed to the tube or to the rod shall be designed and manufactured so as to reduce the danger of short circuits.

7. Multiple tube or rod tools

For maintenance purposes all tools which consist of several tubes or rods shall be able to be dismantled.

SECTION TWO — TYPE TESTS

8. General

In order to show compliance with this standard the manufacturer shall provide evidence that the following tests have been carried out successfully on a minimum of three specimens of each type of construction assembly. Compression and bending tests shall be carried out on complete tools.

However, when the differences between several types of tools are limited to a few characteristics, the tests which are not influenced by these characteristics may be made on only one type and the result applied to the other types.

Tensile tests need not be repeated when the types of tools differ only by the length of the insulating tube.

The tests in Tables III and IV shall be carried out in the sequence specified.

Note. — In Tables III and IV the "Type test" column includes a reference to the clause or sub-clause in which the test is explained. Some columns relating to certain types of tool are divided into a certain number of sub-columns equal to the number of destructive mechanical tests to be applied to the tool. These sub-columns show the sequence of tests to be applied. Any additional test that the customer may require should be specified as an acceptance test.

TABLE III

Type tests of hand poles (hand sticks)

The first test is the visual inspection test (9)* made on each tool.

Family of tools / Type test	Tie pole (tie stick)	Safety hook pole (retractable hook stick)			Hook pole extension (retractable hook stick extension)			Universal hand pole (universal hand stick)		Wire holding pole (wire holding stick)		Cotter-key plier pole				Insulated oiler pole (stick)
Dimensional (10)	2	2			2			2		2		2				2
Torsion MIDCT MADCT (11.1)			2 3				2 4	4 6		4 6						
Bending MIDCT MADCT (11.4)		4 5			3 4										2 3	
Tension MIDCT MADCT (11.2)				2 4					2 3		2 3		2 3			
Dye penetration (12)	5	6	4	5	5	4	5	7	4	7		7		4		5
Electrical (13)	4			3			3	5		5		5				3
Other special type tests	Tension of the rotary blade and prong 3 (14)	Operation of the control rod 3 (15)			Strength test MIDCT 2 MADCT 3 Tensile test (16)			Torsion of wing screws 3 (17)		Tighten-ing test 3 (18)		Tightening test 3 (19) / Torsion of the support handle MIDCT 4 MADCT 6 (19)		Torsion of the operating handle MIDCT 2 MADCT 3 (19)		Operation of the control rod 4 (20)

* See note to Clause 8.

(Table continued on page 19)

TABLE III *(continued)*

Family of tools / Type tests	Wire-cutters	All-angle cog spanner (wrench)	Flexible insulated spanner (wrench)	Clip-on ammeter pole (amertong)	Extendable universal hand pole (stick)			Measuring pole or rod (stick)
Dimensional (10)	2	2	2	2	2			2
Torsion MIDCT MADCT (11.1)		3 5	3 5				2 3	
Bending MIDCT MADCT (11.4)					4 6			
Tension MIDCT MADCT (11.2)						2 3		
Dye penetration (12)	5	6	6		7		4	5
Electrical (13)	4	4	4		5			4
Other special type tests	Cutting tests 3 (21)				Torsion of wing screws 3 (17)			Torsion of wing screws 3 (17) Solvent and abrasion resistance 6 (22) Electrical test after abrasion 7 (22)

TABLE IV

Type tests of conductor support poles (wire support sticks)

The first test is the visual test (9)* made on each tool.

Family of tools / Type test	Conductor wire support pole (support stick)		Tension pole (strain stick)	Tension puller (dead-end tool)
Dimensional (10)	2		2	2
Tension (11.2) MIDCT MADCT	3 5		3 5	3 5
Compression (11.3) MIDCT MADCT		2 3		
Dye penetration (12)	6	4	6	6
Electrical	4 (13)		4 (13)	4 (13) and (23)

* See note to Clause 8.

Example of a test sequence: safety hook pole (retractable hook stick)

Three samples

Test:

— first: visual
— second: dimensional
— third: operation of the control rod
— fourth: bending: 1.25 F_{BN}
— fifth: bending: 2.5 F_{BN}: destructive
— sixth: dye penetration (if necessary)

Three other samples

Test:

— first: visual
— second: torsion: 1.25 T_N
— third: torsion: 2.5 T_N: destructive
— fourth: dye penetration (if necessary)

Three other samples

Test:

— first: visual
— second: tension: 1.25 F_{TN}
— third: electrical (if necessary)
— fourth: tension: 2.5 F_{TN}: destructive
— fifth: dye penetration (if necessary)

9. Visual inspection

Each sample shall be visually inspected to check for manufacturing defects and correct functioning.

10. Dimensional check

Each sample shall be measured to ensure that it complies with the dimensions stated by the manufacturer.

11. Mechanical tests

11.1 *Torsion*

The torques given in Table V shall be reached with a rate of rise of 5 ± 2 N.m/s. These shall be maintained for 1 min before observing the results.

TABLE V

Test	Test torque	Result
MIDCT	1.25 T_N	No minor, major or critical defect shall occur
MADCT	2.5 T_N	No major or critical defect shall occur

This torque shall be applied at the ends of the sample.

11.2 *Tension*

The tensile forces given in Table VI shall be reached with a rate of rise of 200 ± 50 N/s. These shall be maintained for 1 min before observing the results.

TABLE VI

Test	Tensile test force	Result
MIDCT	1.25 F_{TN}	No minor, major or critical defect shall occur
MADCT	2.5 F_{TN}	No major or critical defect shall occur

This force shall be applied at the ends of the sample.

11.3 *Compression*

The compression forces given in Table VII shall be reached with a rate of rise of 200 ± 50 N/s. These shall be maintained for 1 min before observing the results.

TABLE VII

Test	Compression test force	Result
MIDCT	1.25 F_{CN}	No minor, major or critical defect shall occur
MADCT	2.5 F_{CN}	No major or critical defect shall occur

This force shall be applied at the ends of the sample.

11.4 *Bending*

The bending forces given in Table VIII shall be reached with a rate of rise of 20 ± 5 N/s. These shall be maintained for 1 min before observing the results.

TABLE VIII

Test	Bending test force	Result
MIDCT	1.25 F_{BN}	No minor, major or critical defect shall occur
MADCT	2.5 F_{BN}	No major or critical defect shall occur

The tool shall be placed horizontally between two supports separated by 500 mm. The force shall be applied on the head of the sample. The two supports shall be placed at 500 mm and 1 000 mm from the other end of the sample. See Figure B1 of Appendix B.

When the tool is a pole extension or one element of an extendable pole, the force shall be applied on the head of the tool and the other end shall be connected to a fixed base of the same configuration as the tool used in service.

12. Dye penetration test

The dye penetration test shall be made only when holes for inserts (metallic or not) are made in the insulating tube. Five samples, each 100 mm long, containing the holes, shall be completely immersed in a container of 0.1% by volume fuchsine/distilled water solution. The container shall be placed in a vacuum chamber and evacuated to less than 6 500 Pa. The sample shall remain for 1 h in the dye solution and then the vacuum released and the sample removed.

In order to avoid fuchsine spreading from the sample ends during cutting, it is necessary to dry the samples for 24 h in ambient air (IEC Publication 212): conditioning 24 h/18 °C to 28 °C/45% to 75% r.h.

After drying, a 10 mm section shall be cut from each end.

The centre section of each sample (80 mm long) thus obtained shall then be slit lengthways. They shall be free from any fuchsine dye penetration.

13. Electrical test after water conditioning

This test shall be made only on the portion of the tool considered as a part of the insulation, when holes for inserts (metallic or not) are made in the insulating tube.

13.1 *General test conditions*

The test location shall be at standard atmospheric conditions (IEC Publication 212): M/18 °C to 28 °C/45% to 75% r.h. and the water temperature shall be within the same limits as the ambient temperature: 18 °C to 28 °C. A voltage of 100 kV r.m.s. at power frequency shall be applied between electrodes 300 mm apart for 1 min, in accordance with IEC Publication 60. The test arrangement may be as shown in Figure B2 of Appendix B. By agreement between manufacturer and customer, an equivalent test arrangement, test voltage, electrode width and distance and testing duration may be used. In case of dispute, the test arrangement described in Figure B2 of Appendix B shall be used.

Note. — Spacing between samples should be at least twice the spacing of the electrodes.

13.2 *Water conditioning*

The samples shall be immersed in water whose resistivity shall be 100 ± 15 Ωm (IEC Publication 60) and shall be subjected to conditioning during 24 h/23 °C/water (IEC Publication 212). The samples shall be taken from the water and the surface liquid shall be removed by wiping with a clean absorbent cloth.

The test voltage shall be applied within 5 min.

13.3 *Test results*

The test shall be considered as having been satisfactory if, during and after the test for 1 min, the following conditions are satisfied:

— no flashover, no sparkover, no puncture,
— no visual trace of tracking or erosion on the surface,
— no perceptible temperature rise.

14. Tie pole (tie stick)

Tension of the rotary blade and rotary prong

The tie pole shall be fixed. An increasing tensile force of 100 N/s shall be applied on the rotary blade, in a parallel direction to the pole axis (see Figure B3 of Appendix B), until it reaches 1.25 F_{TN}. After 1 min at this value the force shall be removed. The blade shall turn easily without any stiffness. No deformation of the blade, or cracking in the resin joint visible to the naked eye shall occur. An increasing tensile force shall then be applied, in the same direction, until it reaches 2.5 F_{TN}. No major or critical defect shall occur. The same test shall be applied to the rotary prong under the same conditions (see Figure B4 of Appendix B).

These tests may be simultaneously applied to the pole.

15. **Safety hook pole (retractable hook stick)**

Operation of the control rod

The safety hook pole shall be positioned vertically. The hook shall be opened. An increasing force shall be applied on the sliding hand grip until it latches. It shall occur between 15 N and 50 N (see Figure B5 of Appendix B).

The same test with the same conditions shall be made with the hook in mid-position (closed but not fully retracted).

16. **Hook pole extension (retractable hook stick extension)**

Tensile test

The opening hook shall be closed on a steel rod of 10 mm diameter. The hook pole extension shall be fixed on a testing piece representing the head of a safety hook pole. Screws shall be tightened with a 5 N · m torque (see Figure B6 of Appendix B).

A tensile force shall be increased at a rate of 50 N/s and shall be applied to the link ring through the testing piece, until it reaches 1.25 F_{TN} and shall be maintained constant for 1 min.

No minor, major or critical defect shall occur. The force being removed, no part of the hook pole extension shall have permanent deformation. The tensile force shall be increased at a rate of 50 N/s until it reaches 2.5 F_{TN}. No major or critical defect shall occur.

17. **Universal hand pole (universal hand stick) and extendable universal hand pole (stick)**

Torsion of wing screws

An increasing torque of 1 N · m/s shall be applied on the wing screw until it reaches 1.25 T_N.

No minor, major or critical defect, or permanent deformation of the screw or the splined end shall occur.

The torque shall be increased by the same value until it reaches 2.5 T_N.

No major, or critical defect shall occur.

18. **Wire holding pole (wire holding stick)**

Tightening test

A 20 mm diameter smooth metallic rod shall be tightened in the jaws. With the locking lever making a 50° angle with the tube (see Figure B7 of Appendix B), the adjustable jaw shall be brought into contact with the testing rod, with the aid of the fine control milled-nut. The lever shall then be locked and the head of the pole shall be fixed. A force increasing at a rate of 20 N/s shall be applied to the metal rod until it creeps.

This force shall be higher than F_c where F_c is the rated creeping force given by the manufacturer. This test shall be repeated for each position of the jaws relative to the axis of the pole.

No change of position shall occur under tensile forces on the metallic rod.

19. Cotter-key plier pole

19.1 *Tightening test*

A 20 mm diameter metal rod shall be tightened in the jaws with a 35 N · m torque applied on the operating handle. The head of the pole shall be fixed (see Figure B8 of Appendix B) and a force increasing by 20 N/s shall be applied in the direction of the metal rod until it creeps.

This force shall be greater than F_c where F_c is the rated slippage force given by the manufacturer.

19.2 *Torsion of the support handle*

A 20 mm diameter metal rod shall be tightened in the jaws with a 35 N · m torque applied on the operating handle. The rod shall be fixed in a vice as shown in Figure B9 of Appendix B. A progressive torque of 2 N · m/s shall be applied on the support handle until it reaches 1.25 T_N which shall be maintained for 1 min.

No permanent deformation or minor, major or critical defect shall occur.

The torque shall be increased until it reaches 2.5 T_N.

No major or critical defect shall occur.

19.3 *Torsion of the operating handle*

A 20 mm diameter metal rod shall be tightened in the jaws. The rod shall be fixed in a vice and a 45° angle shall be maintained between the operating handle and the support handle (see Figure B10 of Appendix B). A progressive torque of 2 N · m/s shall be applied on the operating handle until it reaches 1.25 T_N, which shall be maintained for 1 min.

No permanent deformation or minor, major or critical defect shall occur.

The torque shall be increased until it reaches 2.5 T_N.

No major or critical defect shall occur.

20. Insulated oiler pole (insulated oiler stick)

Operation of the control rod

The oil reservoir shall be filled with lubricant. The oiler pole shall be positioned vertically and an increasing force shall be applied at the end of the operating handle (see Figure B11 of Appendix B) until an oil jet appears from the spout. It shall occur between 15 N and 50 N.

A 150 N force shall then be applied on the control handle in the same way as above.

No permanent deformation or minor, major or critical defect shall occur.

The oil reservoir shall be emptied almost entirely with the operating handle in order to repeat the first test. The force shall remain between 15 N and 50 N.

21. Wire-cutter

Cutting capability

Ten cuts shall be made with the same pole for each rated maximum section (of a specified material) given by the manufacturer for the cutter. The rated sections and conductors shall be chosen among those which are in general used by the customer.

At each operation of the cutter, the conductor shall be successfully cut in one operation without damage to the cutting edges.

22. Measuring pole or rod (stick)

22.1 *Solvent resistance*

The pole (stick) shall be energetically rubbed, mainly on the coloured parts, with a white cloth soaked with a solvent such as ethylene perchloride.

After 30 s there shall be no coloured deposit on the cloth.

22.2 *Abrasion resistance*

A sample cut from a measuring pole shall be fixed horizontally. A macrogrit abrasive cloth as defined in Appendix E shall be applied as shown in Figure B12 of Appendix B. A 1 kg weight shall be hung on one end of the abrasive cloth. The width of the cloth shall be 50 mm and it shall be made to slide over a coloured section between two marks 200 mm apart within 5 s to 10 s. The 1 kg weight shall be lifted to allow the paper to be placed at its starting position.

After five consecutive cycles the original colour of the measuring pole or rod shall not appear (to the naked eye) under the colouring matter.

22.3 *Electrical test after abrasion resistance test*

Test described in Sub-clauses 13.1, 13.2 and 13.3.

23. Tension puller (dead-end tool)

23.1 *Type A*

Electrical test

This test shall be made when the tension puller is built with an insulating cover on the flange (earth end). (See Figure B13a of Appendix B.) A voltage of 20 kV at power frequency shal be applied for 1 min between the flange (earth end) and an electrode made of wire gauze o conductive cloth placed on the insulating cover so that the clearance in air between th electrode and the flange is 50 mm.

No puncture, sparkover or flashover shall occur during the test.

23.2 *Type B (jacking screw)*

Electrical test on the jacking screw end of the puller

This test shall be required on tension pullers designed so that they have a metal part of the jacking screw that passes inside and toward the insulating section of the puller beyond the outer metal end-fitting (see Figure B13b of Appendix B). An electrode made of wire gauze, conductive cloth or braid shall be placed on the insulation at a position 50 mm from the metal part of the jacking screw end. This electrode shall extend at least 20 mm past the innermost position of any metal part that passes inside the insulating tool. The contact of this electrode shall be as good as possible. If an adhesive is used to hold the braid, this adhesive shall be of a conducting type.

An increasing alternating voltage at power frequency shall be applied at a rate of 5 kV/s between the electrode and the metal jack screw end until the voltage reaches 20 kV. This voltage shall remain constant for 1 min. No puncture, sparkover or flashover shall be observed during the test.

SECTION THREE — SAMPLING AND ROUTINE TESTS

24. Sampling tests

After agreement between the manufacturer and the customer all the type tests described above, or only some of them, shall be carried out again as sampling tests. They shall be made under the responsibility of the manufacturer who shall make the results available to the customer.

Sampling tests shall be carried out only for lots made of more than 90 tools. For lots made of 90 tools or less, sampling tests shall be replaced by acceptance tests (see Appendix A) at the request of the customer.

