

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Live working – Hand tools for use up to 1 000 V a.c. and 1 500 V d.c.

Travaux sous tension – Outils à main pour usage jusqu'à 1 000 V en courant alternatif et 1 500 V en courant continu

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CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references.....	8
3 Terms and definitions.....	8
4 Requirements.....	9
4.1 General requirements.....	9
4.1.1 Safety.....	9
4.1.2 Performance under load.....	9
4.1.3 Multiple-ended hand tools.....	10
4.1.4 Marking.....	10
4.1.5 Separating of covers.....	11
4.1.6 Instructions for correct adjustment and assembly.....	11
4.2 Requirements concerning insulating materials.....	11
4.2.1 General.....	11
4.2.2 Thermal stability.....	11
4.3 Additional requirements.....	11
4.3.1 Hand tools capable of being assembled.....	11
4.3.2 Screwdrivers.....	14
4.3.3 Wrenches – uninsulated areas.....	15
4.3.4 Adjustable wrenches.....	15
4.3.5 Pliers, strippers, cable scissors, cable-cutting hand tools.....	16
4.3.6 Scissors.....	19
4.3.7 Knives.....	20
4.3.8 Tweezers.....	21
5 Tests.....	22
5.1 General.....	22
5.2 Visual check.....	23
5.3 Dimensional check.....	23
5.4 Impact tests.....	23
5.4.1 Type test.....	23
5.4.2 Alternative means in case of insulated and insulating hand tools having completed the production phase.....	26
5.5 Dielectric tests.....	26
5.5.1 General requirements.....	26
5.5.2 Conditioning (for type test only).....	26
5.5.3 Dielectric testing of insulated hand tools.....	27
5.5.4 Dielectric testing of insulating hand tools.....	30
5.6 Indentation test (for insulated hand tools).....	31
5.6.1 Type test.....	31
5.6.2 Alternative means in case of insulated hand tools having completed the production phase.....	32
5.7 Test for adhesion of the insulating material coating (for insulated hand tools).....	32
5.7.1 Conditioning.....	32

5.7.2	Type test	33
5.7.3	Alternative means in case of insulated hand tools having completed the production phase	38
5.7.4	Test of adhesion of insulating covers of conductive adjusting or switching elements	39
5.8	Mechanical tests	39
5.8.1	Insulated hand tools	39
5.8.2	Insulating hand tools	40
5.8.3	Tweezers.....	40
5.8.4	Retaining force test	40
5.9	Durability of marking	42
5.10	Flame retardancy test.....	42
5.10.1	Type test	42
5.10.2	Alternative means in case of hand tools having completed the production phase	43
6	Conformity assessment of hand tools having completed the production phase	44
7	Modifications	44
Annex A (informative)	Mechanical strength of insulating hand tools	45
Annex B (normative)	Suitable for live working; double triangle (IEC 60417-5216:2002-10).....	47
Annex C (informative)	Recommendation for use and in-service care	48
Annex D (normative)	General type test procedure.....	49
Annex E (normative)	Examples of calculation of the unwinded length of coating and acceptable leakage current	50
Annex F (normative)	Classification of defects and tests to be allocated	51
Bibliography	52
Figure 1	– Marking of the electrical working limit adjacent to the symbol double triangle	10
Figure 2	– Description of the insulating overlapping element and different assembly configurations for hand tools capable of being assembled with square drives	12
Figure 3	– Marking symbol for hand tools capable of being assembled and designed to be interchangeable between different manufacturers	13
Figure 4	– Illustration of insulation of typical hand tools	14
Figure 5	– Insulated adjustable wrench	16
Figure 6	– Insulation of pliers.....	17
Figure 7	– Insulation of multiple slip joint pliers.....	17
Figure 8	– Insulation of pliers with a functional area below the joint	18
Figure 9	– Illustration of insulation of pliers and nippers for electronics.....	19
Figure 10	– Insulation of scissors.....	20
Figure 11	– Insulation of knives	21
Figure 12	– Example of insulation of the handles of tweezers	22
Figure 13	– Example of test arrangement for the impact test – Method A	24
Figure 14	– Example of test arrangement for the impact test – Method B	25
Figure 15	– Dielectric testing arrangement for insulated hand tools	28
Figure 16	– Description of dummies for dielectric tests for hand tools capable of being assembled with square drives	29
Figure 17	– Dielectric testing arrangement for insulating hand tools.....	30

