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**Resistance welding — Destructive tests  
on welds in metallic materials — Torsion  
test of resistance spot welds**

*Soudage par résistance — Essais destructifs des soudures sur matériaux  
métalliques — Essai de torsion de soudure par résistance par points*



Reference number  
ISO 17653:2012(E)

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 17653 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 6, *Resistance welding and allied mechanical joining*.

This second edition cancels and replaces the first edition (ISO 17653:2003), which has been technically revised.

# Resistance welding — Destructive tests on welds in metallic materials — Torsion test of resistance spot welds

## 1 Scope

This International Standard specifies specimen dimensions, testing equipment and the procedure for torsion testing of resistance spot welds with single sheet thicknesses ranging from 0,5 mm to 6,0 mm in steels. It can be used for non-ferrous materials in certain circumstances.

The aim of this International Standard is to determine the weld diameter and the failure type of fractured specimens, and to evaluate the influence of different steel types, welding parameters and other factors on the deformation characteristics of a resistance spot weld.

## 2 Normative references

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

ISO 14329, *Resistance welding — Destructive tests of welds — Failure types and geometric measurements for resistance spot, seam and projection welds*

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 14329 and ISO 17677-1 and the following apply.

### 3.1

#### **non-instrumented torsion test**

test used to determine weld diameter and failure type of welds without measuring torque or torsion angle

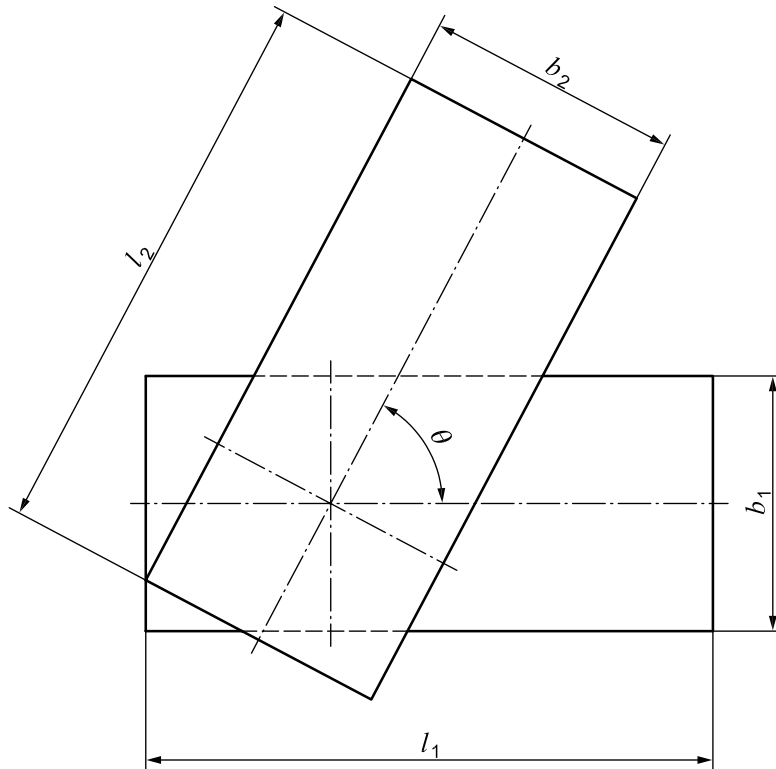
### 3.2

#### **instrumented torsion test**

torsion test with measuring instruments for torque or torsion angle to evaluate the mechanical properties of welds as well as the weld diameter and failure type

## 4 Specimens

Specimens for torsion testing are welded individually. The two coupons with a minimum width of 40 mm and a minimum length of 60 mm shall be welded together such that they can be rotated relative to each other (see Figure 1). The distance of the centre of the spot weld from outer edge in longitudinal direction shall be minimum 20 mm.



- Key**
- $l_1, l_2$  length of coupons ( $\geq 60$  mm)
  - $b_1, b_2$  width of coupons ( $\geq 40$  mm)
  - $\theta$  stacking angle between both coupons before testing

The distance of the centre of the spot weld from outer edge of the coupon in longitudinal direction shall be  $\geq 20$  mm.

