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Fourth edition
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Resistance welding — Testing of welds — Peel and chisel testing of resistance spot and projection welds

Soudage par résistance — Essais des soudures — Essais de pelage et de déboutonnage au burin appliqués aux soudures par résistance par points et par bossages

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 6, *Resistance welding and allied mechanical joining*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 10447:2015), which has been technically revised.

The main changes are as follows:

— the terms and definition given in ISO 17677-1 apply.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

Resistance welding — Testing of welds — Peel and chisel testing of resistance spot and projection welds

1 Scope

This document specifies the procedures and recommended tooling to be used for peel and chisel testing of resistance spot and embossed projection welds. This document applies to welds made in two or more sheets in the thickness range of 0,5 mm to 3,0 mm.

The aim of these tests is to determine:

— weld size and failure mode when welds are destructively tested;

— verification of welds by non-destructive chisel tests.

NOTE The preferred method of peel testing seam welds (mechanized peel testing) is covered in ISO 14270.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17677-1, *Resistance welding — Vocabulary — Part 1: Spot, projection and seam welding*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17677-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Test specimens

When used for quality control in production, tests shall be conducted on actual components or specimens taken from actual components.

When used for setting welding parameters, where it is not practical to use actual components, separate welded test pieces may be used. The test pieces shall be produced from the same material used for the component and welded under conditions adapted to produce the same required weld quality. The effects of different shunt or impedance conditions should be taken into account when producing the test pieces by inserting sufficient material in the throat of the machine to approximate the magnetic effect of the workpiece under production conditions.

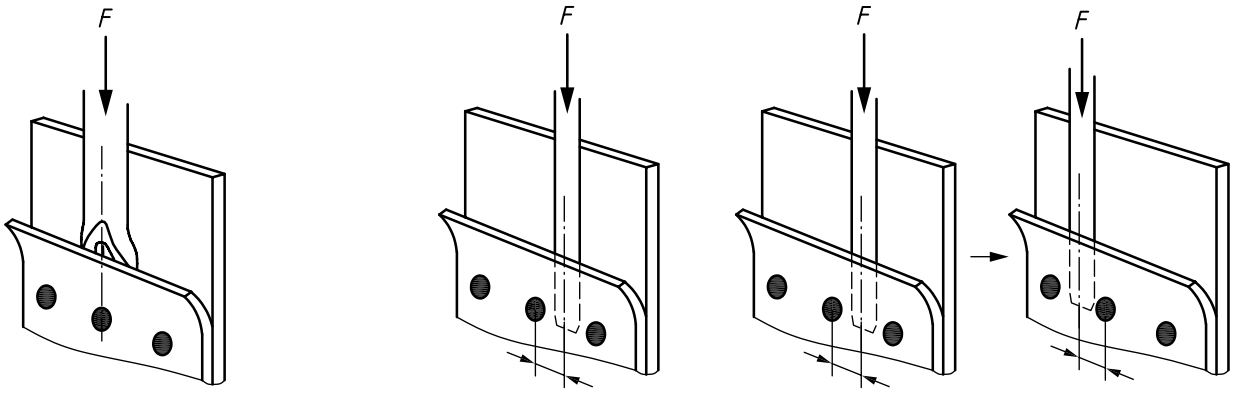
5 Test procedure

5.1 Chisel test

A chisel shall be used to separate the sheets adjacent to the weld under test. There are two types of chisel test.

The destructive type of chisel test shall apply a force that results in stresses primarily normal to the joint interface, as shown in Figure 1 a). This type of chisel test can be used to allow measurement of the weld size after testing.

