
Specimen dimensions and procedure for shear testing resistance spot, seam and embossed projection welds

*Dimensions des éprouvettes et mode opératoire pour l'essai de
cisaillement des soudures par résistance par points, à la molette et par
bossages*



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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 3.

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.

International Standard ISO 14273 was prepared in collaboration with the International Institute of Welding, which has been approved by the ISO Council as an international standardizing body in the field of welding.

Specimen dimensions and procedure for shear testing resistance spot, seam and embossed projection welds

1 Scope

This International Standard specifies specimen dimensions and a testing procedure for shear testing of spot, seam and embossed projection welds, in overlapping sheets, in any metallic material of thickness 0,5 mm to 10 mm, where the welds have a maximum diameter of $7\sqrt{t}$ (where t is the sheet thickness in mm). With welds of diameter $> 5\sqrt{t}$ and $\leq 7\sqrt{t}$, the value of shear strength can be underestimated when using the recommended test specimen dimensions.

The object of shear testing is to determine the shear force that the test specimen can sustain.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system.*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1

shear force

maximum force obtained from the test

3.2

plug diameter

d_p

(plug failure) mean diameter of the plug

See Figure 1 a).

3.3

weld diameter

d

(partial plug failure) mean diameter of the fused zone measured at the interface omitting the corona bond area and the maximum diameter of the plug component of the failure

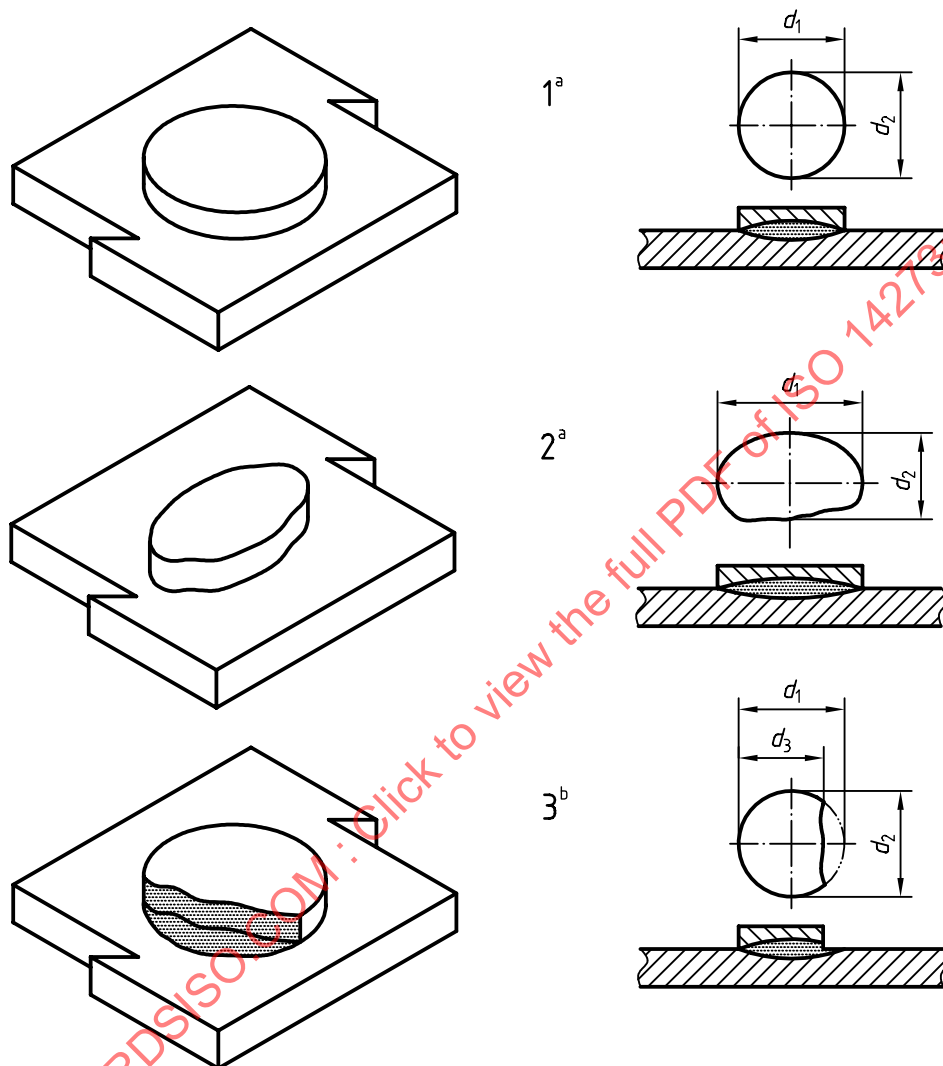
See Figure 1 a).