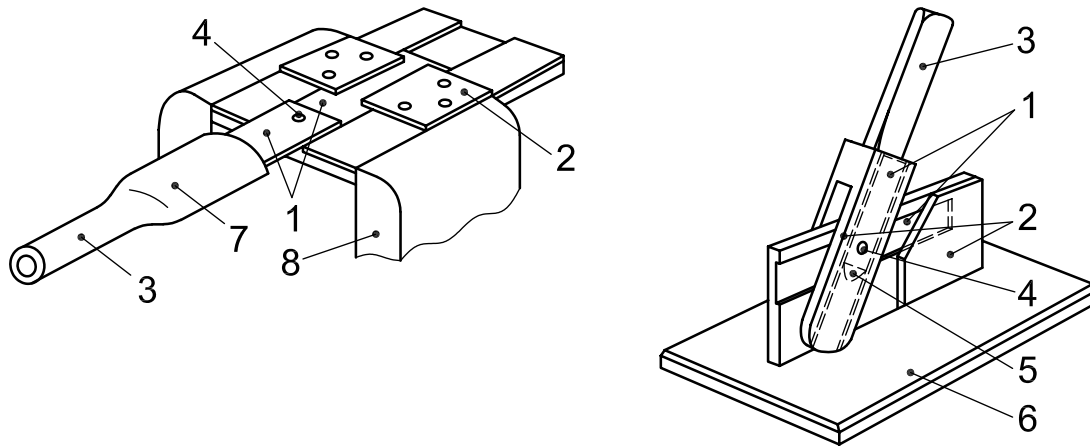
**Figure 1 — Specimen**

## 5 Testing equipment and testing procedure

### 5.1 Non-instrumented torsion test (workshop test)

For the non-instrumented torsion test (workshop test), the lower sheet of the specimen is gripped as shown in Figure 2. The upper sheet of the specimen is held in a plier or flattened end pipe as shown in Figure 2 a), and rotated steadily in one direction until failure of the spot weld. The testing device shall be designed to minimize the bending of the two sheets of the specimen during testing in order to maintain pure torsional loading of the spot weld. This is necessary to increase the comparability of the test results. This test method determines the weld diameter and the failure type.

**NOTE** In the case of sheet material thicker than 2,0 mm the other sheet of the specimen can be gripped with the movable specimen gripper, and rotated until failure.