Figure 18 – Indentation test	32
Figure 19 – Principle of the testing device for checking adhesion of the insulating coating on conductive parts of the insulated hand tools – Test on the working head – Method A	34
Figure 20 – Principle of the testing device for checking adhesion of the insulating coating on conductive parts of the insulated hand tools – Test on the working head – Method B	35
Figure 21 – Testing device for checking adhesion of the insulating coating of screwdrivers on conductive parts and the handle	36
Figure 22 – Example of mountings for checking stability of adhesion of the insulation of the entire hand tool	38
Figure 23 – Dummies for testing locking systems used with square drives nominal size 12,5 mm of ISO 1174	41
Figure 24 – Dummies for testing locking systems used with square drives nominal size 10 mm of ISO 1174	41
Figure 25 – Example of a flame retardancy test arrangement	43
Table 1 – Dimensions and tolerances of the insulating overlapping element	13
Table 2 – Dimensions and tolerances for dummies to be used for dielectric tests	29
Table A.1 – Torque values for insulating screwdrivers	45
Table D.1 – Sequential order for performing type tests ^a	49
Table F.1 – Classification of defects and associated requirements and tests	51

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**LIVE WORKING –
HAND TOOLS FOR USE UP
TO 1 000 V AC AND 1 500 V DC**

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International Standard IEC 60900 has been prepared by IEC technical committee 78: Live working.

This third edition cancels and replaces the second edition, published in 2004. This edition constitutes a technical revision.

It includes the following significant technical changes with regard to the previous edition:

- general review of the requirements and test provisions;
- preparation of the elements of evaluation of defects, and general application of IEC 61318:2007 (Ed.3);
- deletion of Annexes D and E, not applicable according to IEC 61318 Ed.3;
- introduction of a new normative Annex D on chronology of type tests;
- introduction of a new normative Annex F on classification of defects.

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

FDIS	Report on voting
78/947/FDIS	78/953/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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Withhold

INTRODUCTION

This International Standard has been prepared in accordance with the requirements of IEC 61477 where applicable.

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.

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.

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Withhold

LIVE WORKING – HAND TOOLS FOR USE UP TO 1 000 V AC AND 1 500 V DC

1 Scope

This International Standard is applicable to insulated and insulating hand tools used for working live or close to live parts at nominal voltages up to 1 000 V a.c. and 1 500 V d.c.

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 (where appropriate).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *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, *Live working – Conformity assessment applicable to tools, devices and equipment*

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

ISO 1174-1, *Assembly tools for screw and nuts – Driving squares – Part 1: Driving squares for hand socket tools*

ISO 9654, *Pliers and nippers for electronics – Single-purpose nippers – Cutting nippers*

ISO 9655, *Pliers and nippers for electronics – Single-purpose pliers – Pliers for gripping and manipulating*

ISO 9656, *Pliers and nippers for electronics – Test methods*

ISO 9657, *Pliers and nippers for electronics – General technical requirements*

3 Terms and definitions

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

NOTE For the definitions of general terms in this document, reference should be made to the IEC 60050 series or to special definitions laid down in IEC 60743. Nomenclature of hand tools are found in the relevant ISO standards such as ISO 1703, ISO 5742 and ISO 8979.

3.1

hand tool (for live working)

hand held insulated or insulating tool

Note 1 to entry: Hand tools are normally tools such as screwdrivers, pliers, wrenches or knives.

[SOURCE: IEC 60050-651:1999, 651-01-27, modified – The scope of the definition has been enlarged.]

3.2

insulated hand tool

hand tool made of conductive materials, fully or partially covered by insulating materials

[SOURCE: IEC 60050-651:1999, 651-01-25, modified – The definition has been changed to refer specifically to hand tools.]

3.3

insulating hand tool

hand tool made totally or essentially from insulating materials except for inserts made from conductive materials used for reinforcement, but with no exposed conductive parts

[SOURCE: IEC 60050-651:1999, 651-01-26, modified - The definition has been changed to refer specifically to hand tools and its scope has been narrowed.]

4 Requirements

4.1 General requirements

4.1.1 Safety

Insulated and insulating hand tools shall be manufactured and dimensioned in such a way that they protect the user from electric shock.

NOTE Insulated hand tools completely covered by insulating materials and insulating tools minimize the risk of short circuits between two parts at different potentials when they are used in the correct manner.

The following requirements have been prepared in order that the hand tools 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 (where appropriate).

4.1.2 Performance under load

The mechanical specifications for insulated hand tools shall comply with the corresponding ISO standards, or, where no ISO standard exists, with a standard specified by the manufacturer or the customer, (for example a national standard). The mechanical specifications for the working parts of the hand tools shall be retained even after application of an insulating layer.

Insulating hand tools specially designed for live working may have lower stress resistance than insulated hand tools, but they shall withstand the expected workloads without failing due to remaining deformation or breaking. These hand tools can be equipped with devices that limit the workloads that can be applied with them, for example by overload slipping clutches (see also Annex A).