NOTE Measurement of the minimum diameter of the plug component should be quoted separately.

3.4 weld diameter

d
(interface failure) mean diameter of the fused zone measured at the interface, omitting the corona bond area

See Figure 1 b).



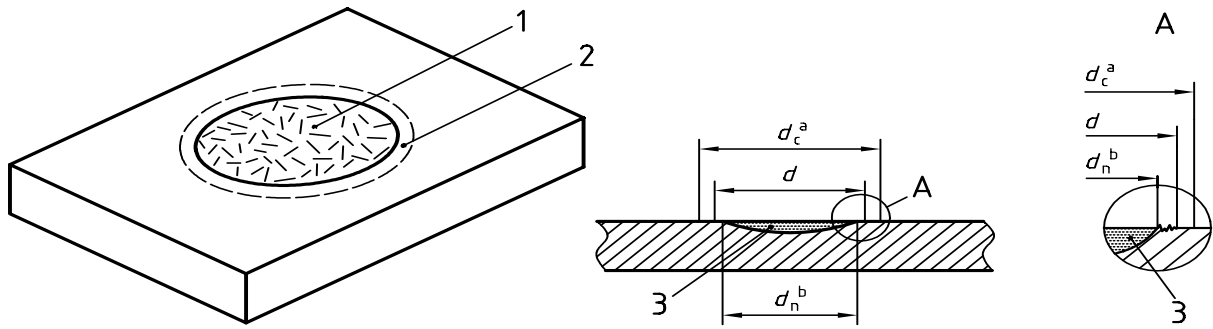
Key

- 1 Symmetrical
- 2 Asymmetrical
- 3 Partial

^a $d = d_p = (d_1 + d_2)/2$

^b $d = (d_1 + d_2)/2$ and $d_p = (d_2 + d_3)/2$

a) Weld with plug (slug) failure

**Key**

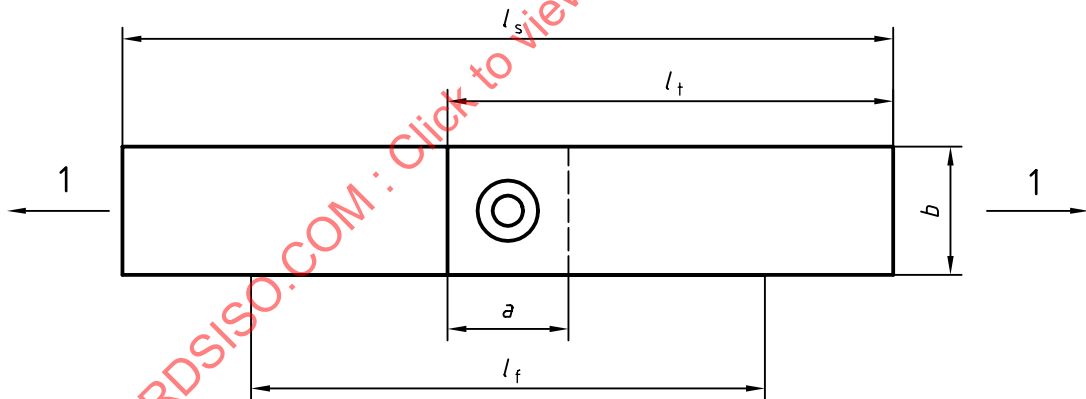
- 1 Sheared nugget
- 2 Corona bond zone
- 3 Nugget
- ^a Diameter of the corona.
- ^b Diameter of the nugget.

b) Weld with interface failure, $d < d_c$

Figure 1 — Measurement of weld size

4 Test pieces and specimens

See Figure 2 and Table 1.

