INTERNATIONAL STANDARD

ISO 17653

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

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

Reference number
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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 International Standard 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 the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 5, *Testing and inspection of welds*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

Annex A of this International Standard is for information only.

Contents

Foreword

This document (EN ISO 17653:2003) has been prepared by Technical Committee CEN/TC 121, "Welding", the secretariat of which is held by DS, in collaboration with ISO/TC 44 "Welding and allied processes".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2003, and conflicting national standards shall be withdrawn at the latest by September 2003.

In this European Standard annex A is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard is applicable to spot welded test specimens with single sheet thicknesses ranging from 0,5 mm to 3,0 mm in steels. It may be used for non-ferrous materials in certain circumstances, see annex A.

The aim of this test is to determine the influence of different steel types, welding parameters and other factors on the deformation characteristics of a spot weld. Using this test, it is possible to determine the weld diameter and the fracture type from fractured specimens. Additionally, the maximum torsion moment (torque) and the corresponding torsion angle can be determined.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

prEN ISO 14329:1999, *Welding — Destructive testing of welds — Failure types and geometric measurements for resistance spot, seam, and projection welds (ISO/DIS 14329:1999).*

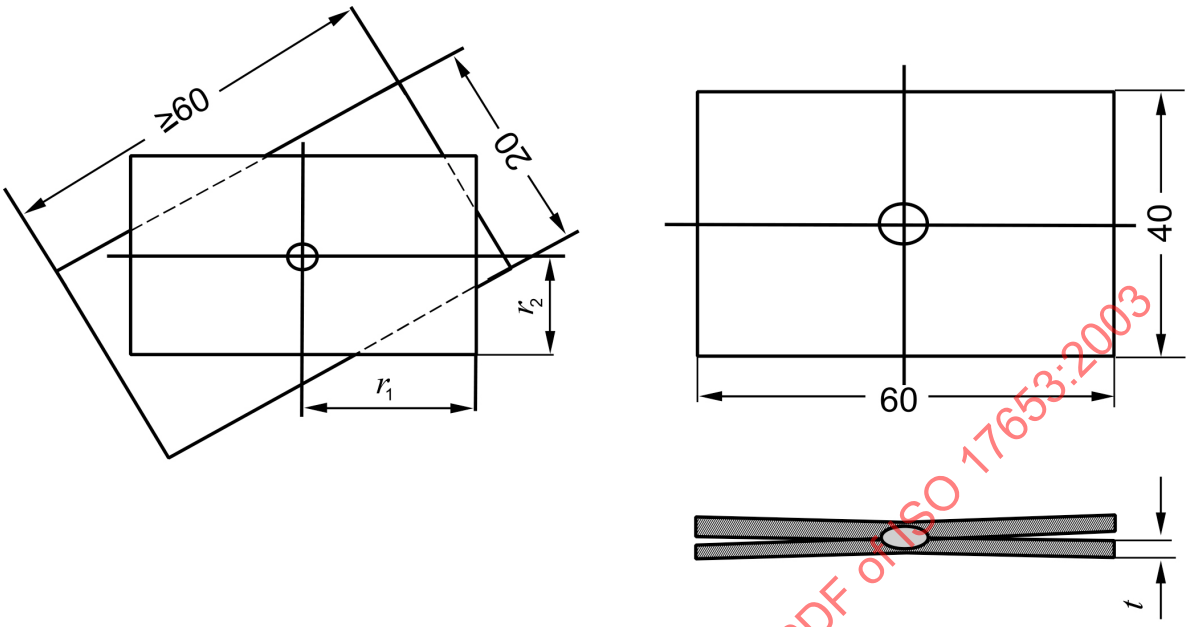
3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in prEN ISO 14329:1999 apply.

4 Specimens

Specimens for torsion testing are welded individually. In the case of the non-instrumented torsion test, the minimum distance of the spot weld from the edge shall be greater than 10 mm. When using an instrumented torsion device, the minimum distance shall be 20 mm. The specimen dimensions shall be adjusted to the test equipment but shall be adequate to ensure test specimen rigidity (see Figure 1). The spot weld shall be located in the centre of the test specimen (see 5.2.2).

Dimensions in millimetres



Key

r_1 distance from the edge to the centre of the spot weld
r_2 distance from the edge to the centre of the spot weld
t material thickness (0,5 mm to 3,0 mm)