The sampling plan and the acceptable quality level shall be as in Table IX.

TABLE IX

Sampling plan

Lot or batch size	Sample size	Acceptance number	Rejection number
91 to 150	8	0	1
151 to 500	13	1	2
501 to 1 200	20	1	2
1 201 to 10 000	32	2	3

The tools tested at more than 125% of a rated value given by the manufacturer shall not be re-used.

25. Routine tests

The manufacturer shall make available to the customer the results of the tests and, in order to show compliance with this specification, he shall provide evidence that the routine tests have been carried out successfully on items of equipment fulfilling the following requirements:

— conformity of the items of equipment being considered with those which underwent the type tests,
— consistency of the items of equipment being considered.

25.1 *Visual inspection*

Each tool shall be visually inspected to check for manufacturing defects.

25.2 *Operation check*

Each tool shall be inspected to check for correct function and fit.

CHAPTER II: UNIVERSAL TOOL ATTACHMENTS (FITTINGS)

SECTION FOUR — TECHNICAL CHARACTERISTICS COMMON TO ALL TOOL ATTACHMENTS

26. General

Bolts loaded in shear shall not have their screw thread in the shear plane between connected members, unless the root diameter is adequate for the load safety factors.

— For fittings of tools loaded in tension or compression, it is preferable that they shall be designed so that the loading is centred and along the axis of the pole (or rod).

— The method of attachment of fittings shall be selected to ensure that the fitting cannot become detached accidentally.

— The method of attachment shall be such that the angle made by the pole and the tool axis, after attachment, shall be variable with a 30 pitch.

— The two examples of splined ends given in Appendix D are in accordance with these characteristics.

27. Dimensional and mechanical characteristics

— *Dimensional characteristics*

For each type of tool the manufacturer shall indicate the rated dimensions relating to the specific functions of the tool.

Mechanical characteristics

For each type of tool the manufacturer shall give rated values corresponding with the characteristics specified in Tables X and XI.

TABLE X

Splined end attachment

Visual tests (Clause 32) and dimensional checks (Clause 33) only are required in:

— Oilcan
— Ratchet spanner (wrench)
— Positive grip clamp pole head
— Shepherd's hook
— Ball-socket adjuster
— Fixed double prong head
— Split-pin (cotter-key) installer
— Insulator ball guide
— Hammer
— Self-aligning fuse puller
— Screw clamp
— Spiral disconnector
— Pruning saw
— Screwdriver
— Conductor sander
— Mirror

Family of tools / Characteristics	Hook pole (retractable hook stick) and universal adapters	Formed wire tool	Locating pin	Conductor cleaning brush	Spanner (wrench)
T_N	X				X
F_{TN}	X				
F_{BN}			X		
Other special characteristics	Torsion strength of the wing screws	Tensile strength of the prong		Crushing strength	

Family of tools / Characteristics	Split-pin remover (cotter-key remover)				Holding fork	Split-pin installer remover	Binding (tie) wire-cutter	Rotary blade	Rotary prong	Adjustable pliers	Vice-grip pliers	Adjustable insulator fork
	Spiral type	Fine point type	Cam type	Snap-out type								
T_N	X											X
F_{TN}				X				X	X			
F_{BN}		X	X		X	X	X			X	X	X
Other special characteristics				Rated return force						Tightening capability	Tightening capability	Strength of the articulation

Family of tools / Characteristics	All-angle pliers	Pin-holder	Flexible spanner (wrench) head	Ammeter holder	Anti-interference braid applicator	Hack saw
T_N			X	X		
F_{BN}	X	X			X	X
Other special characteristics	Tightening capability					

Family of tools / Characteristics	Conductor (wire) gauge	Gap gauge
F_{TN}		X
Other special characteristics	Deformation strength	

TABLE XI

Clevis and tenon pole tools (clevis and tongue tools)

Family of tools / Characteristics	Clevis eye attachment	Tension head (strain link) tongue attachment	Clevis tenon (tongue) adapter	Clevis tenon (tongue) extension	Strain roller tenon (tongue) attachment	Clevis screw adapter
F_{TN}	X	X	X	X	X	X

28. **Mechanical protection**

When necessary the ends of each attachment shall have adequate means for mechanical protection such as a cap. Metal attachments shall be carefully designed to ensure that all edges are rounded where this does not impair the function of the tool.

29. **Corrosion protection**

Metal parts shall be protected against corrosion either by their inherent composition, or by a suitable treatment.

30. **Conducting attachments**

All conducting attachments shall be as small as possible to reduce the danger of short circuit.

SECTION FIVE — TYPE TESTS

31. **General**

In order to show compliance with this standard the manufacturer shall provide evidence that the following tests have been carried out successfully on a minimum of three samples of each type of attachment. However, when several types of attachment are similar and the differences are limited to a few characteristics, the tests which are not influenced by these characteristics may be made on only one type and the result applied to the other types.

Note. In Tables XII and XIII the "Type test" column includes a reference to the clause in which the test is explained. Some columns relating to types of attachment are divided into a certain number of sub-columns equal to the number of destructive mechanical tests to be applied to the tool. These sub-columns show the sequence of tests to be applied.

TABLE XII

Type tests of splined end attachments

The first test is the visual inspection test (32)* made on each attachment.

Family of tools / Type test	Hook pole adapter (retractable hook stick adapter) and universal adapter (35)	Formed wire tool (36)	Locating pin (drift) (37)	Conductor cleaning brush		Oilcan (40)	Ratchet spanner (wrench) (41)	Spanner (wrench) (42)	Positive grip clamp (stick) head	Shepherd's hook
				Semi-tubular (38)	V-shaped (39)					
Dimensional (33)	2	2	2	2	2	2	2	2	2	2
Compatibility (34)	3	3	3	3	3	3	3	3	3	3
Torsion	4							4		
Bending			4							
Tension	2									
Other special type tests	Torsion of the wing screws 2	Tension of the prong 4		Fatigue test 4 Test of the articulation 5 Crushing test 6	Fatigue test 4	Operation of the control rod 4	Friction 4			

Family of tools / Type test	Split-pin remover (cotter-key remover) (43)				Ball-socket adjuster	Holding fork (44)	Fixed double prong head	Split-pin installer (cotter-key installer)	Split-pin installer (cotter-key) remover (45)	Binding wire (tie)-cutter (46)
	Spiral type	Fine point type	Cam type	Snap-out type						
Dimensional (33)	2	2	2	2	2	2	2	2	2	2
Compatibility (34)	3	3	3	3	3	3	3	3	3	3
Torsion	4									
Bending		4	5			4			4	4
Tension				5						
Other special type tests			Friction 4	Return force measure 4						

* Figures given within brackets refer to clauses in this standard.

(Table continued on page 45)

TABLE XII *(continued)*

The first test is the visual inspection test (32)* made on each attachment.

Family of tools / Type test	Rotary blade (47)	Rotary prong (48)	Insulator ball guide	Hammer	Self-aligning fuse-puller	Screw clamp	Adjustable pliers (49)		Vice-grip pliers (50)		Adjustable insulator fork (51)			All-angle pliers (52)		Pin-holder (53)
Dimensional (33)	2	2	2	2	2	2	2		2		2			2		2
Compatibility (34)	3	3	3	3	3	3	3		3		3			3		3
Torsion											4					
Bending							4		4			2		4		5
Tension	4	4														
Other special type tests								Tightening capability 2		Handle installation 2 Handle opening 3 Tightening capability 4			Test of the articulation 2		Tightening capability 2	Holding force measure 4

* Figures given within brackets refer to clauses in this standard.

(Table continued on page 47)

TABLE XII *(end)*

The first test is the visual inspection test (32)* made on each attachment.

Family of tools / Type tests	Flexible spanner (wrench) head (54)	Ammeter holder (55)		Anti interference braid applicator (56)	Spiral disconnector	Hack saw (57)	Pruning saw	Screwdriver	Conductor sander	Mirror (58)	Conductor gauge (wire gauge) (59)	Gap gauge (60)
Dimensional (33)	2	2		2	2	2	2	2	2	2	2	2
Compatibility (34)	3	3		3	3	3	3	3	3	3	3	3
Torsion	4	4										
Bending				5		4						
Tension												5
Other special ype tests			Shock test 2	Control of the slide section 4						Friction 4 Test of the mechanical protection 5	Measure of diameters 4 Rule slipping test 5 Gauge deformation 6	Electrical test 4

* Figures given within brackets refer to clauses in this standard.

TABLE XIII

Type tests of clevis and tenon pole tools (clevis and tongue tools)

The first test is the visual inspection (32)* made on each tool.

Family of tools / Type tests	Clevis eye attachment	Tension head (strain link) tongue attachment	Clevis tenon adapter (tongue)	Clevis tenon (tongue) extension	Strain roller tenon (tongue) attachment	Clevis screw adapter
Dimensional (33)	2	2	2	2	2	2
Compatibility (34)	3	3	3	3	3	3
Tension (61)	4	4	4	4	4	4

* Figures given within brackets refer to clauses in this standard.

32. **Visual inspection**

Each specimen shall be visually inspected to check for manufacturing defects and correct functioning.

33. **Dimensional check**

Each type of attachment shall be checked by measurement to ensure that it complies with the dimensions stated by the manufacturer.

34. **Compatibility check**

The tool attachments shall be checked to ensure that they fit properly on the pole which it has been built for.

35. **Hook pole adapter (retractable hook stick adapter) and universal adapter**

Torsion of the adapter

The adapter shall be fixed on the testing pieces as shown in Figure C1 of Appendix C. The wing screw shall be tightened with a 3 N.m torque.

A progressive torque shall be applied about the central axis of the hook pole until it reaches 1.25 T_N. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. The torque shall be applied again until it reaches 2.5 T_N. No major or critical defect shall occur.

Tension of the adapter

The adapter shall be fixed on the testing pieces as shown in Figure C1 of Appendix C. The wing screw shall be tightened with a 3 N.m torque.

A progressive tensile force shall be applied along the axis of the hook pole until it reaches 1.25 F_{TN}. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. The tensile force shall be applied again until it reaches 2.5 F_{TN}. No major or critical defect shall occur.

Torsion of the wing screw

The adapter shall be fixed on the testing pieces (see Figure C2 of Appendix C). A progressive torque of 10 N.m/s shall be applied to the wing screw until it reaches 1.25 T_N. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. The torque shall be applied again until it reaches 2.5 T_N. No major or critical defect shall occur.

36. **Formed wire tool**

Tension of the prong

The tool shall be fixed through its splined end (e.g. on a universal hand pole).

A progressive force of 50 N/s shall be applied on the prong (see Figure C3 of Appendix C) until it reaches 1.25 F_{TN}. This shall be maintained for 1 min.

No permanent deformation, or minor, major or critical defect shall occur. The force shall be applied again until it reaches 2.5 F_{TN}. No major or critical defect shall occur.

37. **Locating pin (locating drift)**

Bending

The locating pin (drift) shall be placed in the testing appliance shown in Figure C4 of Appendix C.

A progressive bending force of 200 N/s shall be applied on the axis of the splined end until it reaches 1.25 F_{BN}. This shall be maintained for 1 min.

No permanent deformation or minor, major or critical defect shall occur. The bending force shall be applied again until it reaches 2.5 F_{BN}. No major or critical defect shall occur.

38. **Conductor cleaning brush: semi-tubular type**

Fatigue test

The brush shall be placed in a testing device and subjected to rectilinear motion under a given pressure.

The pressure shall be chosen so that the crushing of the metallic points on a 20 mm diameter bar is 10% of their length (see Figure C5a of Appendix C).

The brush shall be subjected to 3 000 cycles of reciprocating motion:

Stroke: 100 $\pm$ 10 mm
Speed of reciprocating motion: 50 $\pm$ 2/min.

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

At the end of this test, the metallic points and the brush shall keep their efficiency.

Test of the articulation

The brush body shall be fixed, a progressive torque shall be applied to the splined end until it turns around the brush body. Rotation shall occur between 0.1 N.m and 0.15 N.m.

Cold crushing

Brushes shall be placed in a conditioning enclosure (6 h/– 10 °C). Closing crushing tests shall then be made as shown in Figure C6a of Appendix C and opening crushing tests shall be made as shown in Figure C6b during 1 h/10 °C applying 2.5 F_{CN} on the brush body.

No major or critical defect shall occur.

Hot crushing

Brushes shall be placed in a conditioning enclosure (4 h/55 °C/20% r.h.). Closing crushing tests shall be made as shown in Figure C6a of Appendix C and opening crushing tests shall be made as shown in Figure C6b of Appendix C during 1 h/55 °C/20% r.h. applying 2.5 F_{CN} on the brush body.

No major or critical defect shall occur. After the force is removed, the brush shall return to its original size, at ambient temperature (M/23 °C/50% r.h.).

Note. — Conditioning should be carried out in accordance with IEC Publication 212.

39. Conductor cleaning brush: V-shaped type

Fatigue test

The same test as the fatigue test for semi-tubular type brushes but as shown in Figure C5b of Appendix C.

40. Oilcan

Operation of the control handle

The oil reservoir shall be filled with lubricant and the oilcan shall be positioned vertically.

An increasing force shall be applied to the end of the operating handle until an oil jet appears from the spout. This shall occur between 15 N and 50 N.

A 150 N force shall then be applied on the control handle in the same way as above.

No permanent deformation or minor, major or critical defect shall occur.

The oil reservoir shall be emptied almost entirely with the operating handle and the first test repeated. The force shall remain within 15 N and 50 N.

41. Ratchet spanner (ratchet wrench)

Friction

The body of the tool shall be fixed and a progressive torque shall be applied to the splined end until it turns without stiffness. Rotation should occur between 2 N.m and 3 N.m.

42. **Spanner (wrench)**

Torsion

The spanner shall engage a nut which cannot rotate (see Figure C7 of Appendix C). The splined end of the spanner shall be engaged with the splined end fitting of a universal hand pole whose screw shall be tightened with a 10 N.m torque. A progressive torque shall be applied to the splined ends until it reaches 1.25 T_N. This shall be maintained for 1 min.

No permanent deformation, minor, major or critical defect, shall occur. The progressive torque shall be applied again until it reaches 2.5 T_N. No major or critical defect shall occur.

43. **Split-pin remover (cotter-key remover)**

a) Spiral type

The point of the tool shall be inserted in a d mm diameter hole drilled in a plate which is harder than the tool. A metal plate shall be fixed a mm underneath the hole axis; the tool shall be in contact with this support plate (see Figure C8 of Appendix C). 1.25 T_N shall be applied to the splined end of the tool through the splined end of a universal hand pole and shall be maintained for 1 min.

No permanent deformation, or minor, major or critical defect shall occur. Then 2.5 T_N shall be applied. No major or critical defect, shall occur.

b) Fine point type

The point of the tool shall be inserted in a d mm diameter hole drilled in a 10 mm thick plate which is harder than the tool. A metal plate shall be fixed a mm underneath the hole axis; the tool shall be in contact with this support plate (see Figure C9 of Appendix C). A torque of 1.25 T_N shall be applied through a lever (e.g. a universal hand pole) fixed on the splined end, and shall be maintained for 1 min.

No permanent deformation, or minor, major or critical defect shall occur. Then the force shall be applied until it reaches 2.5 T_N. No major or critical defect shall occur.

c) Cam type (Pry Type)

Bending

Let *"a"* be the rated distance given by the manufacturer (see Figure C10 of Appendix C). The point of the tool shall be inserted in a d mm diameter hole drilled in a plate which shall be harder than the tool. A support plate shall be fixed underneath the hole axis (see Figure C10). The wings shall be in contact with the support plate. Then 1.25 F_{BN} shall be applied at the rated distance a mm from the point of the tool and shall be maintained for 1 min. The point shall not slip out of the hole.

At the end of the test no deformation, minor, major or critical defect shall occur. Then 2.5 F_{BN} shall be applied at the distance a mm. No major or critical defect shall occur.

Friction

Through a complete turn of the splined end, the minimum torque which produces rotation of the end and the maximum value needed to maintain this rotation shall be determined. The rotation shall occur between 0.5 N.m and 1.5 N.m.

d) Snap-out type

— Return force measure: let F_R be the rated return force of the spring given by the manufacturer. The minimum force which puts the tool to the end of its travel shall be measured. It shall be equal to $F_R \pm 20\%$.

— Tension: the snap-out split-pin remover (cotter-key remover) shall be fixed on a testing piece made with a splined end fitting. Then 2.5 F_{TN} shall be applied to the cone-shaped point of the tool through an 8 mm diameter pin, at the speed of 500 N/s. No major or critical defect shall occur.