4.1.3 Multiple-ended hand tools

Multiple-ended hand tools, such as box wrenches, keys for hexagonal socket screws, double-ended socket-wrenches, double-head open-end wrenches, etc., are not allowed for insulated hand tools but are allowed for insulating hand tools if the design assures that there is no conductive connection between two of the working heads.

4.1.4 Marking

The marking shall be clearly identifiable by persons with normal or corrected sight without further magnification. Each hand tool and/or tool component shall be legibly and permanently marked with the following items of marking:

- on the insulating material or on the metal part:
 - marking of the origin (manufacturer's name or trade mark);
 - on the insulating material:
 - model/type reference;
 - year of manufacture (at least the last two digits of the year);
 - symbol IEC 60417-5216:2002-10 – Suitable for live working; double triangle (see Annex B);
- NOTE For the symbol, 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.
- indication 1 000 V (i.e. the electrical working limit for alternating current), immediately adjacent to the symbol double triangle (see Figure 1 for an example);

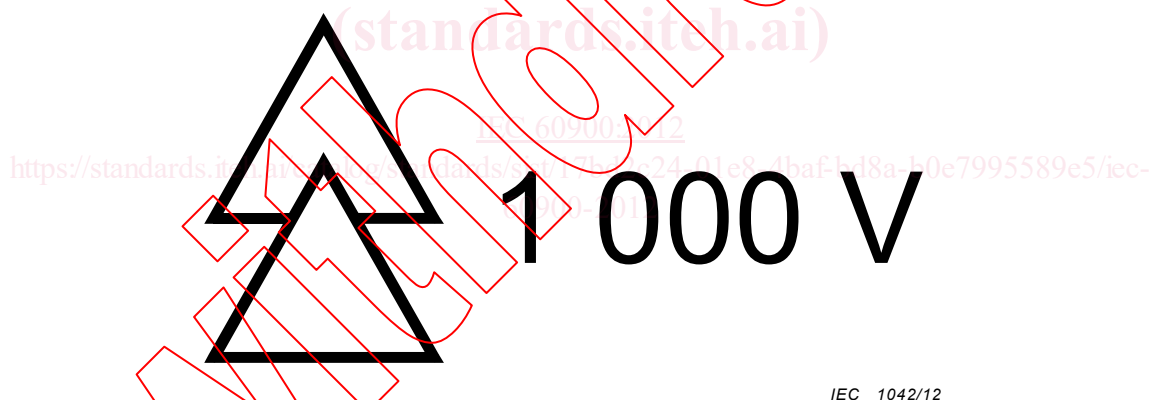


Figure 1 – Marking of the electrical working limit adjacent to the symbol double triangle

- number of the relevant IEC standard immediately adjacent to the symbol double triangle, (IEC 60900);
- for hand tools designed for use at extremely low temperature: letter “C” (see 4.2.2);
- additional marking for hand tools capable of being assembled and designed to be interchangeable between different manufacturers (see 4.3.1.3.2);
- additional marking where specified by the customer (for example ownership mark).

The hand tools shall bear no voltage marking apart from those described above.

NOTE For example, the indication of test voltage may lead to the assumption that the hand tool is suitable for work at that voltage.

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.

The symbol double triangle shall be at least 3 mm high; the letter and the figures of the electrical working limit shall be at least 2 mm (see Figure 1).

4.1.5 Separating of covers

If hand tools have conductive elements (for example: torque adjusting screws, operating direction switches, etc.) which are insulated with covers of insulating materials, these covers shall be well fastened, so that they do not come off during normal use (see 5.7.4).

4.1.6 Instructions for correct adjustment and assembly

Where the manufacturer deems that instructions are necessary for correct adjustment or assembly, then the manufacturer shall provide these in accordance with the general provisions given in IEC 61477 (see also Annex C).

4.2 Requirements concerning insulating materials

4.2.1 General

The insulating material shall be selected according to the electrical, mechanical and thermal stresses to which it may be exposed during use. In addition, the insulating material shall have an adequate resistance to ageing and be flame retardant.

The insulating coating may consist of one or more layers. If two or more layers are adopted, contrasting colours may be used.

The design and construction of the handles shall provide a secure handhold and prevent unintentional hand slipping.

4.2.2 Thermal stability

The service ability of the hand tools shall not be impaired within the temperature range $-20\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$.

The insulating material applied on hand tools shall adhere securely to the conductive part from $-20\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$.

Hand tools intended for use at extremely low temperatures (down to $-40\text{ }^{\circ}\text{C}$) shall be designated "Category C" and shall be designed for this purpose.