**Key**

- 1 Direction of test load

Figure 2 — Test shear specimen

Table 1 — Dimensions of shear test specimen

Dimensions in millimetres

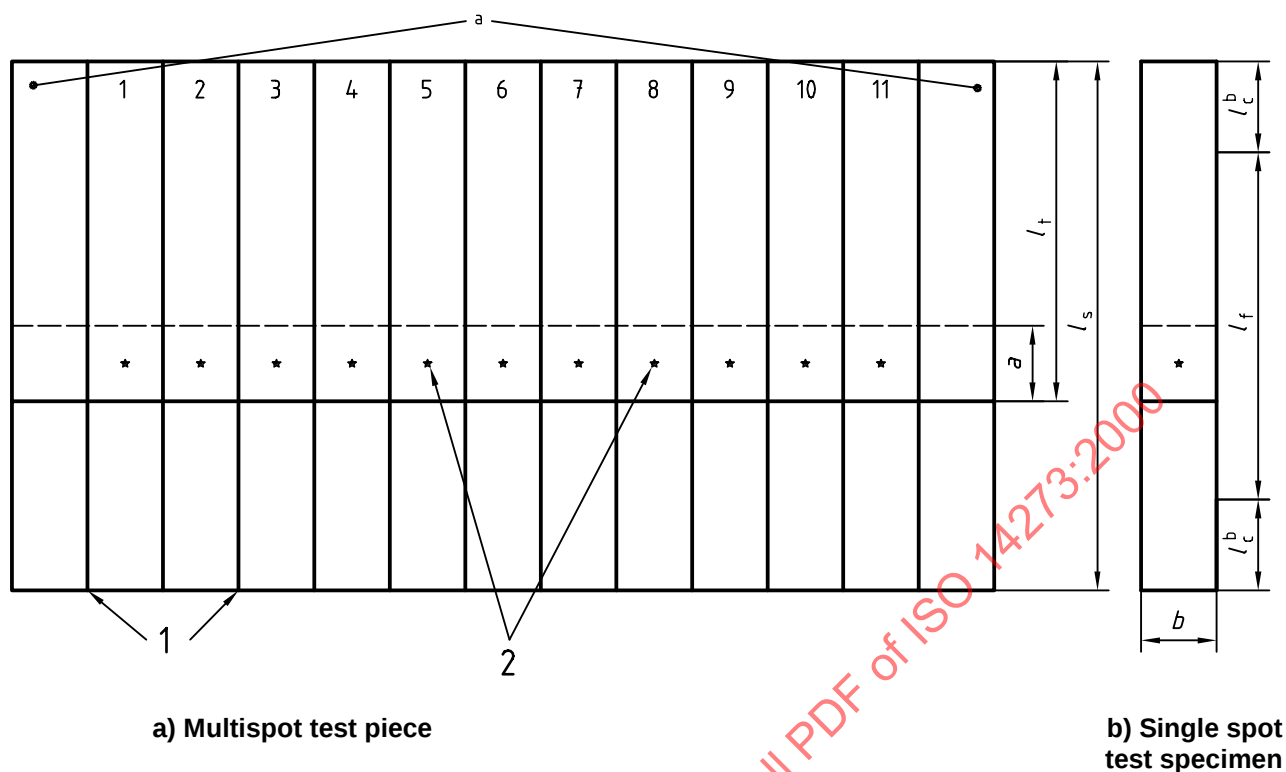
Thickness t	Overlap a	Specimen width ^a b	Specimen length l_s	Free length between clamps l_f	Length of individual test coupons l_t
$0,5 \leq t \leq 1,5$	35	45 (30)	175	95	105
$1,5 < t \leq 3$	46	60 (30)	230	105	138
$3 < t \leq 5$	60	90 (55)	260	120	160
$5 < t \leq 7,5$	80	120 (80)	300	140	190
$7,5 < t \leq 10$	100	150 (100)	320	160	210
^a Figures in parentheses will give approximately 10 % reduction in strength and these widths may be used only by agreement between the manufacturer and the purchaser.					

The test specimen can be produced, either by making a certain number of individual spot welds joining two test sheets as in Figure 3 a), and then cutting them, or by welding each one separately as shown in Figure 3 b). In the case of different sheet thicknesses the dimensions shall be based on the thinner sheet.

In the case of multispot welding equipment each electrode shall weld one multispot test piece as in Figure 3 a) or its own individual test specimen as in Figure 3 b). Because shunting occurs during welding of a multispot test piece the welding current used shall be higher than that for welding the single spot test specimen.

When projection welding, all welds shall be tested but for multi-spot welding the first and last welds on the test piece shall be discarded as shown in Figure 3 a).

The properties of the welded joints in the test piece shall not be affected by the process of cutting into individual test specimens. For spot and projection welding the minimum number of test specimens shall be eleven.