44. Holding fork

Bending

The fork shall be fixed as shown in Figure C11 of Appendix C. A progressive bending force of 10 N/s shall be applied in the axis of the splined end until it reaches 1.25 F_{BN}. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. The fork shall not open, or slip. Then the force shall be applied again until it reaches 2.5 F_{BN}. No major or critical defect shall occur.

45. Split-pin installer remover (cotter-key installer remover)

Bending

The tool shall be assembled with a solidly fixed splined end. The wing screw shall be tightened with 4 N.m torque. The tool shall be placed as shown in Figure C12 of Appendix C. 1.25 F_{BN} shall be applied, 200 mm from the axis of the splined end, and shall be maintained for 1 min.

No minor, major or critical defect shall occur. Then another tool shall be placed as shown in Figure C13, page 86, of Appendix C. 1.25 F_{BN} shall be applied to the end of the "installer" part of the tool and shall be maintained for 1 min. Then 2.5 F_{BN} shall be applied. No minor, major or critical defect shall occur.

46. Binding wire-cutter (tie wire-cutter)

Bending

The binding wire-cutter shall be engaged in the notch of the testing device shown in Figure C14 of Appendix C. A progressive bending torque of 5 N.m/s shall be applied as shown in Figure C15 of Appendix C, until it reaches 1.25 F_{BN}.

No minor, major or critical defect shall occur. Then the torque shall be applied again until it reaches 2.5 F_{BN}. No major or critical defect shall occur.

47. **Rotary blade**

Tension

The splined end of the rotary blade shall be fitted to a splined end fitting; a progressive tensile force of 50 N/s shall be applied to the blade as shown in Figure C16 of Appendix C, until it reaches 1.25 F_{TN}. This shall be maintained for 1 min.

No permanent deformation, minor, major or critical defect shall occur. Blade rotation, by hand, shall be normal. Then the force shall be applied again until it reaches 2.5 F_{TN}. No major or critical defect shall occur.

48. **Rotary prong**

Tension

The same test as for the rotary blade, but as shown in Figure C17 of Appendix C, shall be carried out.

49. **Adjustable pliers**

Tightening capability

A 20 mm diameter metal rod shall be placed in the adjustable pliers as shown in Figure C18 of Appendix C. A progressive torque of 1 N.m/s shall be applied to the splined end, rigidly locked in the lengthwise axis of the tool, until it reaches 1.25 T_N. This shall be maintained for 1 min.

No permanent deformation, minor, major or critical defect shall occur. The progressive torque shall be applied again until it reaches 2.5 T_N. No major or critical defect shall occur.

Bending

A 20 mm diameter metal rod shall be gripped in the adjustable pliers as shown in Figure C19 of Appendix C, with a 35 N.m torque. A progressive bending force of 20 N/s shall be applied to the fixed splined end until it reaches 1.25 F_{BN}. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. A progressive bending force shall be applied again until it reaches 2.5 F_{BN}. No major or critical defect shall occur.

50. **Vice-grip pliers**

Tightening capability

A 20 mm diameter metal rod shall be placed in the pliers as shown in Figure C20 of Appendix C. A progressive tightening torque of 1 N.m/s shall be applied to the eye screw end of the vice-grip pliers in the lengthwise axis of the tool until the torque reaches 1.25 T_N. This shall be maintained for 1 min.

No minor, major, or critical defect shall occur. The torque shall be applied again in the same manner until it reaches 2.5 T_N. No major or critical defect shall occur during a 1 min holding period.

Handle installation

A 20 mm diameter metal rod shall be placed in the pliers as shown in Figure C20 of Appendix C. The eye screw shall be tightened to a torque value equal to 0.25 T_N with the clamp handle over-centre device in the open position.

The clamp handle over-centre device shall then be gripped with a clamp to apply a closing force on the handle as shown in Figure C20 of Appendix C. This clamp shall measure the force as the jaws are moved together. The clamp handle will then be removed to the over-centre or locked position. The force required shall not exceed 200 N.

Handle opening

After completing the clamping of the pliers in the handle installation test, the clamp shall be removed.

A reverse motion clamp shall then be positioned as shown in Figure C20 of Appendix C so as to permit the opening of the vice clamp over-centre locking handle lever and measure the force required.

The over-centre handle shall move to permit removal from the metal rod at a value less than 100 N.

Bending

The vice-grip pliers shall then be installed again on the 20 mm diameter metal rod that has now been positioned in a fixed support using an eye-screw torque of T_N and over-centre handle force to close the pliers. The test shall then be continued in the same manner as that for adjustable pliers of Clause 49. No major or critical defect shall occur.

51. Adjustable insulator fork

Torsion of the splined end

A tube of appropriate diameter shall be tightened in the adjustable fork in line with the splined end. The fork shall be fixed to the end of a universal hand pole (stick) whose screw shall be clamped with a 10 N.m torque (see Figure C21 of Appendix C). A progressive torque shall be applied until it reaches 1.25 T_N. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. The torque shall be applied again until it reaches 2.5 T_N. No major or critical defect shall occur.

Bending

The splined end of the tool shall be horizontally fixed to the end of a universal hand pole, in alignment with it (see Figure C22 of Appendix C). A progressive bending force shall be applied until it reaches 1.25 F_{BN}. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. The force shall be applied again until it reaches 2.5 F_{BN}. No major or critical defect shall occur.

Test of the articulation

The end of the fork shall be fixed as in the bending test (see Figure C23 of Appendix C); the locking wing nut of the splined articulation shall be clamped with a 10 N.m torque. A progressive tensile force shall be applied along the axis of the fork pliers maintained in a flat position until it reaches 1.25 F_{TN}. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. The force shall be applied again until it reaches 2.5 F_{TN}. No major or critical defect shall occur.

52. **All-angle pliers**

Tightening capability

A 20 mm diameter metal rod shall be placed in the pliers as shown in Figure C24 of Appendix C. A progressive tightening torque of 1 N.m/s shall be applied to the splined end in the lengthwise axis of the tool until it reaches 1.25 T_N. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. The torque shall be applied again until it reaches 2.5 T_N. No major or critical defect shall occur.

Bending

A 20 mm diameter metal rod shall be clamped between the pliers as shown in Figure C25 of Appendix C, with a 35 N.m torque. A progressive force of 20 N/s shall be applied to the splined end until it reaches 1.25 F_{BN}. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. The force shall be applied again until it reaches 2.5 F_{BN}. No major or critical defect shall occur.

3. **Pin-holder**

Holding force of the spring

A round head rivet-pin corresponding to the type of pin-holder shall be employed in this test. The rivet-pin shall be placed in the notch of the tool and shall be held only by the spring leaf. The adjusting device shall not be employed (see Figure C26 of Appendix C). A progressive force of 1 N/s shall be applied between the fixed pin and the splined end until the pin slips out of the notch. This slippage should occur between 10 N and 15 N.

Bending

A round head rivet-pin corresponding with the type of pin-holder shall be employed in this test. The pin-holder shall be fixed in a horizontal plane; the round head rivet-pin shall be placed downward in the notch of the blade as shown in Figure C27 of Appendix C. The adjusting device shall not be employed. A progressive bending force of 30 N/s shall be applied to the end of the round head rivet-pin until it reaches 1.25 F_{BN}. This shall be maintained for 1 min. The pin shall not slip out of the notch and no minor, major or critical defect shall occur. The force shall be applied again until it reaches 2.5 F_{BN}. No major or critical defect shall occur.

54. **Flexible spanner head (flexible wrench head)**

Torsion

While the other end is fixed, a progressive torque of 2 N.m/s shall be applied to the splined end of the tool until it reaches 1.25 T_N. This shall be maintained for 1 min.

No permanent deformation, minor, major or critical defect shall occur. The torque shall be applied again until it reaches 2.5 T_N. No major or critical defect shall occur.

55. **Ammeter-holder**

Torsion

The ammeter-holder body shall be rigidly fixed as shown in Figure C28 of Appendix C. A progressive torque of 1 N.m/s shall be applied to the splined end until it reaches 1.25 T_N. This shall be maintained for 1 min.

No permanent deformation, no minor, major or critical defect shall occur. The torque shall be applied again until it reaches 2.5 T_N. No major or critical defect shall occur.

Shock test

This test shall be performed only when the ammeter-holder is made of brittle material. The ammeter-holder shall be placed on the pendulum as shown in Figure C29 of Appendix C for a shock test. The weight of the testing hammer shall be 0.5 kg and the height shall be 0.5 m. Only one shock shall be applied to the most fragile parts.

No minor, major or critical defect shall occur.

56. **Anti-interference braid applicator**

Checking of the slide section

Each slide section shall be checked with a gauge (see Figure C30 of Appendix C). The gauge shall be inserted in the slide (in the smallest section) up to the thrust block and it shall not be possible to insert the gauge in the other slide.

Bending

This test shall be made on the two slides (one after the other) of the tool. The testing piece (see Figure C31 of Appendix C) shall be engaged in the slide up to the thrust block. The tool shall be fixed so that the slide is horizontal, opening downward (see Figure C31 of Appendix C). A progressive bending force of 10 N/s shall be applied to the end of the testing piece until it reaches 1.25 F_{BN}.

No permanent deformation, no minor, major or critical defect shall occur. The force shall be applied again until it reaches 2.5 F_{BN}. No major or critical defect shall occur.

57. **Hack saw**

Bending

The saw handle shall be fitted so that its axis is normal to the blade axis. The wing screw shall be tightened with a 3 N.m torque. A pin of suitable diameter shall be inserted in the hole of the handle and the formed part of the frame shall be placed against a pin. A progressive force of 50 N/s shall be applied through a cable (see Figure C32 of Appendix C), between the straining screw and the pin inserted in the handle, until it reaches 1.25 F_{BN}. This shall be maintained for 1 min.

No permanent deformation, no minor, major or critical defect shall occur. The force shall be applied again until it reaches 2.5 F_{BN}. No major or critical defect shall occur.

58. **Mirror**

Friction

The splined end of the mirror shall be fixed to the splined end of a testing piece (see Figure C33 of Appendix C) so that the optical axis is horizontal whatever the articulation position may be. The torque which causes the rotation of the mirror around the frictional articulation shall be measured. The measured value shall be between 0.3 N.m and 0.6 N.m.

Mechanical protection

The mirror shall be dropped on a flat hard surface once on the flat with the mirror facing down (mirror plan horizontal) and once on the edge (mirror plan vertical) from a 1 m height.

No major or critical defect shall occur.

59. **Conductor (wire) gauge**

Diameter measurement

Three different diameters (with a 5% accuracy) of measuring rods shall be measured with the conductor (wire) gauge. The difference between measured values and the corresponding correct diameters shall be not greater than 5%.

Rule slipping test

The moveable rule shall be placed in its lower position. A force shall be applied to its slide so that the rule slips in its seating as shown in Figure C34 of Appendix C. This shall occur between 2.5 N and 5 N.

Deformation of the gauge body

The gauge shall be fixed and a 16 ± 0.1 mm diameter metal rod shall be placed in the measuring "V" (see Figure C35 of Appendix C). A progressive force of 10 N/s shall be applied to the rod along the axis of the gauge until it reaches 1.25 F_{CN}. Deformation measured on the rule shall be less than 5 mm.

No minor, major or critical defect shall occur. No deformation shall persist after the force is removed. The force shall be applied again until it reaches 2.5 F_{CN}. No major or critical defect shall occur.

60. **Gap gauge**

Tension

The gap gauge shall be placed in a testing device as shown in Figure C36 of Appendix C. A progressive force shall be applied to the splined end through a hook stick adapter (retractable hook pole adapter) until it reaches 1.25 F_{TN}. This shall be maintained for 1 min.

No minor, major or critical defect shall occur. Then the force shall be applied again until it reaches 2.5 F_{TN}. No major or critical defect shall occur.

Electrical test

The gauge shall be soaked in water and conditioned for 24 hours (24 h/23 ± 0.5 C/water) then wiped and left in free air for one hour (1 h/18 C-28 C/45%-75% r.h. — see IEC Publication 212). Electrodes shall be placed on each side of the gauge and shall be held with a light pressure (see Figure C37 of Appendix C). The dimensions of the electrodes shall be those of the gauge body; their edges shall be rounded. An alternating voltage shall be applied, at power frequency, between the two electrodes. The customer shall specify the thicknesses and the corresponding test voltage values which meet the safety rules of his electrical network.

No flashover or puncture shall occur.

61. **Clevis and tenon pole tools (clevis and tongue tools)**

Tension

The tool shall be fitted in a tensile test bench between two suitable pins. A progressive tensile force of 500 N/s shall be applied until it reaches 1.25 F_{TN}. This shall be maintained for 5 min.

No minor, major or critical defect shall occur. The force shall be applied again until it reaches 2.5 F_{TN}. No major or critical defect shall occur.

SECTION SIX — SAMPLING AND ROUTINE TESTS

62. **Sampling tests**

After agreement between the manufacturer and the customer all the type tests described above, or only some of them, shall be carried out again as sampling tests. They shall be made under the responsibility of the manufacturer who shall make the results available to the customer.

Sampling tests shall be carried out only for lots of more than 90 tool attachments. For lots of 90 or less tool attachments, sampling tests shall be replaced by acceptance tests (see Appendix A) on request by the customer.

The sampling plan and the acceptable quality level shall be as in Table XIV.

TABLE XIV

Sampling plan

Lot or batch size	Sample size	Acceptance number	Rejection number
91 to 150	8	0	1
151 to 500	13	1	2
501 to 1 200	20	1	2
1 201 to 10 000	32	2	3

The tools tested at more than 125% of a rated value given by the manufacturer shall not be re-used.

63. **Routine tests**

The manufacturer shall make available to the customer the results of the tests and, in order to show compliance with this specification, he shall provide evidence that the routine tests have been carried out successfully on items of equipment fulfilling the following requirements:

— conformity of the items of equipment being considered with those which underwent the type tests,

— consistency of the items of equipment being considered.

63.1 *Visual inspection*

Each tool shall be visually inspected to check for manufacturing defects.

63.2 *Operation*

Each tool shall be inspected to check for correct function and fit.

CHAPTER III: SPECIAL CLAUSES

64. Marking

Each tool of a batch shall carry at least the following information in a durable form:

— the name or trademark of the manufacturer,

— the type reference,

— the year and, if possible, the month of manufacture (this is not compulsory for splined end tool attachments).

The marking shall not affect the performance of insulating parts (if any); if a removable label is used, the performance shall not be affected by its removal.

65. Modifications

Before carrying out any modification of any characteristic of a tool during the manufacture of an order, the manufacturer shall obtain the agreement of the customer.

Modifications may require new type tests, in whole or in part, according to the degree of the modifications.

66. Acceptance tests

See Appendix A.

APPENDIX A

ACCEPTANCE TESTS

As defined in IEC Publication 50(151), under IEV 151-04-20, an acceptance test is a contractual test to prove to the customer that the device meets certain conditions of its specification. These tests may be carried out on every unit (routine test) or a sampling of the units (sampling tests).

If a customer indicates in his specification that the device shall meet the IEC standard only, the acceptance tests are those (both routine and sampling tests) which are specified in this standard.

The customer may, however, if he wishes, ask for additional tests or modify the sampling size but shall include this in his own specification. For example, during mechanical tests, the applied forces should correspond to a 1.1 coefficient when they are proportional to rated values indicated by manufacturers. The force being maintained for 1 min, no minor, major or critical defect should occur.

The customer may wish to witness the tests, have someone witness them or simply accept the results of the tests as carried out by the manufacturer. He may also specify that the tests be carried out in an independent laboratory of his choice or even in his own laboratory.

Further, the customer may specify the additional tests or larger sampling sizes when he is purchasing from a new manufacturer because he has experienced problems with a particular manufacturer, or because he is purchasing a new product or a new manufacturing process.