The non-destructive type of chisel test is used to verify the weld quality or soundness without measuring the weld size. The chisel shall not strike the weld portion. The striking locations and procedure in the chisel testing shall be according to Figure 1 b) or Figure 1 c).



a) Type 1 (recessed chisel) **b) Type 2 (testing from one side)** **c) Type 3 (testing from both sides)**

Key

F force

Figure 1 — Chisel testing of resistance spot and projection welded joints

Table 1 — Selection of recommended chisels for chisel testing

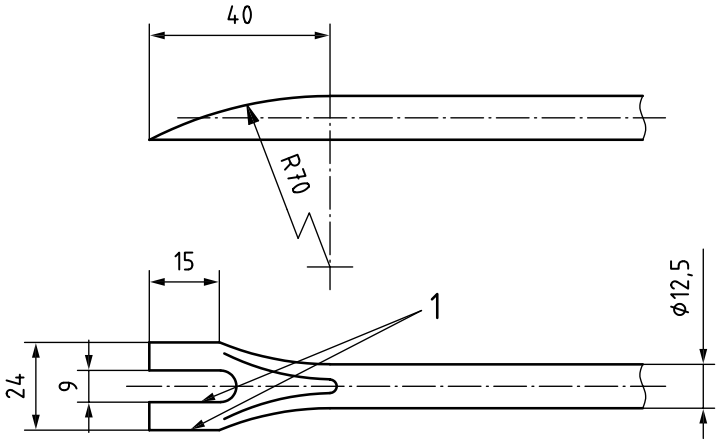
Chisel design	Test types (destructive or non-destructive)	For testing	
		Weld diameter d_w mm	Plate thickness t mm
Figure 2 a)	Both	< 8	–
Figure 2 b)	Both	< 13	–
Figure 3 a)	Non-destructive	–	≤ 2,0
Figure 3 b)	Non-destructive	–	> 2,0

Typical chisel designs are shown in Figure 2 and Figure 3. The chisel geometry should be chosen based on the workpiece thickness and geometry, weld diameter, distance between welds and whether the weld is to be destructively or non-destructively tested (see Table 1).

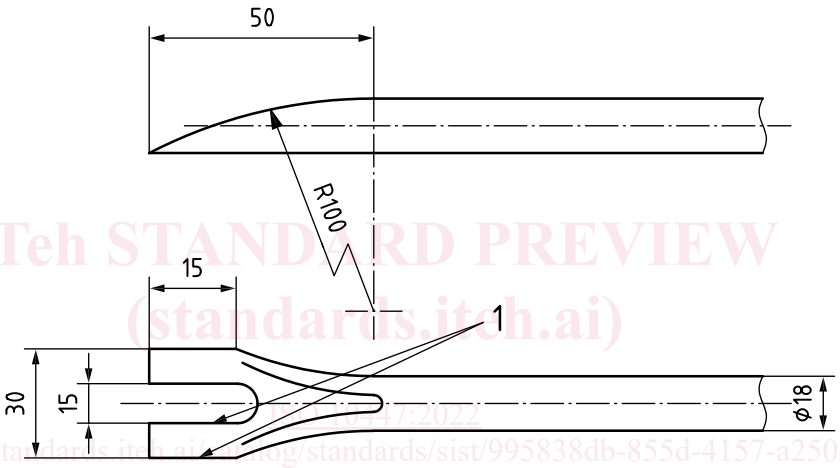
The slot in the chisel shown in Figure 2 is only necessary if the axis of the chisel is placed at the centre of the weld.

The chisel should be driven between the sheets manually by a hammer or tool with, for example, pneumatic, electric or hydraulic drive.

Dimensions in millimetres



a) Chisels for weld diameter < 8 mm



b) Chisels for weld diameter < 13 mm

Key

1 burr to be removed from all corners

Figure 2 — Typical dimensions of chisels for destructive chisel testing

The results of chisel testing are influenced by the following factors:

a) chisel shape – dimensions and condition;

b) hammer type – mass and type of blow;

c) test specimen – sheet thickness;