4.3 Additional requirements

4.3.1 Hand tools capable of being assembled

4.3.1.1 Retaining devices for hand tools capable of being assembled

Hand tools capable of being assembled shall have suitable retaining devices to prevent unintentional separation of the assembly. The retaining forces shall be tested according to 5.8.4.

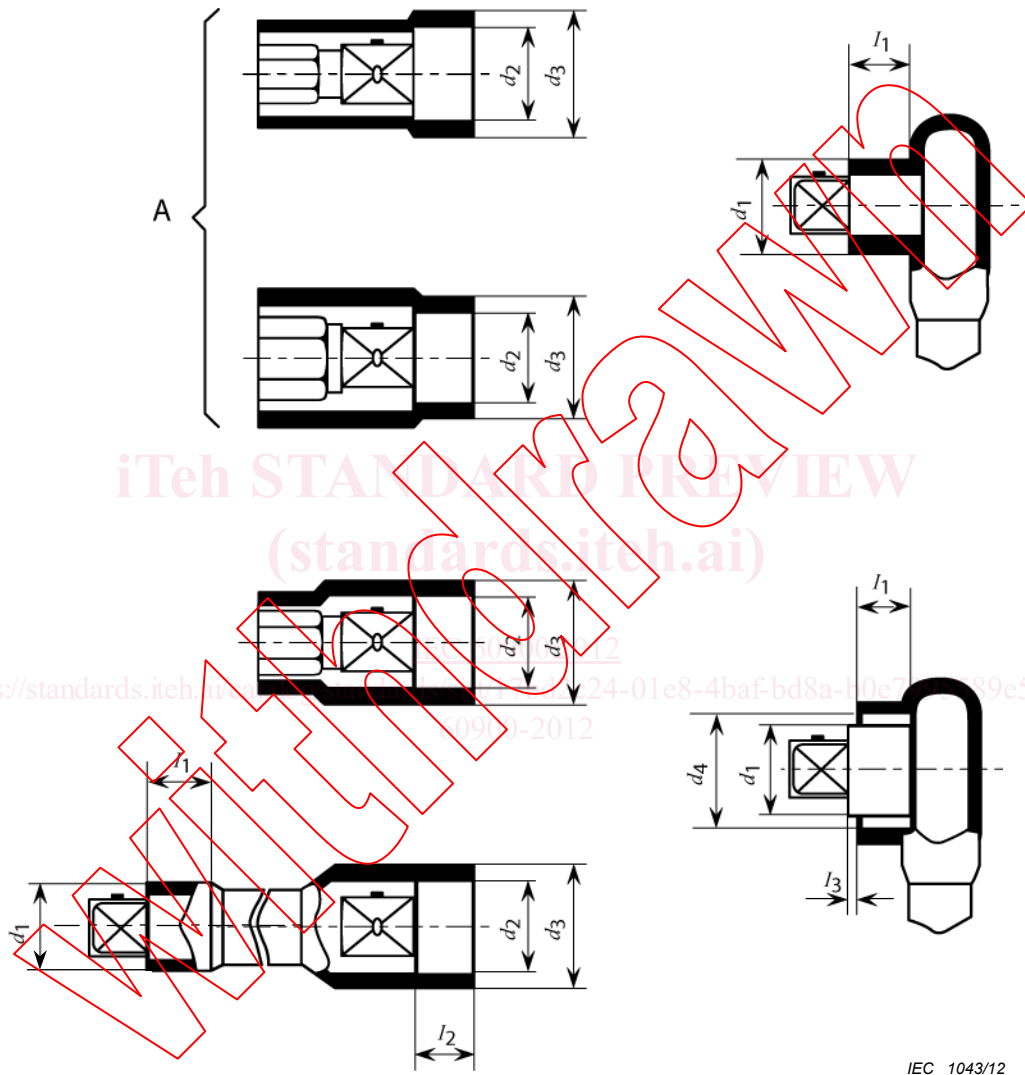
4.3.1.2 Insulation design for hand tools capable of being assembled

In the case of connecting parts of hand tools capable of being assembled, the insulation shall be applied in such a manner that if any part becomes detached during use by exceeding the retaining forces according to 5.8.4, no conductive part, which may still be live, can be inadvertently touched or cause a disruptive discharge.

4.3.1.3 Hand tools capable of being assembled with square drives

4.3.1.3.1 General

Hand tools capable of being assembled with square drives shall have square drives and square sockets in accordance with ISO 1174-1 (for separating forces, see 5.8.4.2). To ensure compatibility of insulation between different manufacturers, these hand tools shall be designed with overlapping elements described in Figure 2. Their dimensions and tolerances shall be in accordance with Table 1.