APPENDIX B

INSULATING POLES WITH PERMANENTLY ATTACHED FITTINGS — FIGURES

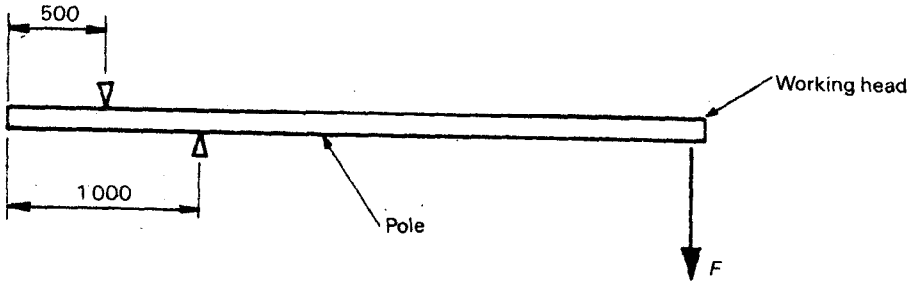
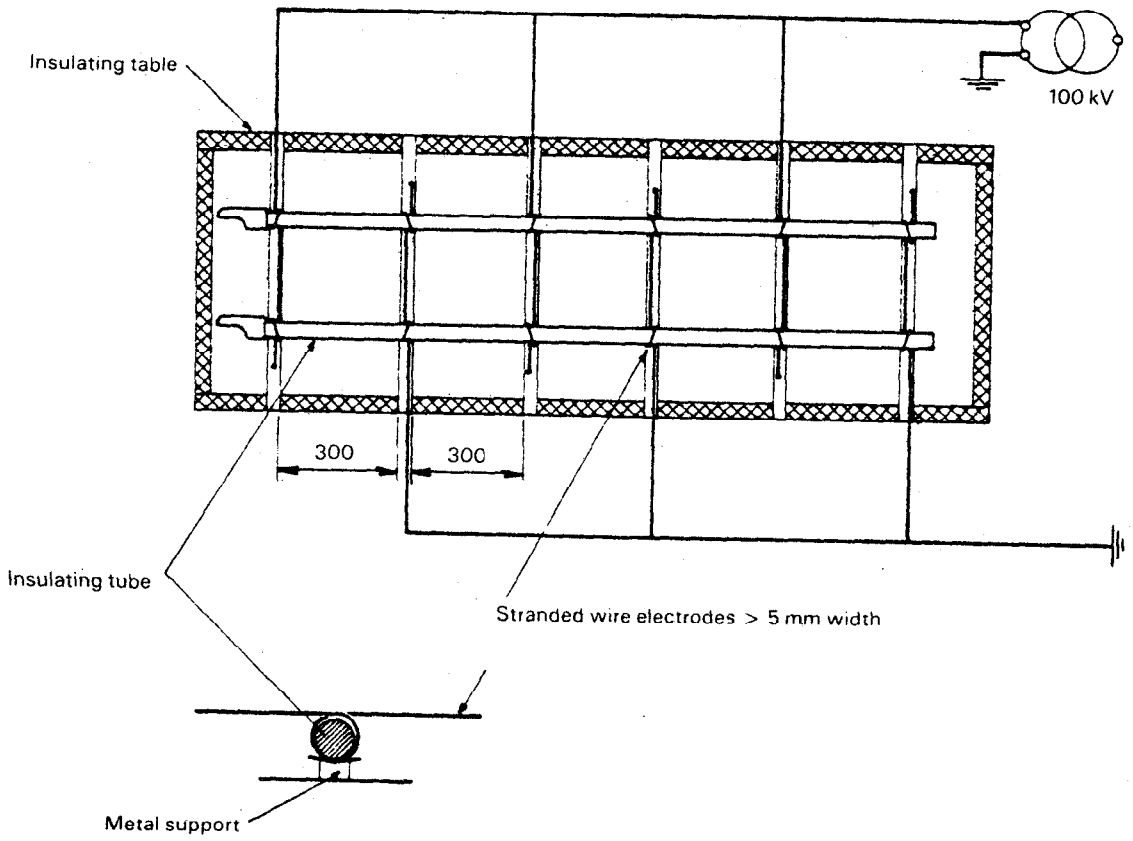


FIG. B1. — Bending test.

Dimensions in millimetres



Dimensions in millimetres

FIG. B2. — Electrical test.

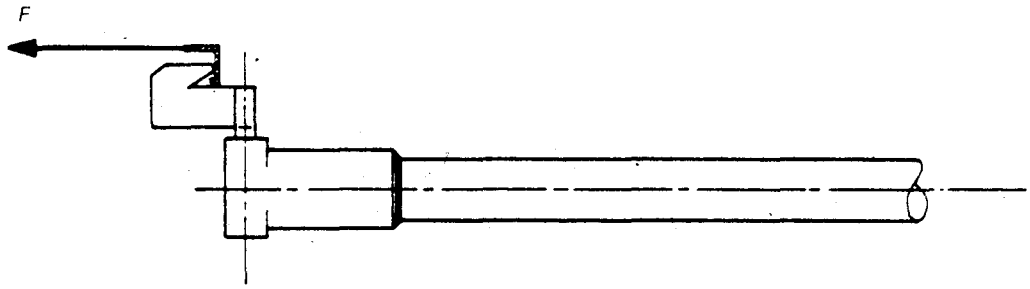


FIG. B3. — Tension of the rotary blade.

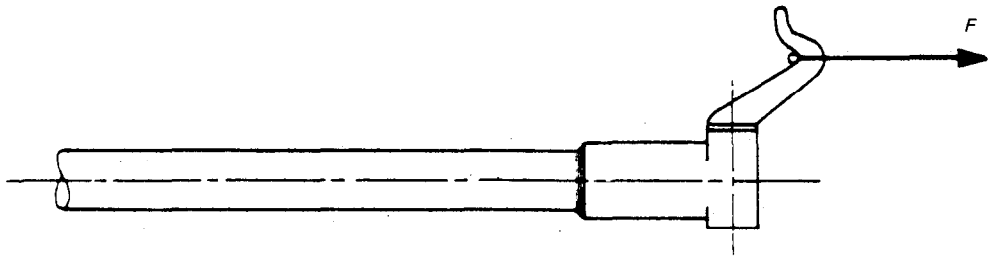


FIG. B4. — Tension of the rotary prong.

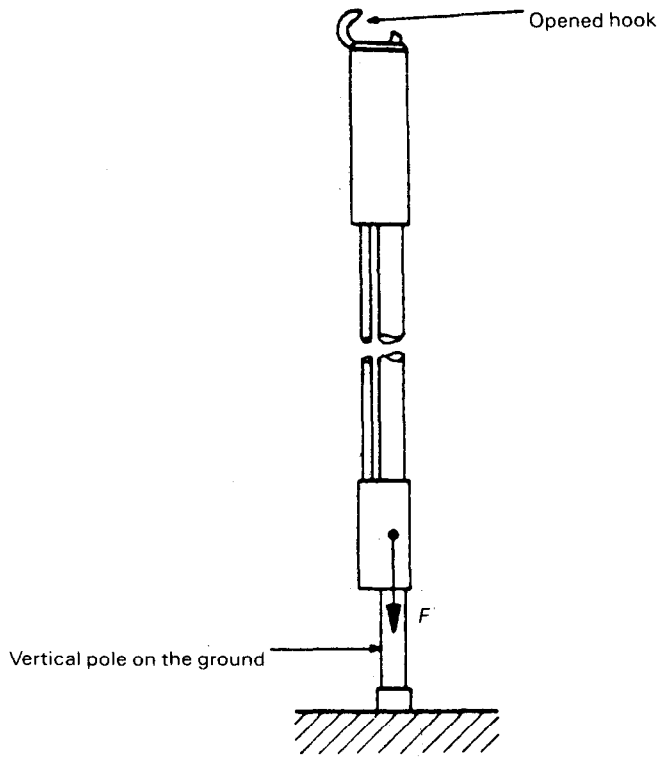


FIG. B5. — Operation of the control rod.

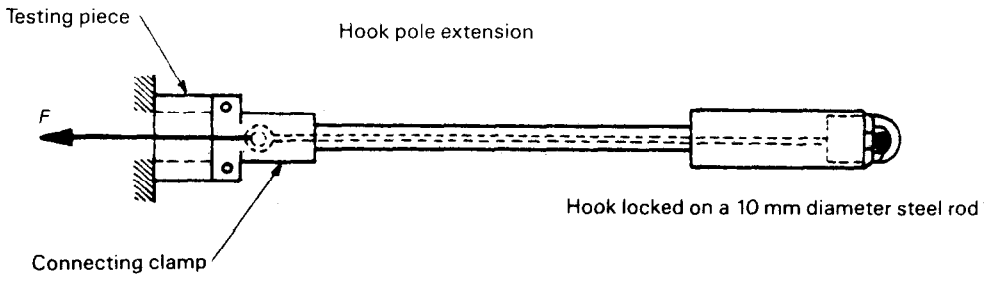


FIG. B6. — Tensile test of connecting clamp.

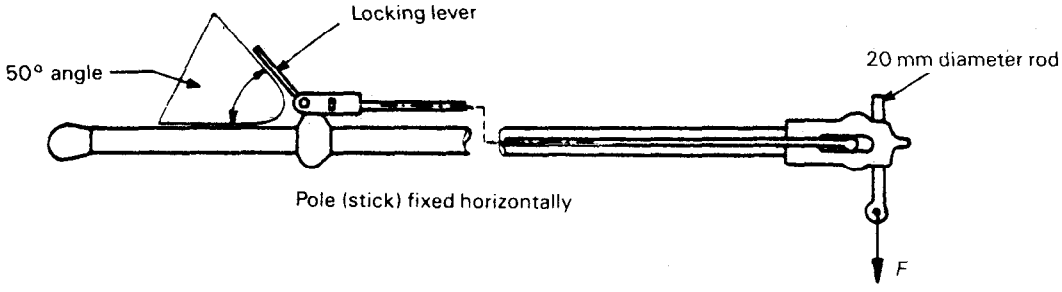


FIG. B7. — Wire holding pole (stick): tightening test.

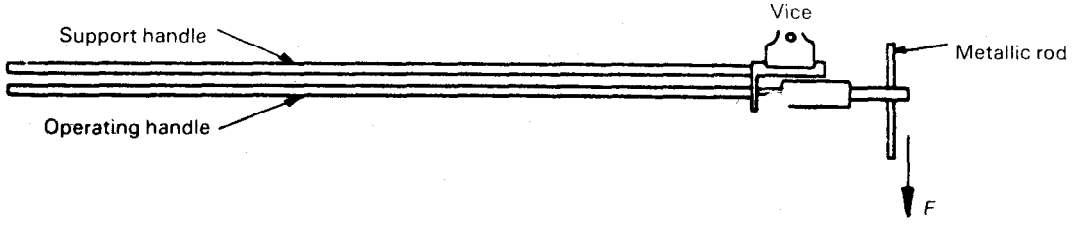


FIG. B8. — Cotter-key plier pole: tightening test.

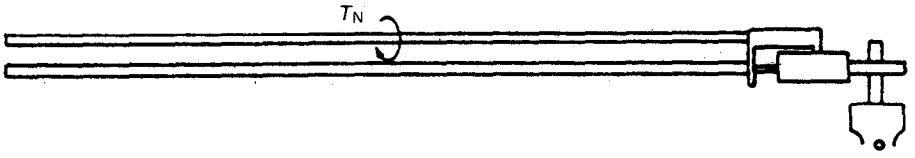


FIG. B9. — Cotter-key plier pole: torsion of the support handle.

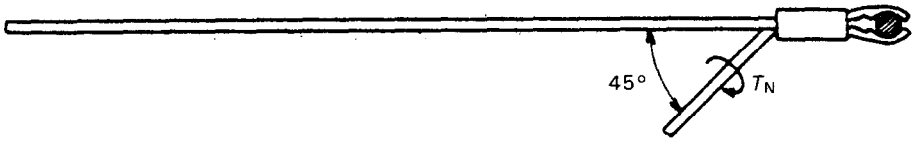


FIG. B10. — Cotter-key plier pole: torsion of the operating handle.

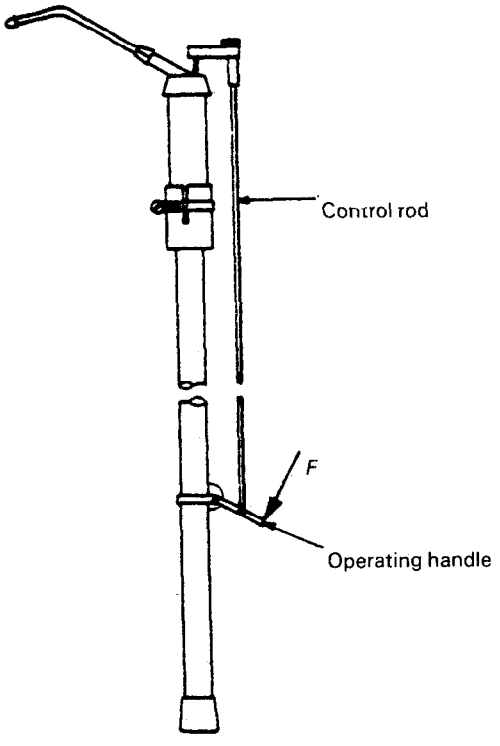


FIG. B11. — Insulated oiler pole: operation of the control rod.

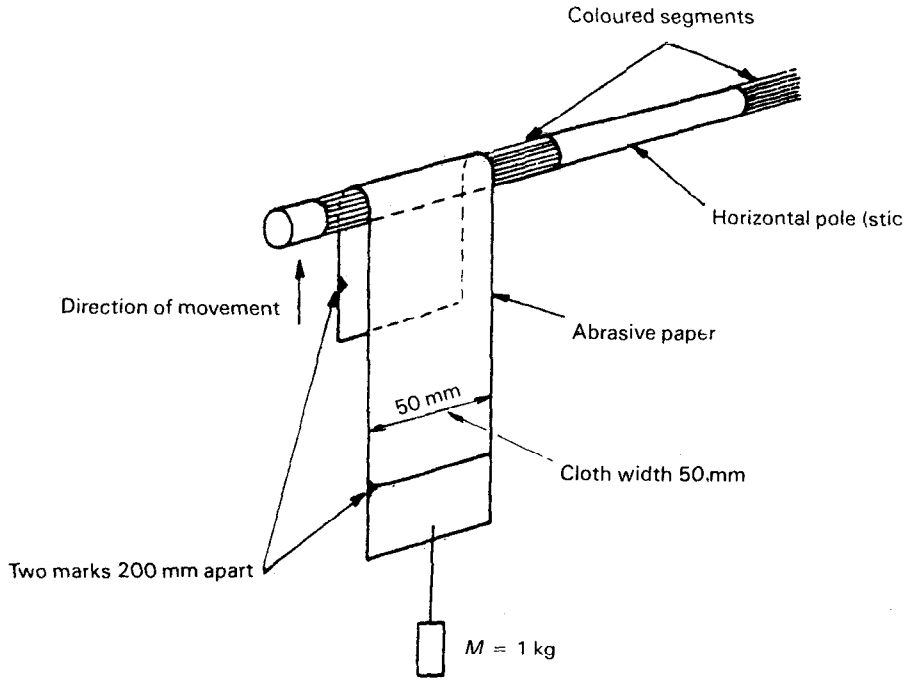


FIG. B12. — Measuring pole or rod (stick): abrasion resistance test.