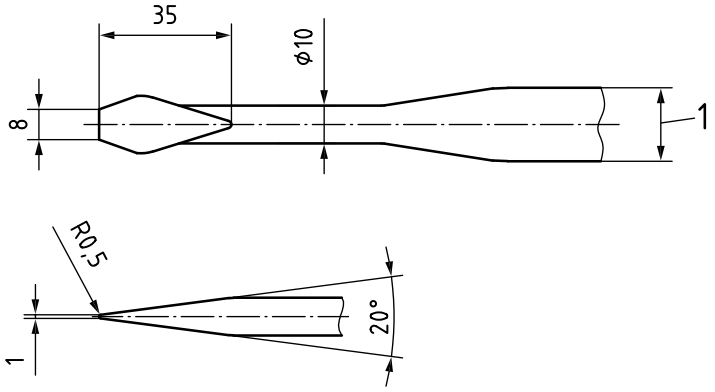
d) position of the weld in relation to the sheet and its edge;

e) position of the chisel relative to the weld;

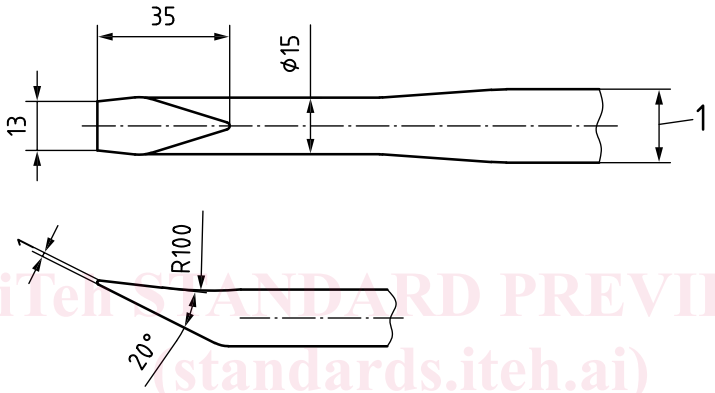
f) insertion depth of chisel.

Before non-destructive chisel testing is implemented in production, the effectiveness of the test shall be verified by destructive tests. Non-destructive chisel testing should be used with considerable caution, especially when used with high-strength steels. Joint design and material thickness can also influence the results.

Dimensions in millimetres



a) Type 2-1 chisel (for thickness ≤ 2 mm)



b) Type 2-2 chisel (for thickness > 2 mm)

Key

1 arbitrary value

Figure 3 — Examples of dimensions of chisels for non-destructive chisel testing

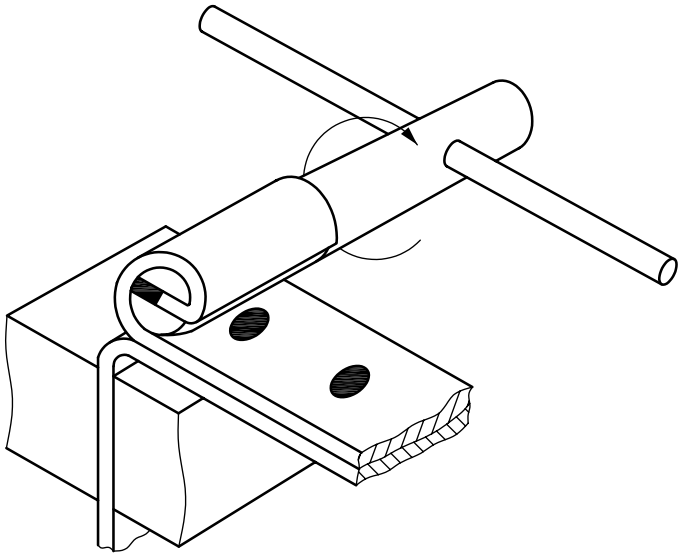
For destructive chisel testing, a chisel shall be driven between the sheets and adjacent to the weld until fracture occurs in or adjacent to the weld, or until severe deformation occurs. The aim of this test is to separate the sheets so that a weld plug or interfacial fracture occurs to allow weld size to be determined.

In the case of a weld between three or more sheets, the test shall be made between each adjacent pair of sheets.