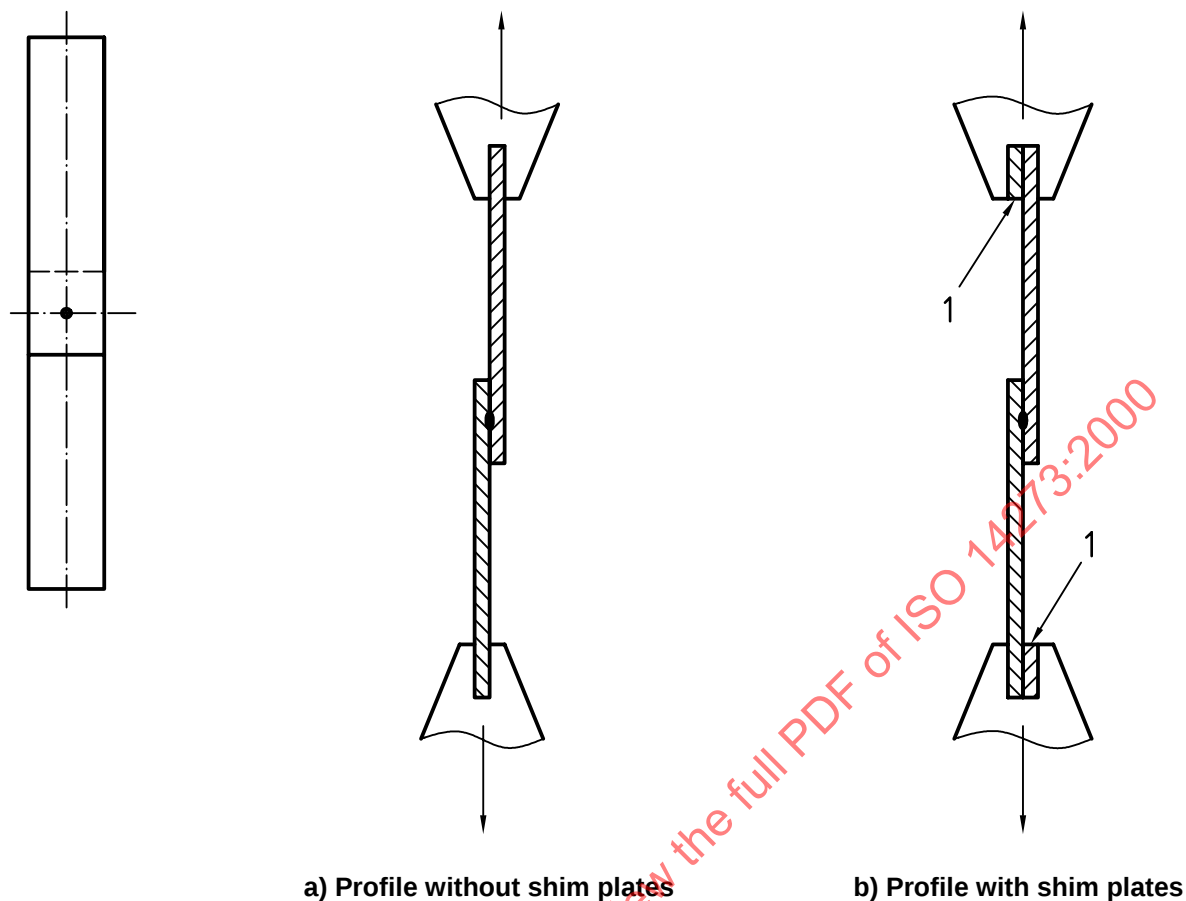
Key

- 1 Cuts
- 2 Spots
- a Discarded.
- b Clamping length.

Figure 3 — Test specimen dimensions and sampling position for multispot welded test pieces

5 Test equipment and testing procedure

The specimen is clamped in a tensile testing machine which shall satisfy the requirements of ISO 7500-1, in such a way that the clamps are at the required distance from one another. For sheet thickness < 3 mm or where the ratio of the thicknesses of the two sheets is $> 1,4$, shim plates shall be used for clamping the test specimen in the grips of the tensile testing machine. The shim plate shall be as thick as the sheet of the test specimen as shown in Figure 4. Testing shall be carried out at room temperature.