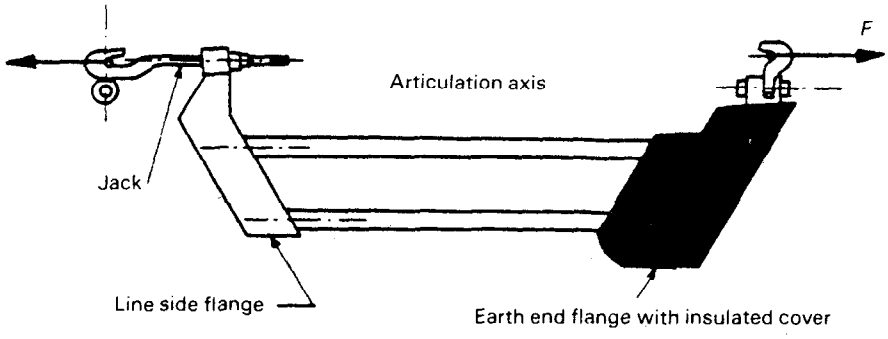


FIG. B13a. — Tension puller (dead-end tool). } Type A

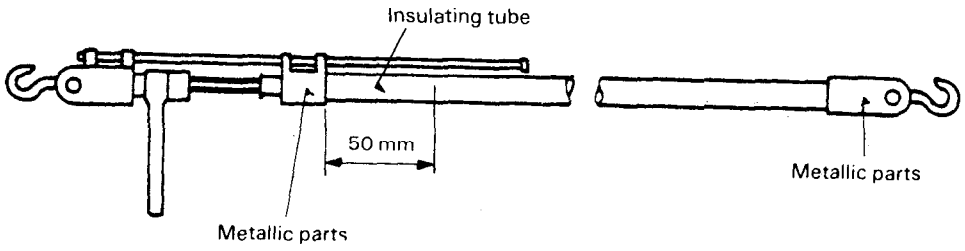


FIG. B13b. — Tension puller (dead-end tool). } Type B { Jacking screw

APPENDIX C
UNIVERSAL TOOL ATTACHMENTS (FITTINGS) — FIGURES

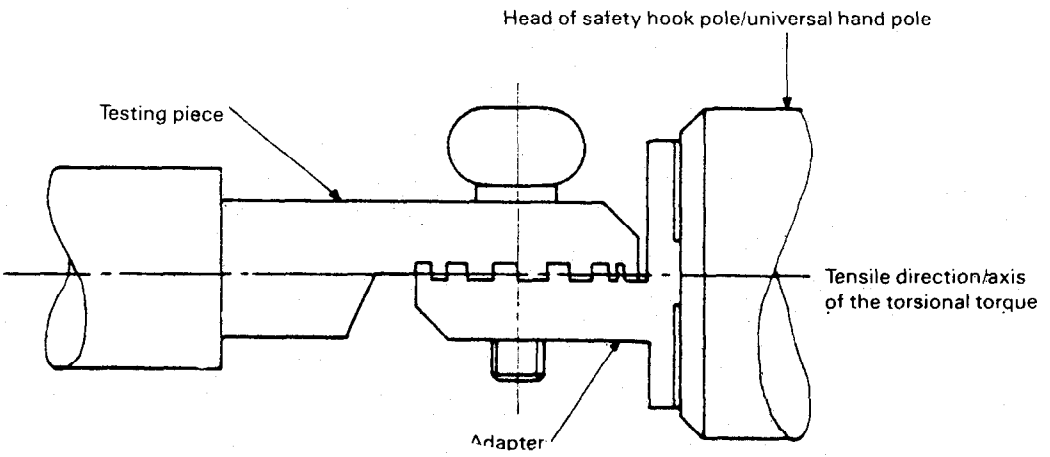


FIG. C1. — Torsion and tension of the universal adapter and the hook pole adapter (retractable hook stick adapter).

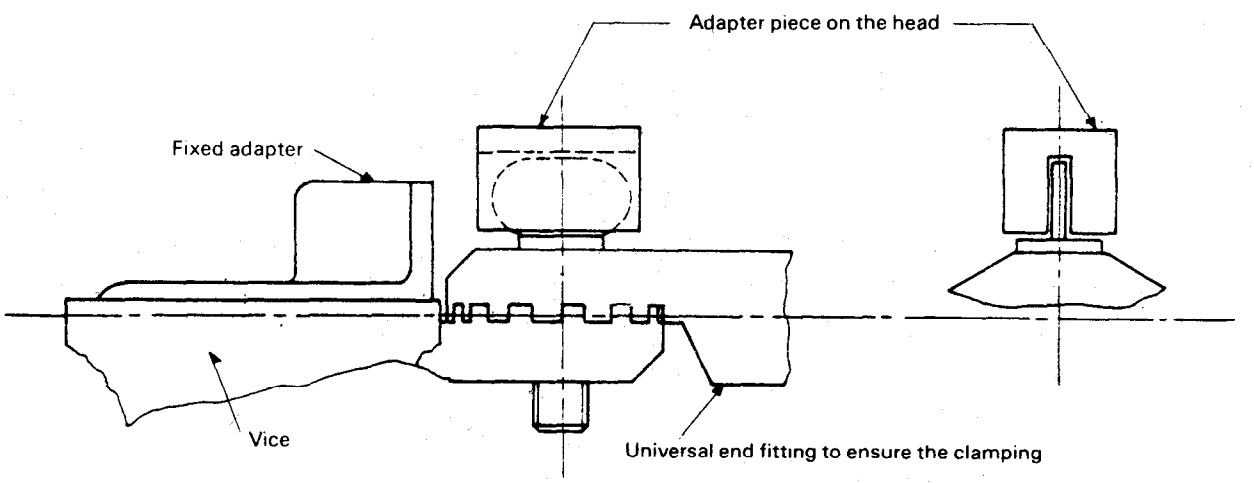


FIG. C2. — Torsion of the wing screw.

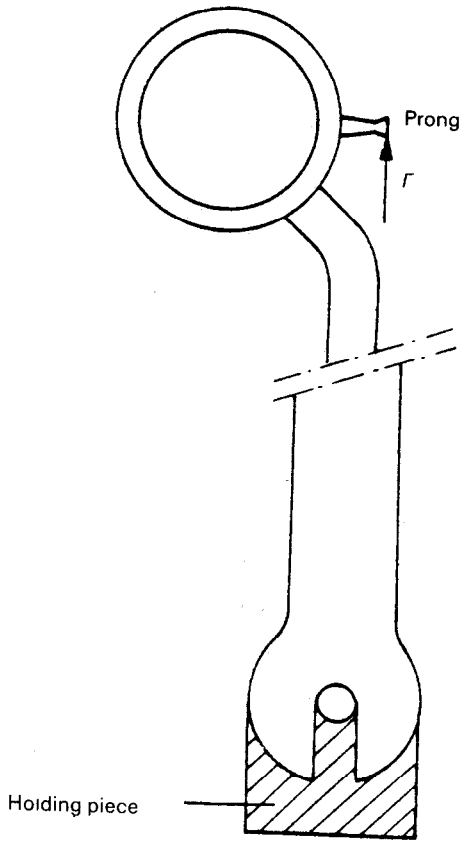


FIG. C3. — Tension of the prong of the formed wire tool.

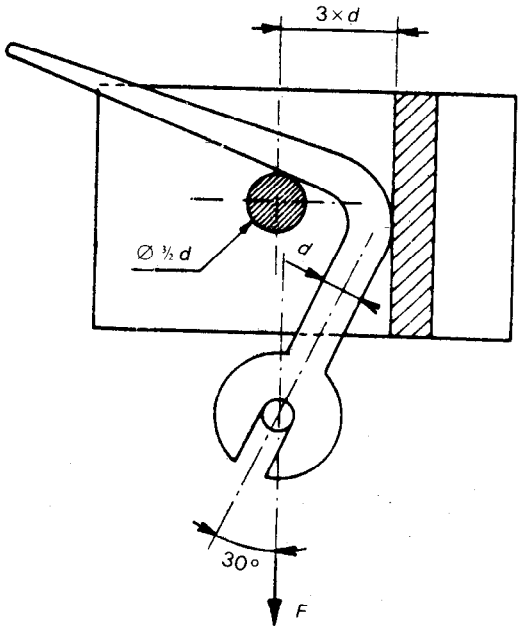


FIG. C4. — Bending of the locating pin (locating drift).

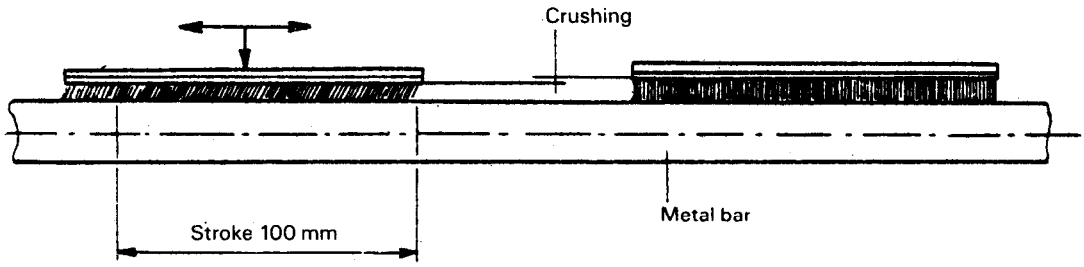


FIG. C5a. — Fatigue test of the conductor cleaning brush: semi-tubular type.

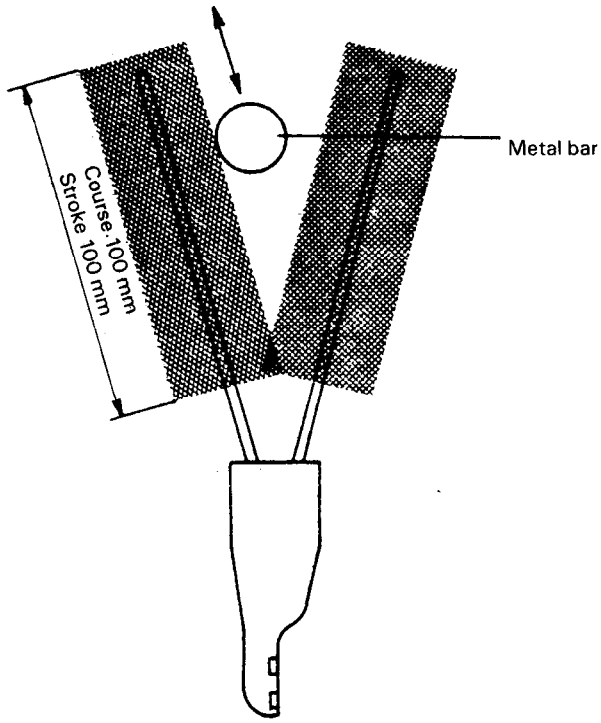


FIG. C5b. — Fatigue test of the conductor cleaning brush: V-shaped type.

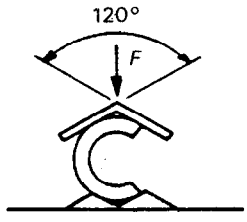


FIG. C6a. — Closing crushing.

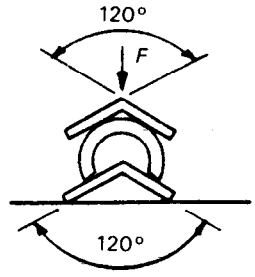


FIG. C6b. — Opening crushing.

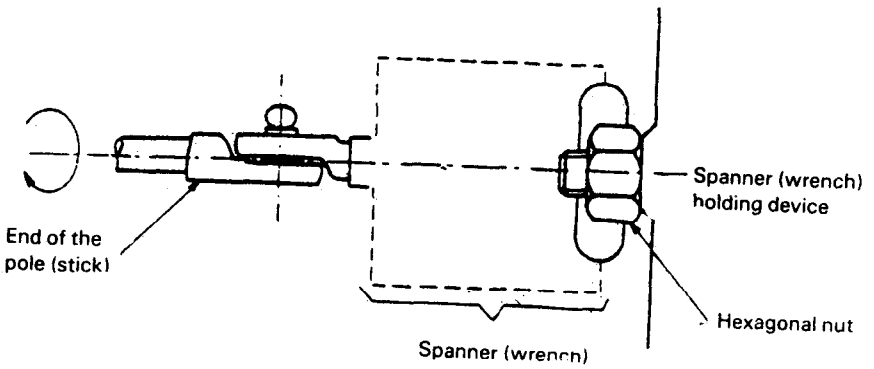


FIG. C7. — Spanner (wrench): torsion test.

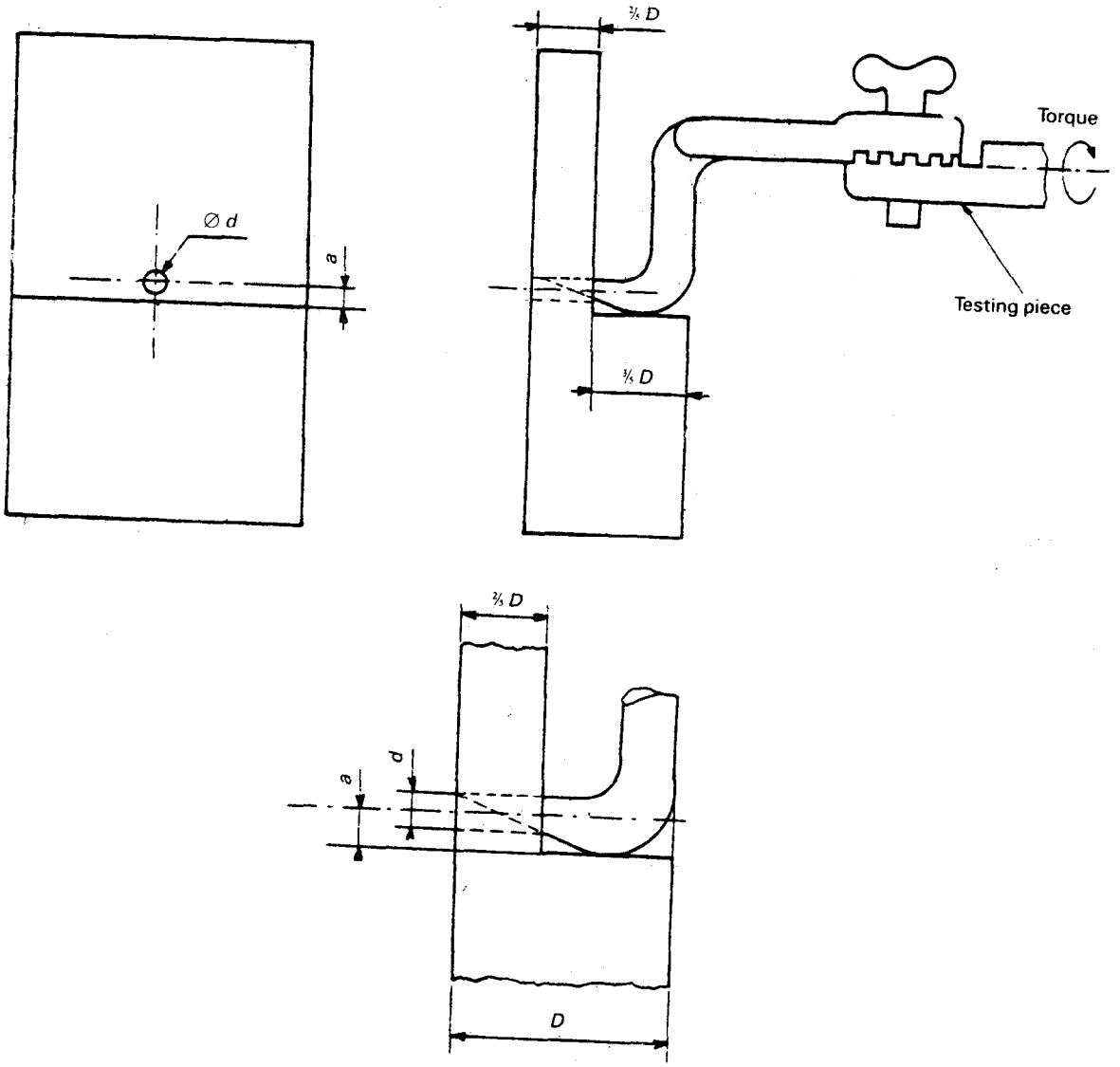


FIG. C8. — Split-pin remover/spiral type: torsion test.

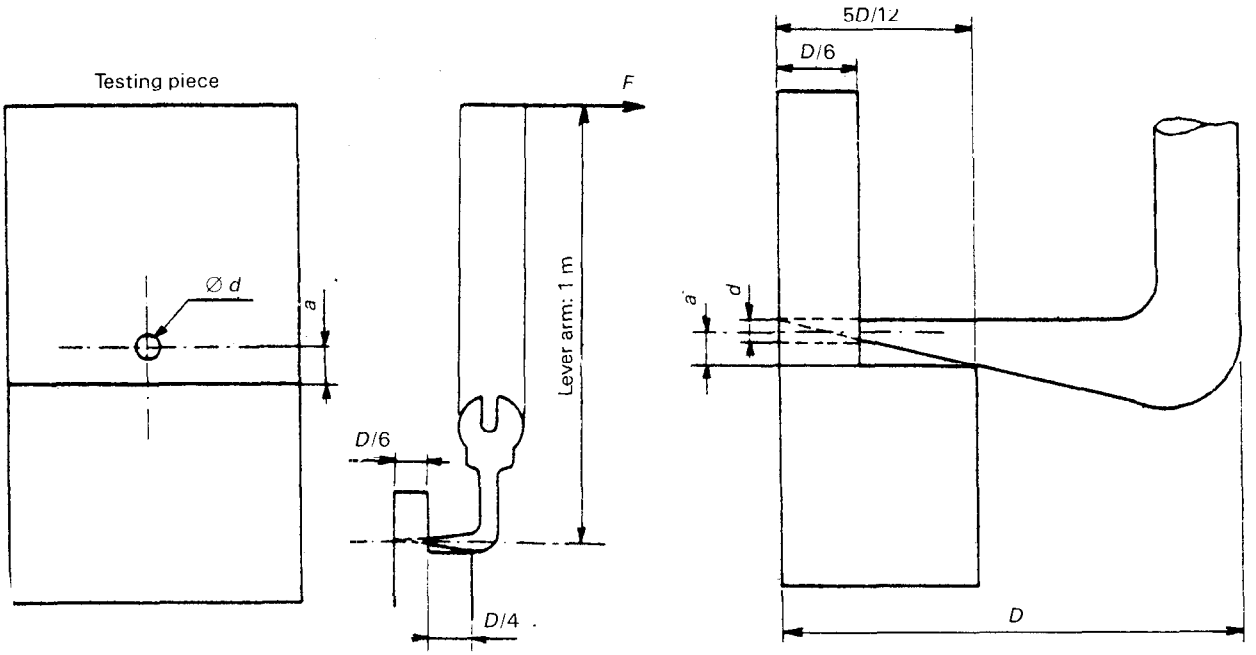


FIG. C9. — Split-pin remover/fine point type: torsion test.