a) specimens for non instrumental torsion test Non-instrumented

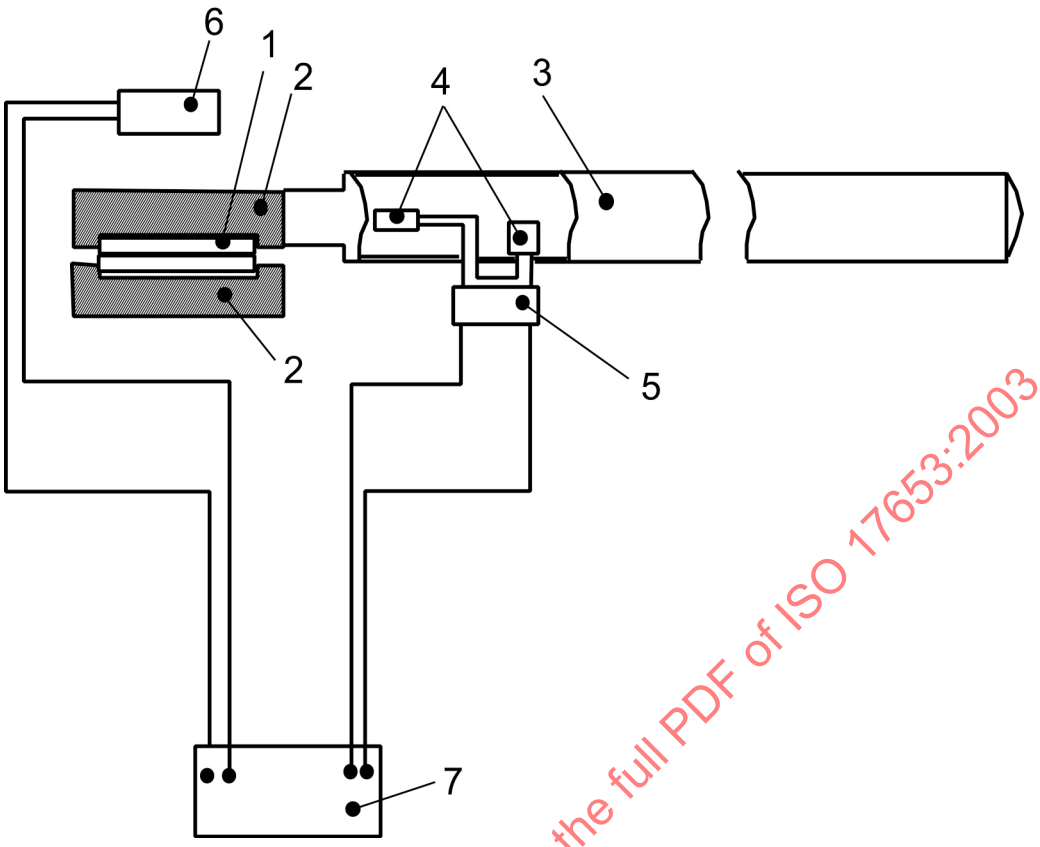
b) recommended specimen dimensions for instrumented torsion test using a torsion device (manual or mechanized)

Figure 1 — Specimens

5 Testing equipment and testing procedure

5.1 Manual torsion test using a pair of tongs (workshop test)

For this test, the lower sheet of the specimen is gripped using a specimen gripper similar to that shown in Figure 2. This can be subsequently clamped in a vice. The upper sheet of the specimen is held in a pair of tongs and twisted continuously in one direction until rupture of the spot weld. Bending of the two sheets of the specimen shall be avoided during testing in order to maintain pure torsional loading at the spot weld. This is essential if the test results are to be comparable. This test method only allows weld diameter and fracture type to be determined.



Key
1 Specimen
2 Specimen gripper
3 Torque bar
4 Strain gauge
5 Strain gauge amplifier
6 Potentiometer for measuring the torsion angle
7 X-Y-recorder

Figure 2 – Measuring equipment

5.2 Instrumented torsion test

5.2.1 Manual twisting

The device used for this variant of torsion test shall be constructed in such a way that the clearance between the edge of the specimen and the tooling shall not exceed 0,3 mm. Positioning of the specimen shall be arranged in such a way that the interface between the two sheets corresponds to the torsional plane of the device and shims, or an adjusting mechanism, may be used for this purpose. Twisting of the specimen shall be possible without tilting or interference between the specimen sheets or the parts of the tooling.

The torsion moment is imposed manually via a lever arm on the rotating part of the testing device (upper part). During testing, the lever arm shall be moved manually at a slow and steady rate of about 90° in 5 s.

Torsion moment and torsion angle are measured during testing using measuring equipment as shown in Figure 2 for example. Permanent records may be made using suitable instrumentation, for example an X-Y recorder.

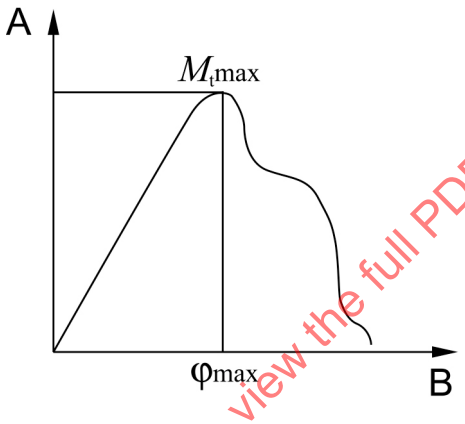
5.2.2 Mechanized torsion test

In this variant of the torsion test, the torsion moment is imposed by an electric or electro-hydraulic drive. A steady torsional speed, approximately 90° per 5 s, is recommended. Measurement of the torsion moment and torsion angle is carried out using procedures, described in 5.2.1.

When using either manual or mechanical torsion test procedure the centre of electrode indentation shall not deviate by more than 1,0 mm from the torsional axis of the torsion device (see annex A).

6 Evaluation of test results

A torsion moment – torsion angle curve is used to determine the maximum torsion moment and the corresponding torsion angle, see figure 3.



Key

A Torsion moment M_t
B Torsion angle φ

Figure 3 — Measuring values of the torsion test in the torsion moment – torsion angle curve

The fracture type for the welds shall be evaluated from the fractured specimens, see prEN ISO 14329.

Torsion moment, torsion angle and fracture type are dependent on the sheet thickness, the weld diameter and the mechanical characteristics of the weld metal, heat-affected zone, and parent metal (see annex A).

The weld diameter shall be determined on the fractured specimen as mean weld diameter.

7 Test report

The test report shall refer to this standard and include at least the following information:

a) welding equipment;

b) welding conditions;

c) designation of the materials and sheet thicknesses;

d) weld diameter "d";

e) maximum torsion moment and corresponding torsion angle;

f) fracture type, appearance of the fracture surface (spatter or weld splash, pores, lack of fusion);

g) details of the test procedure and measuring equipment used;

h) and deviations from this standard.