Key

- 1 Shim plate

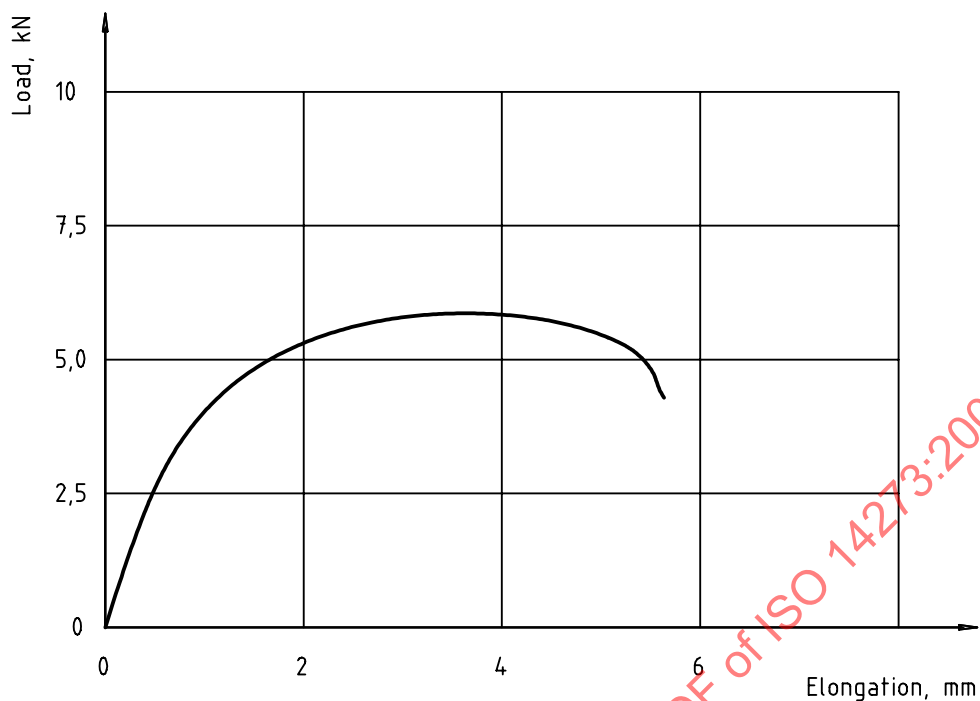
Figure 4 — Shear test configuration

6 Test report

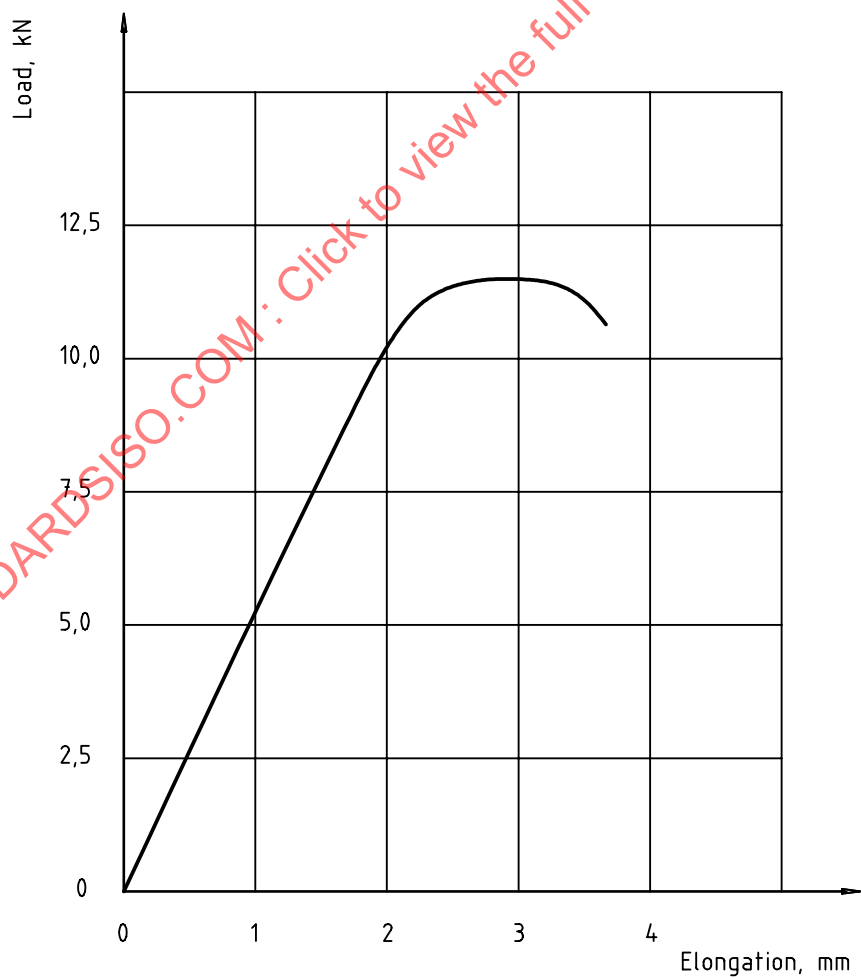
The test report shall contain the following information:

- a) the welding process;
- b) the welding conditions and equipment;
- c) the material and its condition;
- d) the dimensions of the test piece and of the test specimen;
- e) individual values, mean value and standard deviation of the shear force in kilonewtons;
- f) the type of failure;
- g) individual values, mean value and standard deviation of the weld diameter;
- h) special remarks if any.

A load-elongation curve shall be drawn in order to give information on the deformation of the test specimen. Examples are shown in Figure 5.



a) Spot welded joints made on 1 mm thick steel sheet



b) Spot welded joints made on 1,25 mm thick steel sheet

Figure 5 — Typical load-elongation curves for the shear test