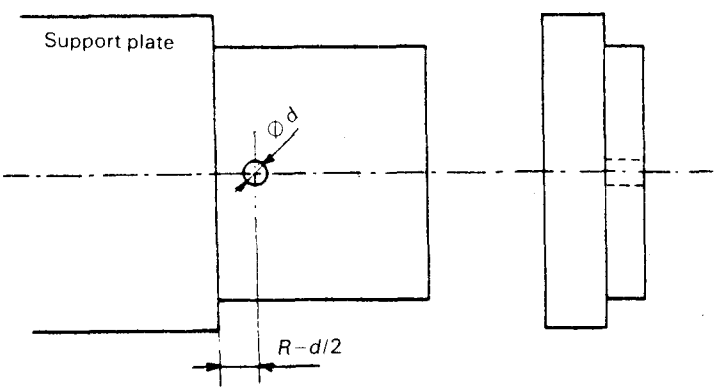
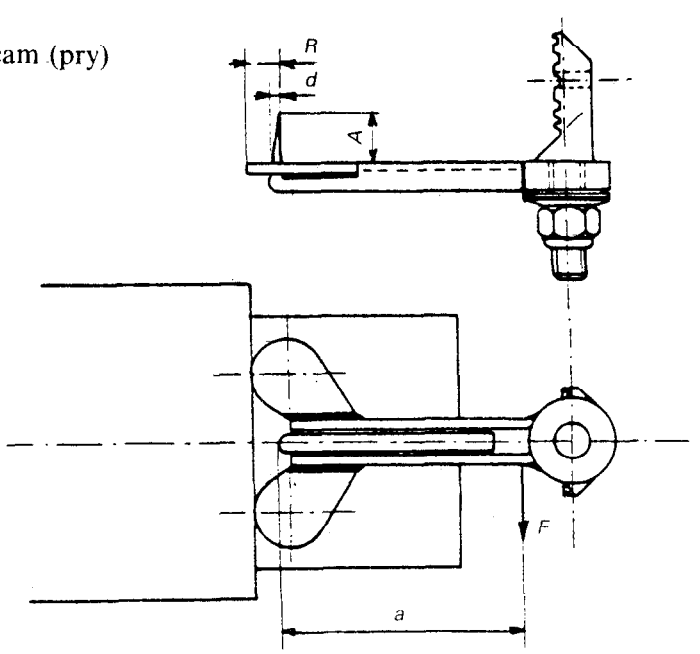


FIG. C10. — Split-pin remover/cam (pry) type: bending test.



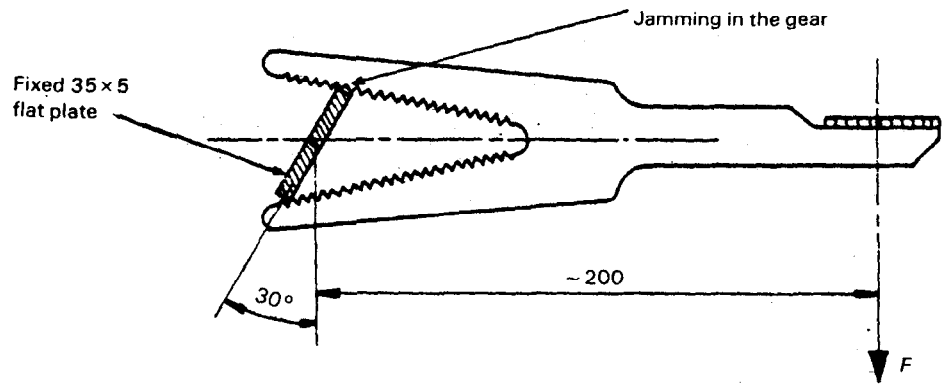


FIG. C11. — Bending test of the holding fork.

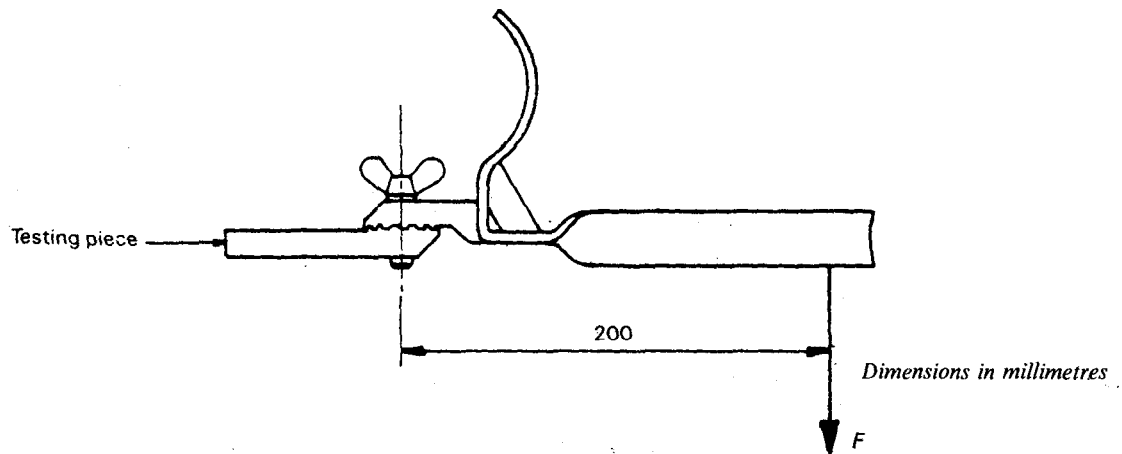


FIG. C12. — Bending test of the split-pin installer remover.

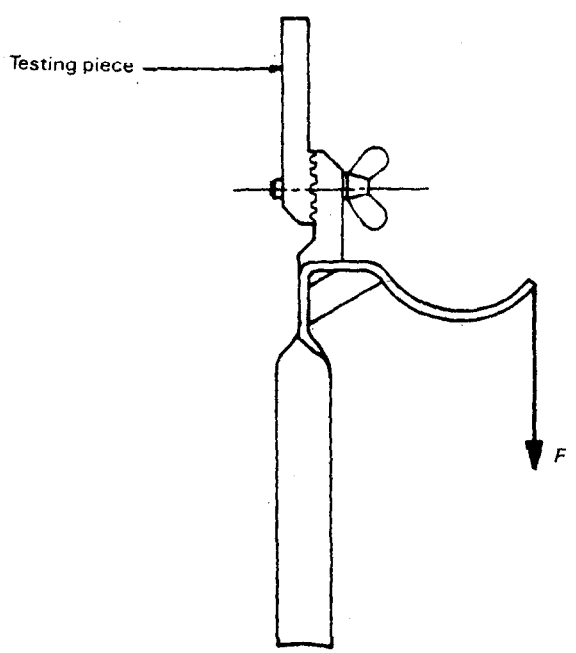


FIG. C13. — Bending test of the split-pin installer remover.

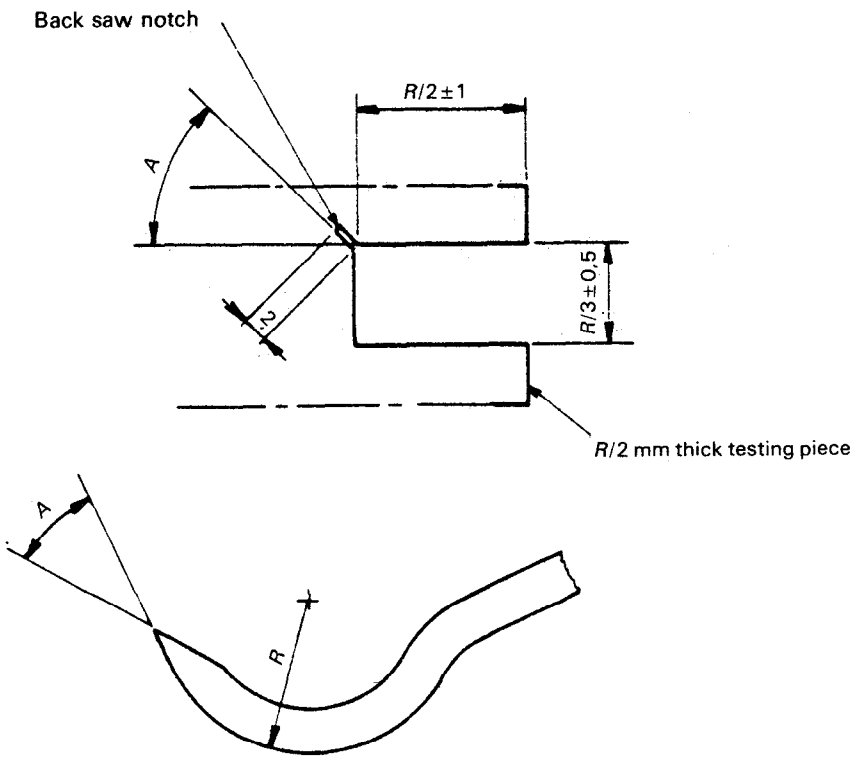


FIG. C14. — Bending test of the binding wire cutter: details of testing piece.

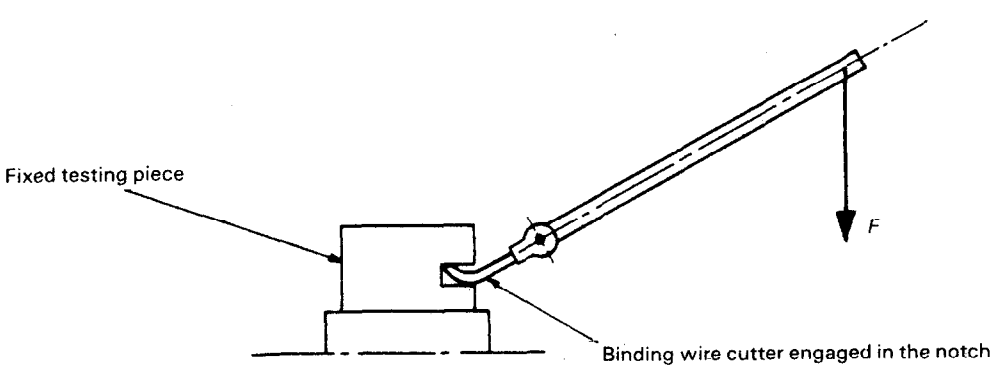


FIG. C15. — Bending test of the binding wire cutter.

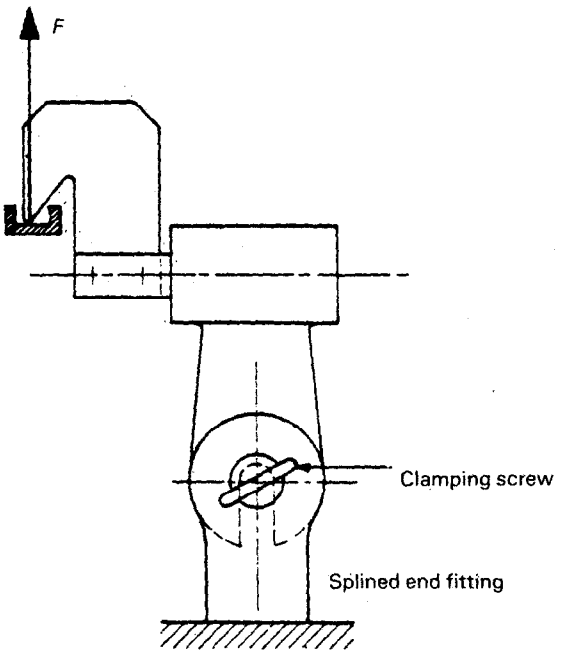


FIG. C16. — Tension test of the rotary blade.

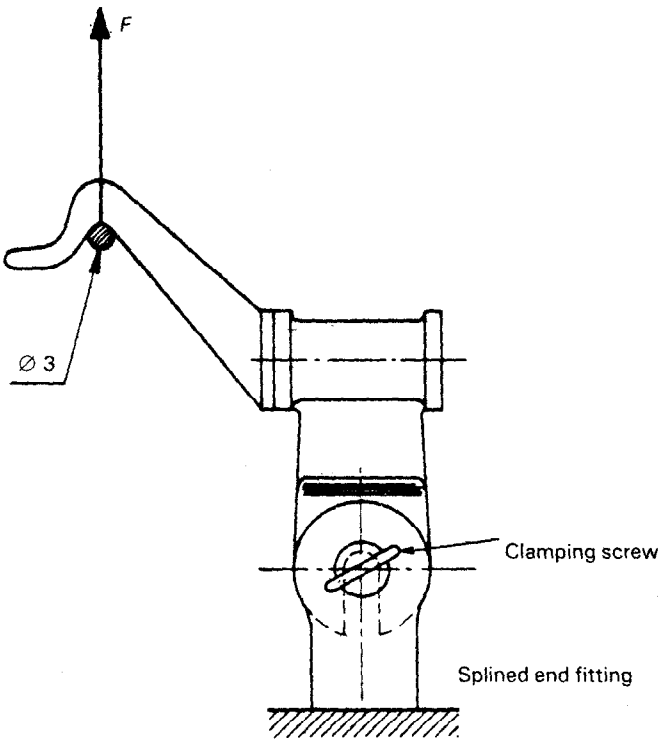


FIG. C17. — Tension test of the rotary prong.

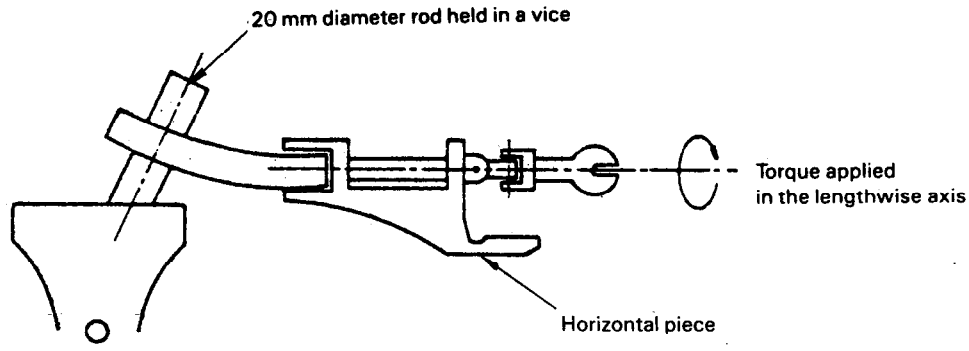


FIG. C18. — Tightening capability of the adjustable pliers.

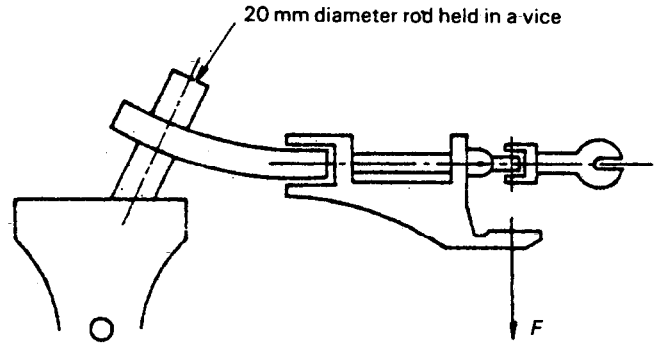
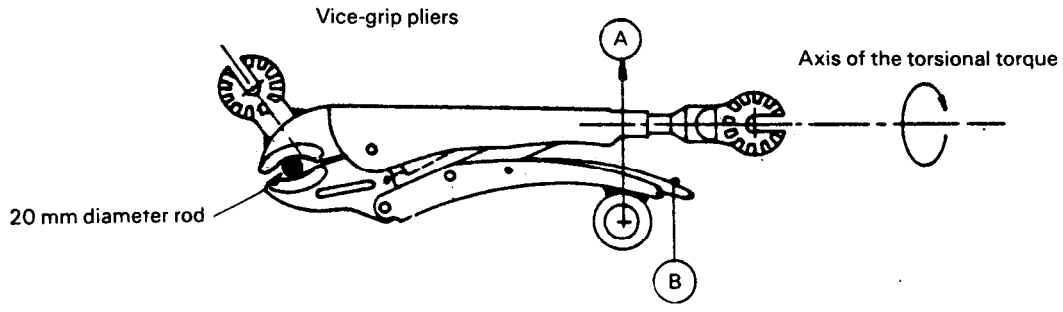


FIG. C19. — Bending test of the adjustable pliers.