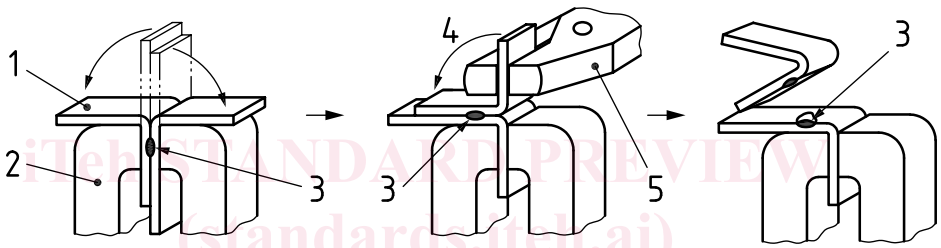
For non-destructive chisel testing, a chisel shall be driven between the sheets and adjacent to the weld until the material yields or bends near the weld. The aim of this test is to obtain an indication that a weld has been made without causing fracture to occur in or adjacent to the weld. In the case of a weld between three or more sheets, the test shall be made between each adjacent pair of sheets. If fracture has not occurred after testing, the components shall be restored to their original shape.

5.2 Peel test

The peel test is a destructive test for determining weld size and fracture mode of a welded lap joint. There are two types of peel test. The manual peel test is shown in Figure 4. The mechanized peel test is shown in Figure 5.



a) Peel testing using a vice and a roller



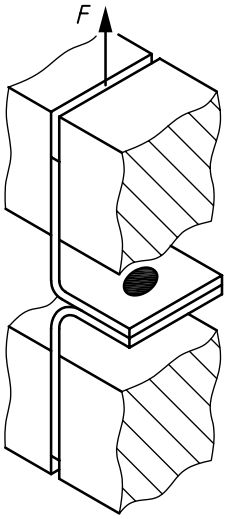
b) Peel testing using a vice and pliers

Key

1	test piece	4	peeling direction
2	vice	5	pliers
3	weld		

Figure 4 — Manual peel test configurations

NOTE Mechanized peel testing is specified by ISO 14270.



Key

F force

Figure 5 — Mechanized peel test configuration

The sheets near the weld are slowly peeled apart until all welds under testing are completely fractured. A roller tool, pincers, pliers, vice or mechanized equipment (see Figure 4 and Figure 5) is typically used. If a roller tool is used, a diameter of 30 mm is recommended for sheet thicknesses up to 1 mm in accordance with Figure 4 a). Testing using a vice and pliers shall be in accordance with Figure 4 b). For materials that are too thick or too strong to be tested manually, mechanized testing in accordance with ISO 14270 is recommended (see Figure 5). The applied force can be generated by means of a normal tensile testing machine or other suitable mechanized equipment.

Fracture mode and plug size vary depending on the direction of the applied force.

Peel testing may be applied to test specimens cut from production components or welded test pieces.

5.3 Measurement of weld size and recording failure modes

A destructive chisel test or peel test allows the measurement of the weld size and assessment of the failure mode in accordance with ISO 17677-1. In the case of mechanized peel testing in accordance with ISO 14270, it can also be possible to measure the force at failure.

Weld diameters (d_w) and plug diameters (d_p) shall be measured in accordance with ISO 17677-1.

Precautions should be taken when measuring weld size, particularly for asymmetrical welds.

In the case of plug failure, the fracture can occur in the parent metal outside of the weld. If possible, this excess metal should be folded back or removed. If this is not possible, then only one dimension may be measured. A knife-edged calliper or measuring device as shown in Figure 6 is used for the measurement of weld diameters with plug failure.

Depending upon the application, for asymmetric welds the ratio between maximum and minimum diameters shall be calculated and included in the test report.

The strength of the weld varies depending on the direction of the applied force when the weld shape is asymmetric.

Weld diameter dimensions should be rounded down to the nearest 0,1 mm.