IEC 1043/12

Key

A admitted shapes

Figure 2 – Description of the insulating overlapping element and different assembly configurations for hand tools capable of being assembled with square drives

Table 1 – Dimensions and tolerances of the insulating overlapping element

Nominal size of the square drive	<i>Dimensions in millimetres</i>						
	I_1 min.	I_2 $\begin{smallmatrix} +2 \\ 0 \end{smallmatrix}$	I_3 $\begin{smallmatrix} +0,5 \\ -0,5 \end{smallmatrix}$	d_1 $\begin{smallmatrix} 0 \\ -1,5 \end{smallmatrix}$	d_2 $\begin{smallmatrix} +1,5 \\ 0 \end{smallmatrix}$	d_3 $\begin{smallmatrix} 0 \\ -1,5 \end{smallmatrix}$	d_4 $\begin{smallmatrix} +1,5 \\ 0 \end{smallmatrix}$
6,3	19	16	2	12,5	13	18	19
10	19	16	2	17,5	18	23	24
12,5	19	16	2	21,5	22	27	28
20	19	16	2	32	33	38	39

$I_1, I_2, I_3, d_1, d_2, d_3$ and d_4 are described in Figure 2.

4.3.1.3.2 Interchangeability of components made by different manufacturers

Hand tools capable of being assembled and designed to be interchangeable between different manufacturers shall be specifically marked as such.

The marking symbol and the dimensions are given in Figure 3. The dimension H shall be greater than or equal to 5 mm.

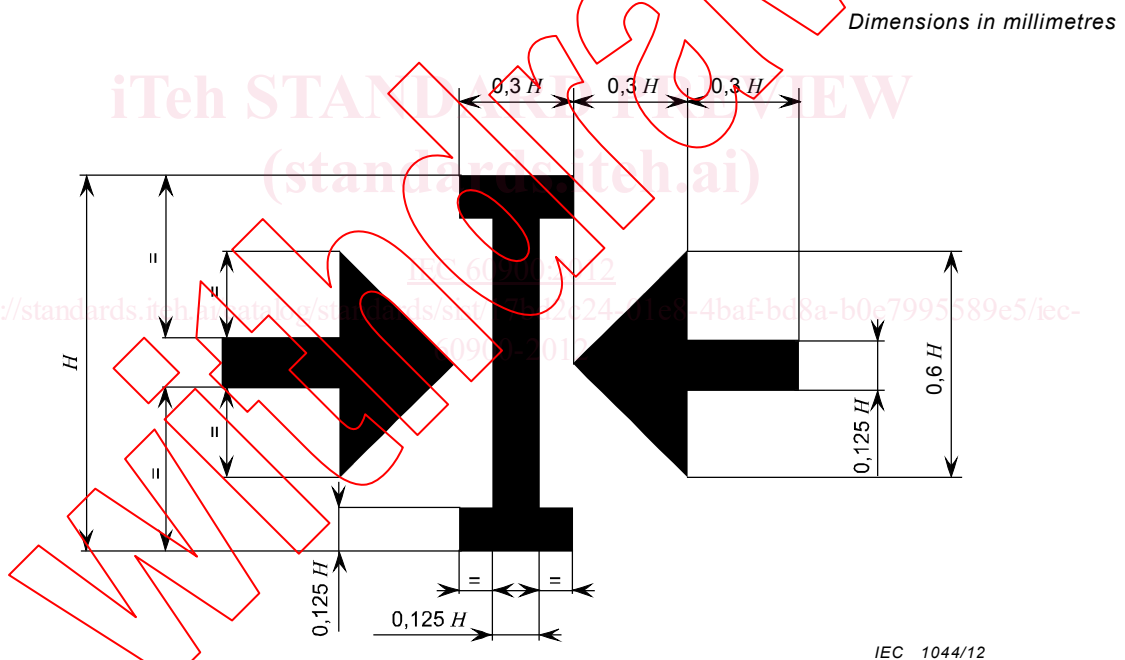


Figure 3 – Marking symbol for hand tools capable of being assembled and designed to be interchangeable between different manufacturers

The reliable function of locking systems used for those hand tools shall be tested by applying a separation test in accordance with 5.8.4 with a corresponding dummy.

For this kind of hand tools, instructions for correct assembly are mandatory. The manufacturer shall include the following information: “To assure that the complete assembly of insulated hand tool components from different manufacturers will withstand separating forces that are expected during the intended use, prior to the use of any assembly the user shall assure, by pulling by hand in a separating direction, that the retaining devices of all used elements are working efficiently”.