(A) Handle installation force

(B) Application point of handle opening force

FIG. C20. — Tightening capability of the vice-grip pliers.

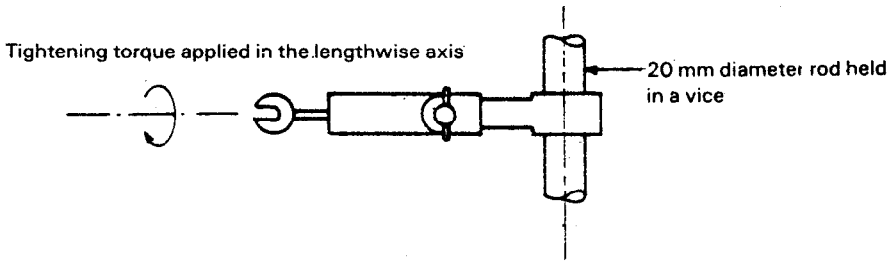


FIG. C24. — All-angle pliers: tightening capability.

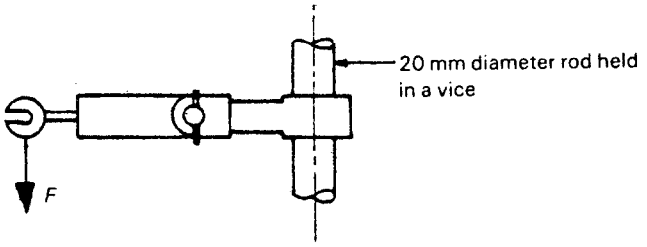


FIG. C25. — All-angle pliers: bending test.

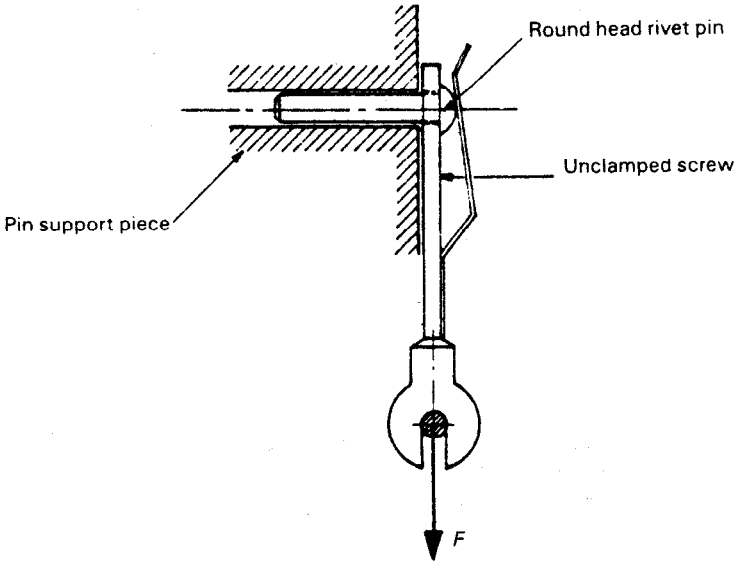


FIG. C26. — Pin-holder: holding force of the spring.

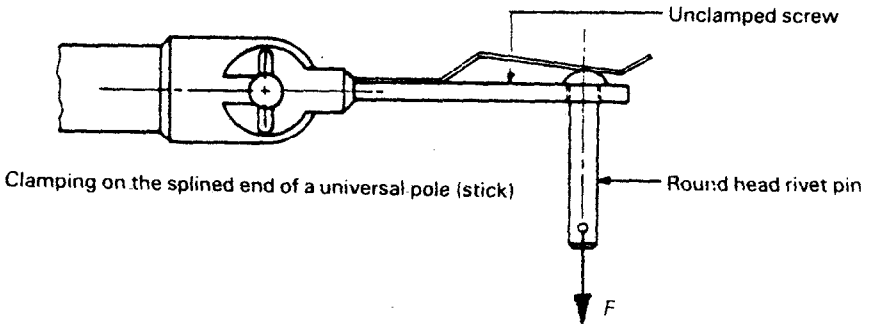


FIG. C27. — Pin-holder: bending test.

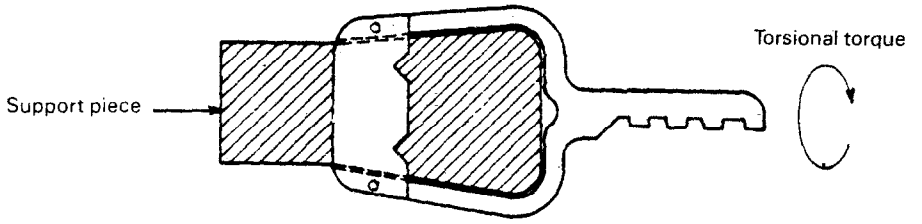


FIG. C28. — Ammeter holder: torsion test.

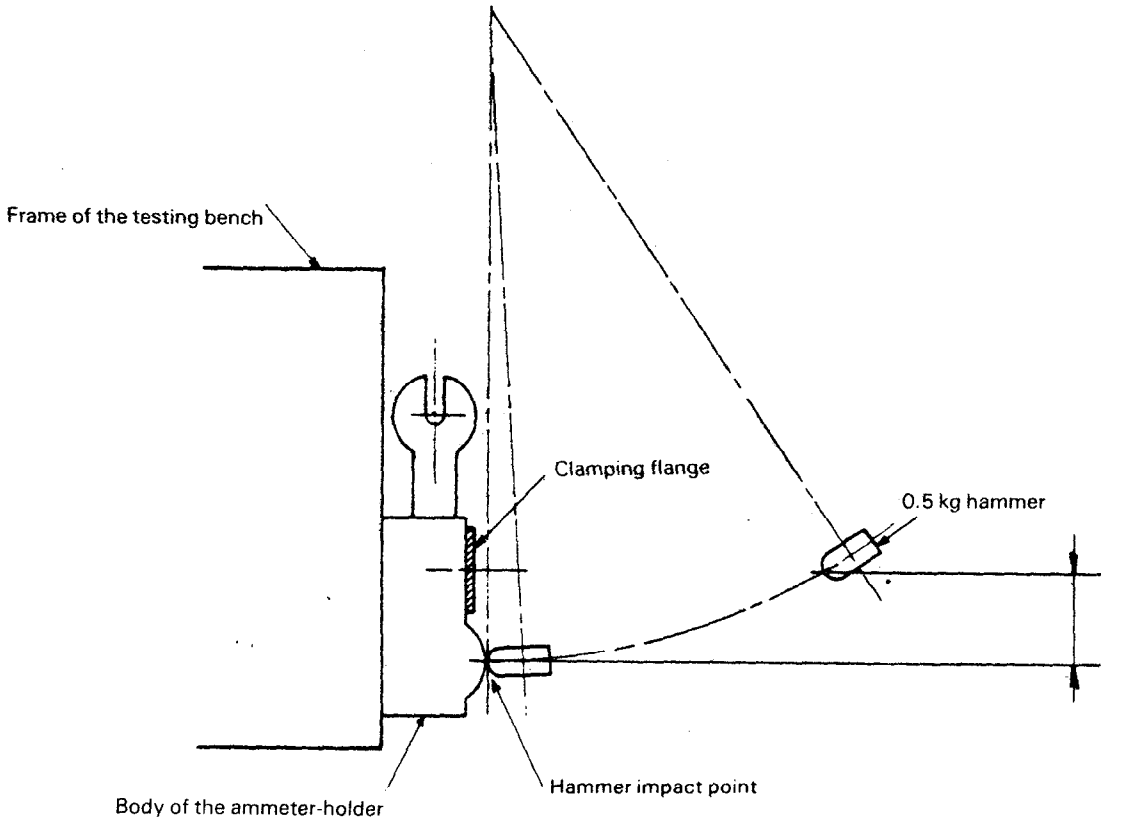
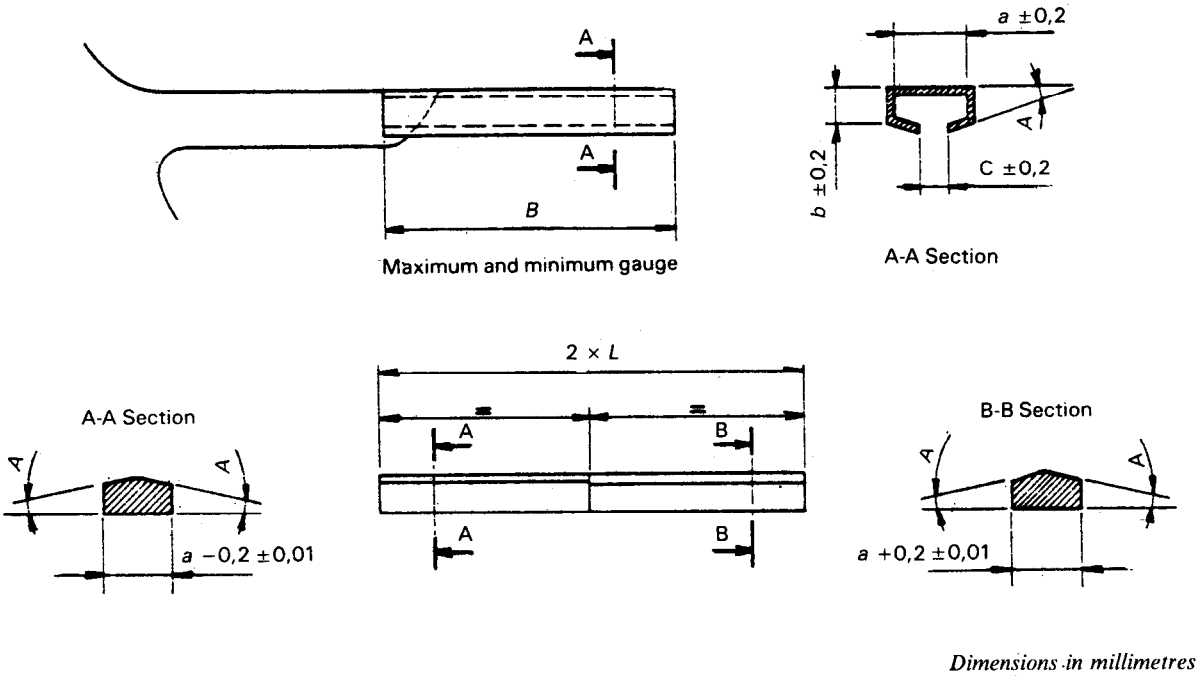


FIG. C29. — Ammeter holder: shock test.



Dimensions in millimetres

FIG. C30. — Anti-interference braid applicator: checking of the slide section.

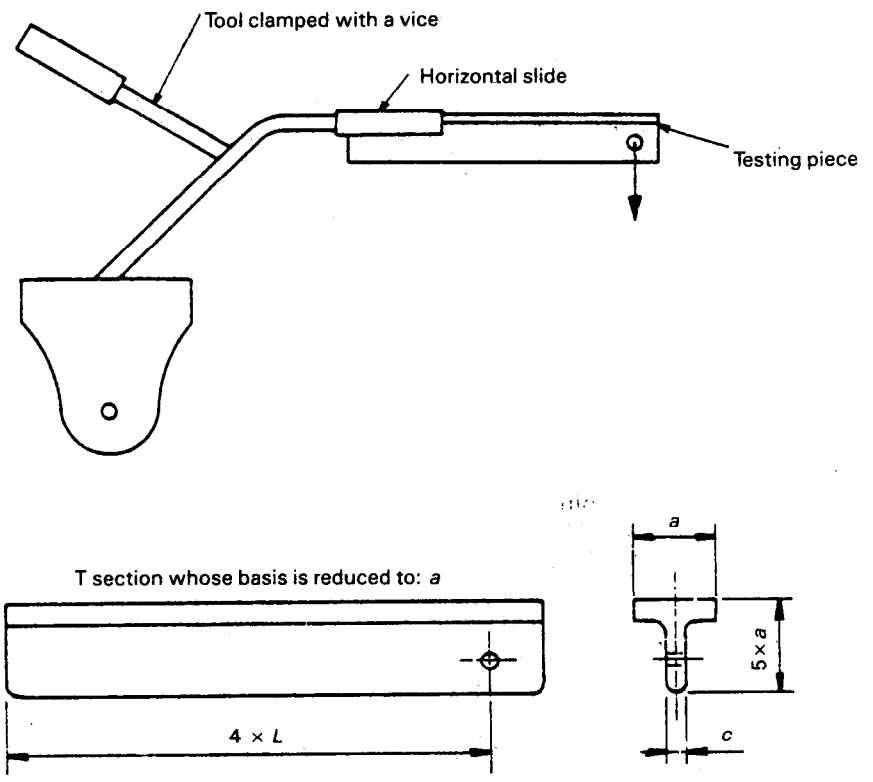


FIG. C31. — Anti-interference braid applicator: bending test.

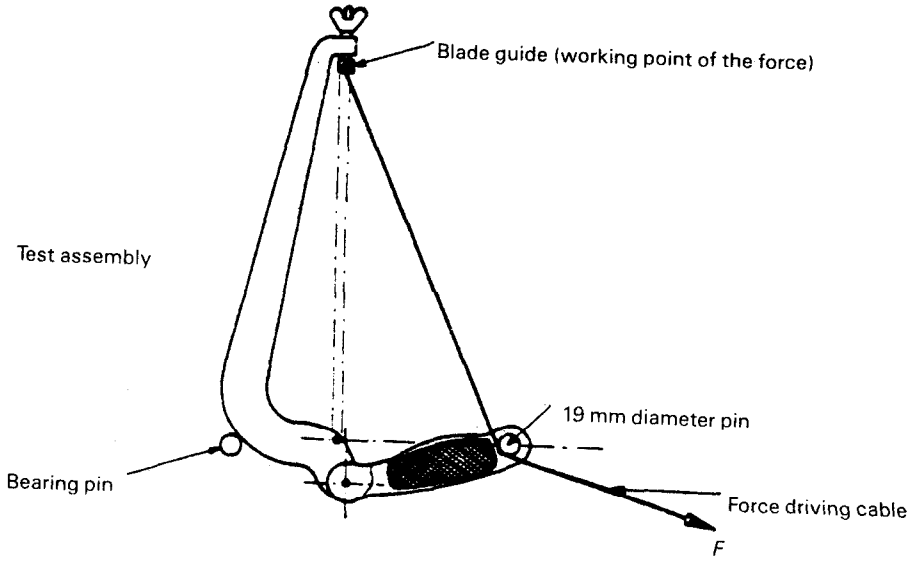


FIG. C32. — Hack saw: bending test.

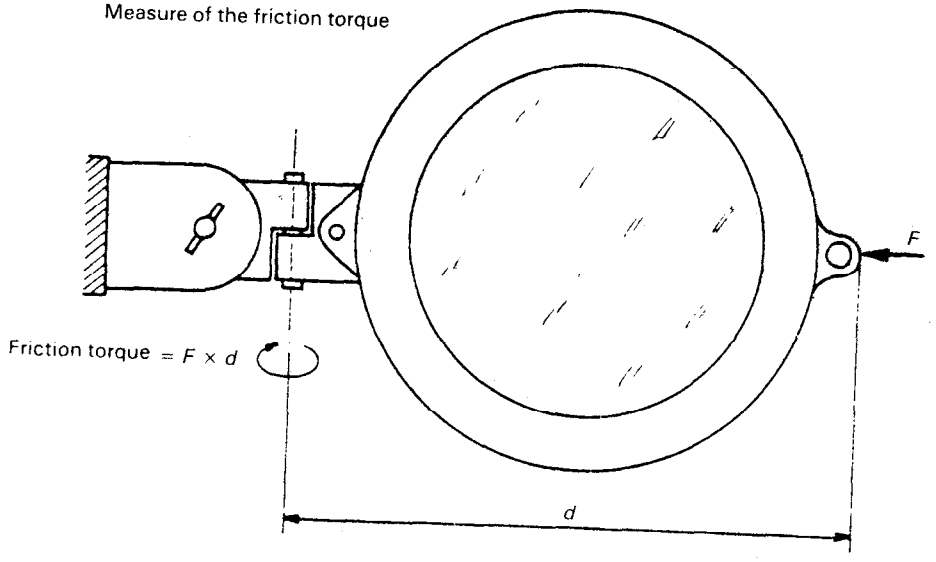


FIG. C33. — Friction test of the mirror.