a) For specimens of thicker thicknesses

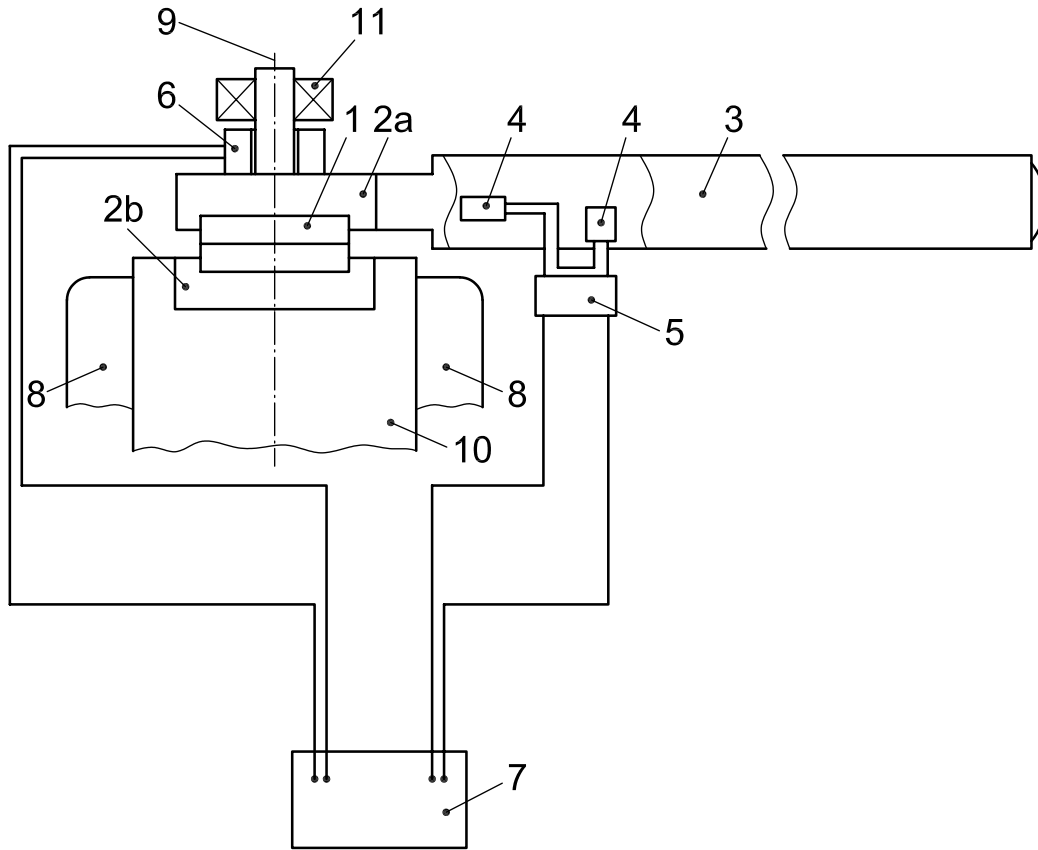
b) For specimens of thinner thicknesses

**Key**

- 1 specimen
- 2 specimen gripper
- 3 handle
- 4 spot weld
- 5 notch to stop slipping of specimen
- 6 fixed specimen gripper mounting
- 7 flattened part of pipe as specimen gripper
- 8 vice

**Figure 2 — Examples of torsion testing devices used only to determine weld diameter and failure type****5.2 Instrumented torsion test**

The device used for the instrumented torsion test shall be constructed such that the clearance between the edge of the specimen and the tooling does not exceed 0,3 mm. The specimen shall be positioned such that the interface between the two sheets corresponds to the torsional plane of the device. Shims or an adjusting mechanism may be used for this purpose. Torque shall be applied to the longer sides of the specimen. Rotation of the specimen shall be possible without tilting the specimen sheets or the gripper.



**Key**

- 1 specimen
- 2a specimen grip (rotatable)
- 2b specimen grip (fixed)
- 3 torque bar
- 4 strain gauge
- 5 strain gauge amplifier
- 6 torsion angle sensor
- 7 data recorder
- 8 grips of clamping device for holding testing jig
- 9 rotation axis
- 10 housing for specimen grippers 2a and 2b with common rotation axis and bearing
- 11 bearing

**Figure 3 — Example of measuring equipment for instrumented torsion test**

The torque is applied manually using a lever or a mechanized drive on the rotating part of the testing device (upper part). During testing, the lever is moved steadily through 90° in approximately 5 s.

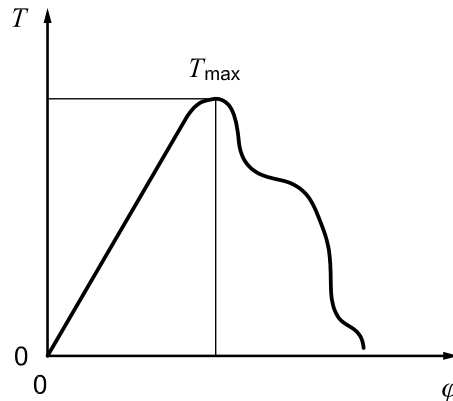
Torque and torsion angle are measured during testing, using measuring equipment as shown in Figure 3, for example. The values should be recorded using a suitable instrument, for example a data recorder.

The centre of electrode indentation shall not deviate by more than 0,5 mm from the axis of rotation.

**6 Evaluation of test results whenever applying the instrumented torsion tests**

A torque,  $T$ , torsion angle,  $\varphi$ , curve is used to determine the maximum torque,  $T_{max}$ , and the corresponding torsion angle (see Figure 4).



**Key**

$T$	torque
$T_{\max}$	maximum torque
$\varphi$	torsion angle

**Figure 4 — Example of a torque vs. torsion angle curve recorded in a torsion test**

The weld diameter and failure type shall be determined from the fractured specimens in accordance with ISO 14329.

NOTE Torque, torsion angle and failure type are dependent on the sheet thickness, the weld diameter and the mechanical characteristics of the weld nugget, heat-affected zone and parent metal.

## 7 Test report

The test report shall include at least the following information:

- a) reference to this International Standard, i.e. ISO 17653:2012;
- b) welding equipment used;
- c) welding conditions;
- d) designation of the materials and sheet thicknesses;
- e) weld diameter,  $d$ ;
- f) maximum torque and corresponding torsion angle, if applicable;
- g) failure type, appearance of the fractured surface (spatter or weld splash, pores, lack of fusion);
- h) details of the test procedure and measuring equipment used;
- i) any deviations from this International Standard.

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