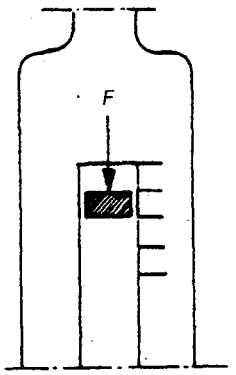


FIG. C34. — Conductor (wire) gauge: rule slipping test.

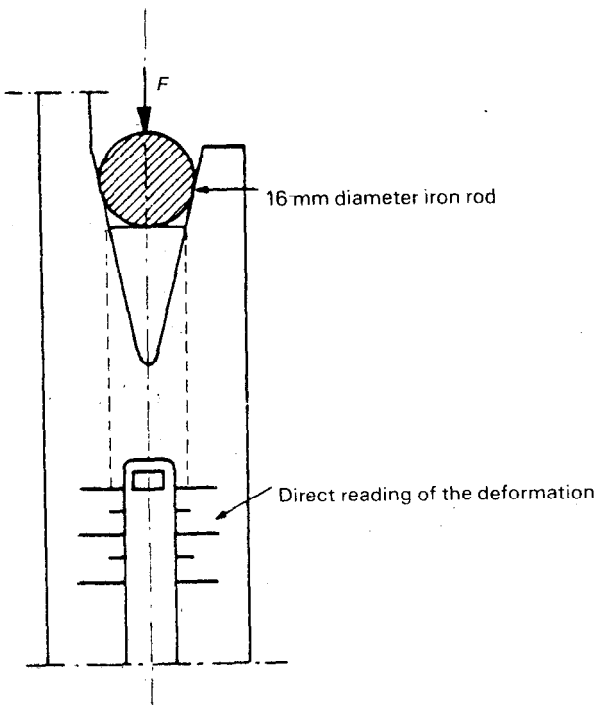


FIG. C35. — Conductor (wire) gauge: deformation of the gauge body.

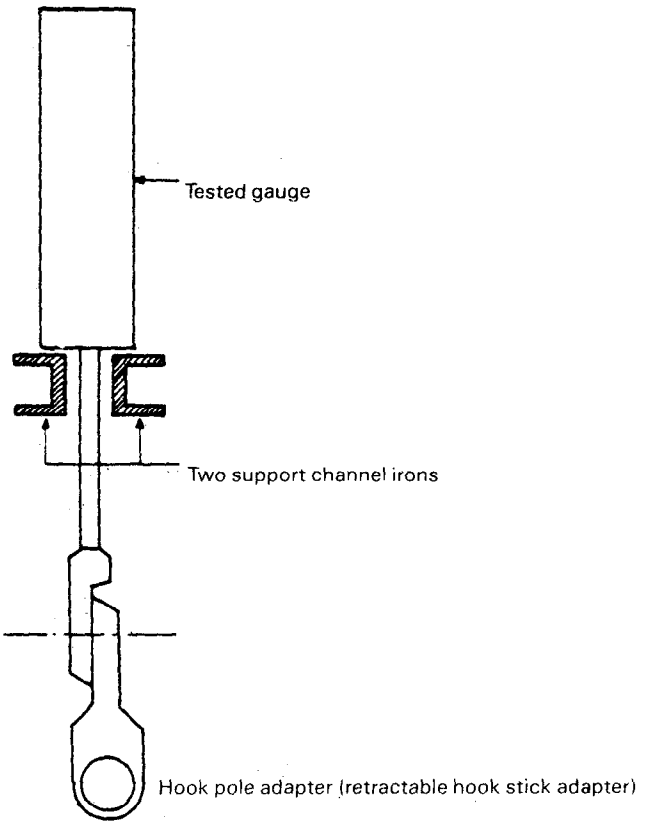


FIG. C36. — Gap gauge: tensile test.

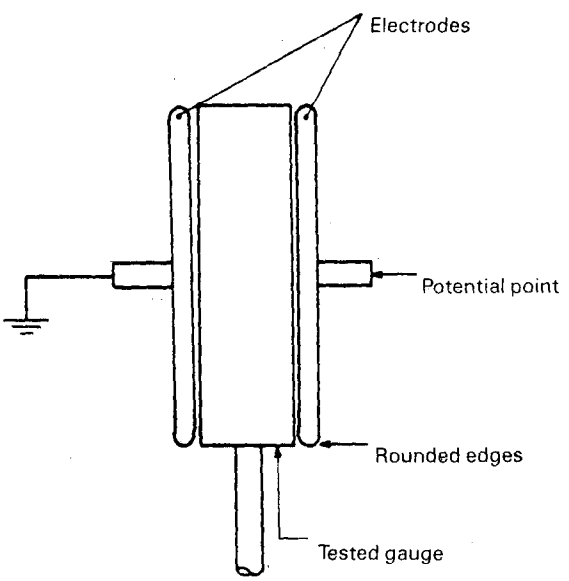
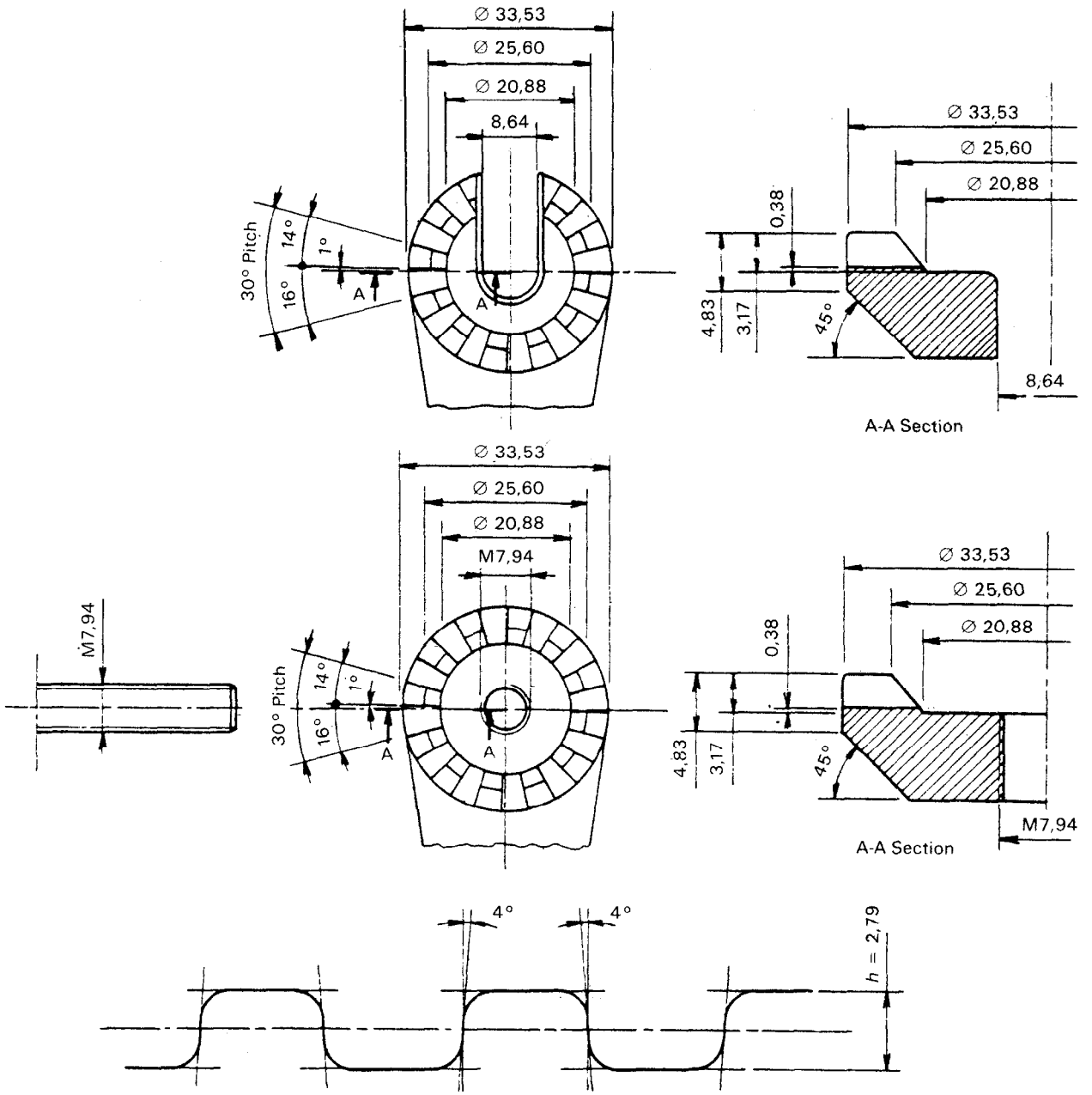


FIG. C37. — Electrical test of the gap gauge.

APPENDIX D

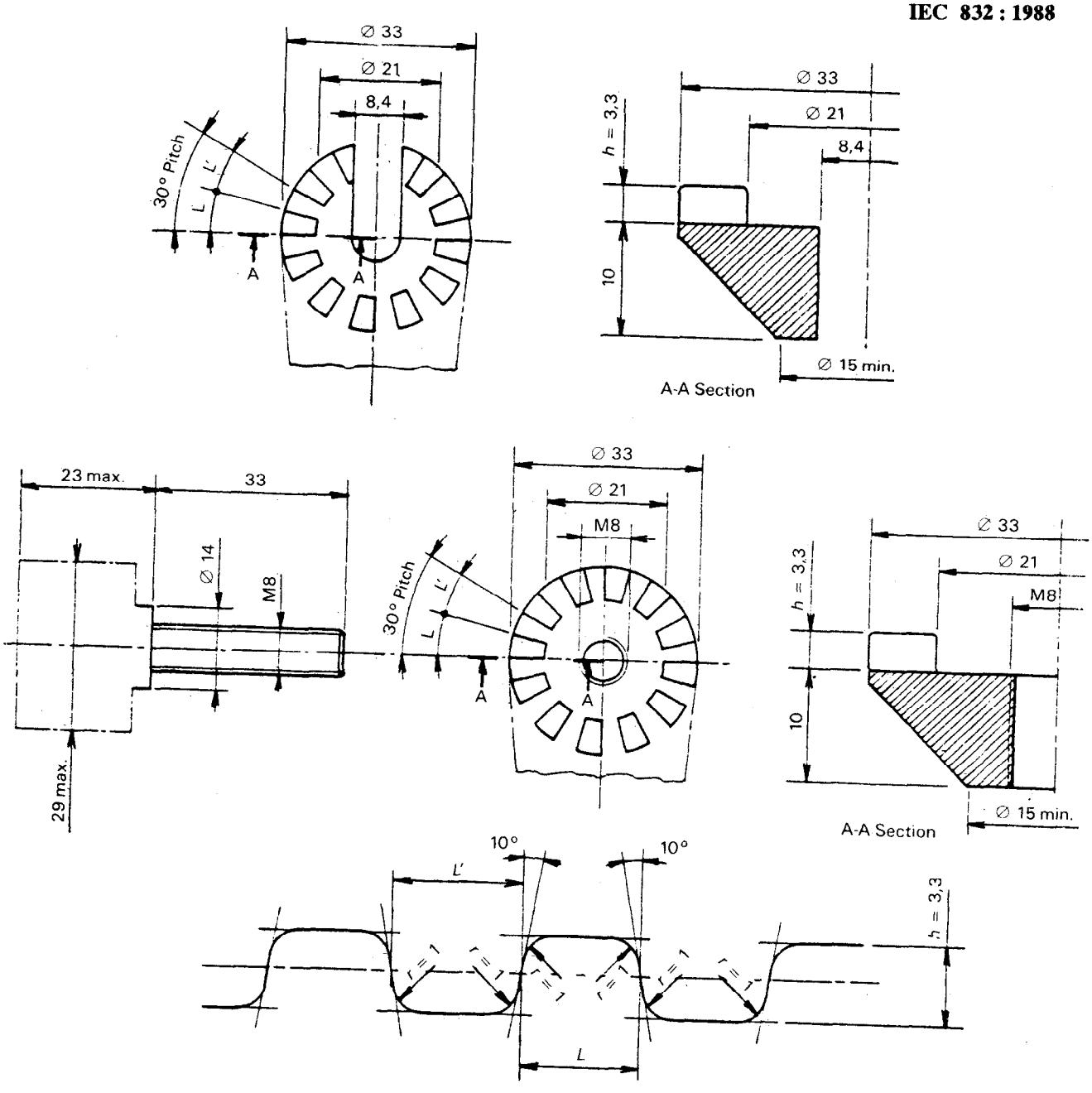
SPLINED ENDS OF POLES AND ATTACHMENTS — EXAMPLES



Dimensions in millimetres

General tolerances: Dimensions: ±0,4
Angles: ± ½

FIG. D1. — First example.



Dimensions in millimetres

General tolerances: Castings: ±0,2 Drop forgings: ±0,1 Except otherwise stated

L′ clearing / Ø 33 = $4{,}42\ ^{-0,2}_{+0}$

L′ clearing / Ø 21 = $2{,}85\ ^{-0,2}_{+0}$

FIG. D2. — Second example.

APPENDIX E

ABRASION RESISTANCE TEST — TECHNICAL DATA

Nature of the backing: Linen cloth.

Flexibility of the abrasive cloth: When applied as described in Clause 22, the abrasive cloth shall wrap the measuring pole (stick) to ensure contact of the abrasive on an angular sector (see Figure E1) from:

$\alpha = 145°$ (max. 180°)
[2.54 rad (max. π rad)]

This will be checked after the test, by observing the marks.

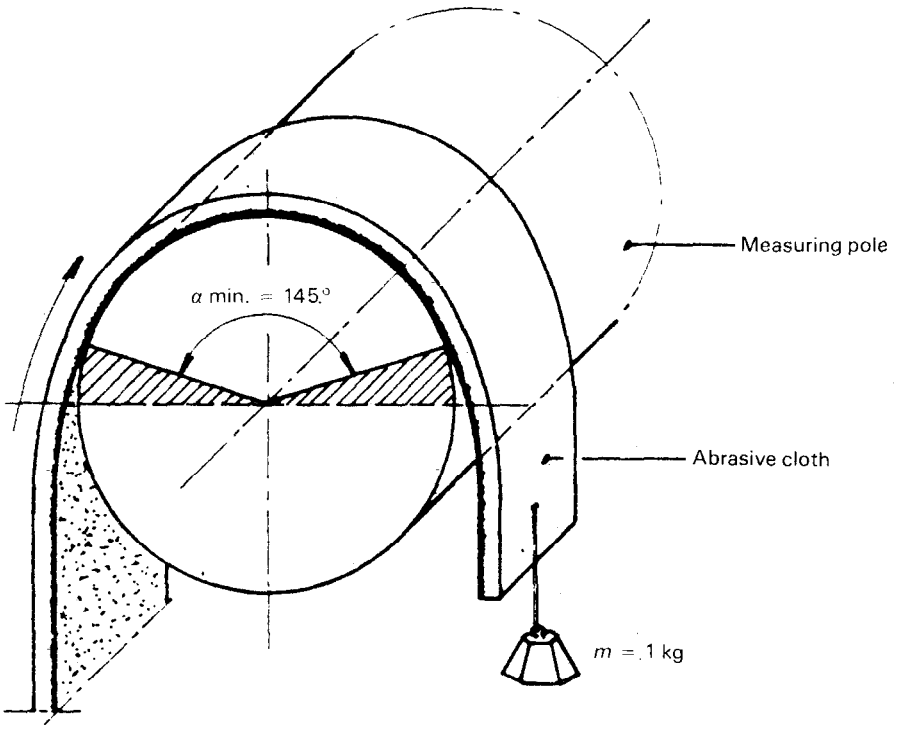


FIG. E1. — Test diagram.

Nature of the grit: Corundum.

Density of the grit: The grit stratum shall form a regular coat which entirely covers the base.

Dimensions of the grit: Mean grit dimension shall be:
dm = 100 ± 10 µm, with $\sigma \leqslant 15$ µm standard deviation.
dm is determined by particle size distribution analysis of the grit used to manufacture the abrasive cloth.
Its standardized reference is "P 150".

NATIONAL ANNEX

REQUIREMENT FOR THE VISIBLE DISCHARGE TEST

The requirement and the method of test of the visible discharge test shall be in accordance with **10.2** of IS 731 : 1971 'Specification for porcelain insulators for overhead power lines with a nominal voltage greater than 1 000 V (*second revision*)'.

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