INTERNATIONAL STANDARD

ISO 14273

Second edition
2016-03-01

Resistance welding — Destructive testing of welds — Specimen dimensions and procedure for tensile shear testing resistance spot and embossed projection welds

Soudage par résistance — Essais destructifs des soudures — Dimensions des éprouvettes et mode opératoire pour l'essai de traction-cisaillement des soudures par résistance par points et par bossages

Reference number
ISO 14273:2016(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

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.

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IIW, *International Institute of Welding*, Commission III.

This second edition cancels and replaces the first edition (ISO 14273:2000), which has been technically revised.

Requests for official interpretations of any aspect of this International Standard should be directed to the ISO Central Secretariat, who will forward them to the IIW Secretariat for an official response.

Introduction

This edition of ISO 14273 no longer includes figures showing failure types and modes for tensile shear and cross tension testing in accordance with ISO 14329.

ISO 14273 has been revised to align it with ISO 17677-1.

Resistance welding — Destructive testing of welds — Specimen dimensions and procedure for tensile shear testing resistance spot and embossed projection welds

1 Scope

This International Standard specifies specimen dimensions and a testing procedure for tensile shear testing of spot 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).

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

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.

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*

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 and the following apply.

3.1
tensile shear strength
TSS
maximum (tensile shear) force obtained from this test

3.2
tensile shear force
force applied on test specimen during tensile shear testing

3.3
saturated strength condition
<resistance welding> condition where beyond a certain specimen width and overlap length, the weld strength does not increase

4 Test pieces and specimens

The configuration of the test specimen is shown in Figure 1 and Table 1.

The test specimen dimensions given in Table 1 are for testing in the saturated strength condition for weld diameters up to $5\sqrt{t}$.

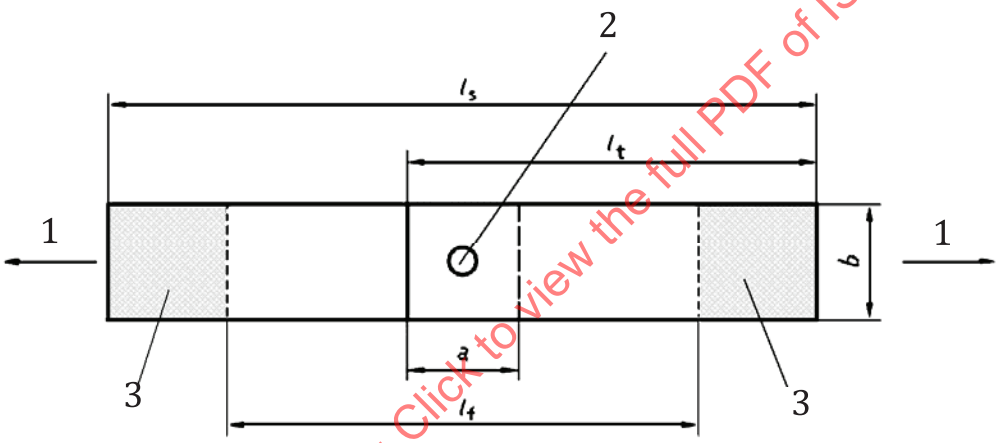
For weld diameters between $5\sqrt{t}$ and $7\sqrt{t}$, tensile shear strength values can be underestimated when using the values given in Table 1 (see Annex A). When testing weld diameters over $5\sqrt{t}$ in the saturated

strength condition, the minimum coupon width shall be 7 to 10 times of the weld diameter (see Figure A.1).

Table 1 — Tensile shear test specimen dimensions for weld diameter ≤ $5\sqrt{t}$

Thickness t mm	Overlap a mm	Specimen width [a] b mm	Specimen length l_s mm	Free length between clamps l_f mm	Length of individual test pieces l_t mm
$0,5 \le t \le 1,5$	35	45 (30)	175	95	105
$1,5 < t \le 3$	45	60 (30)	230	105	138
$3 < t \le 5$	60	90 (55)	260	120	160
$5 < t \le 7,5$	80	120 (80)	300	140	190
$7,5 < t \le 10$	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.



Key

1 direction of test load
2 weld
3 clamping zone

Figure 1 — Tensile shear test specimen

The positional accuracy of the weld on the test specimen shall be ±1 mm or less in every direction.

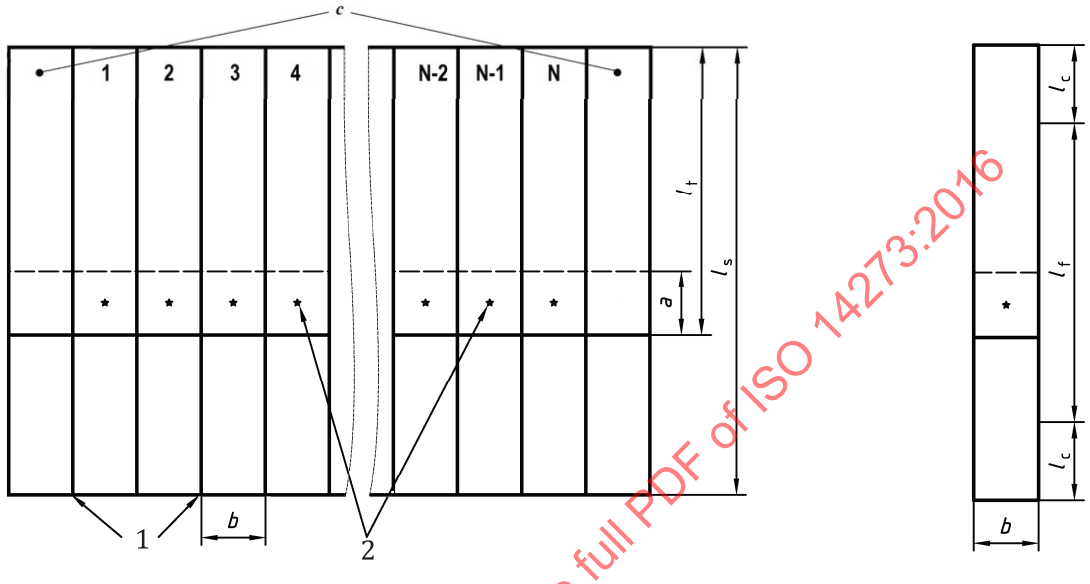
The test specimen can be produced, either by making multiple welds joining two test sheets as shown in Figure 2 a), and then cutting them, or by welding each single weld specimen separately as shown in Figure 2 b). In the case of different sheet thicknesses, the dimensions shall be based on the thinner sheet.

For equipment used to make multiple weld test pieces, each electrode shall weld one multiple weld test piece as shown in Figure 2 a) or a single test specimen as shown in Figure 2 b). Since shunting occurs during welding of a multiple weld test piece, the welding current used shall be higher than that for welding for a single weld test specimen.

For multiple weld test specimens, the first and last welds on the test piece shall be discarded as shown in Figure 2 a).

Test specimens for embossed projection welds shall only be produced as single weld test specimens as shown in Figure 2 b).

For multiple weld test pieces, the properties of the welds shall not be affected by the cutting process used to separate individual test specimens. To obtain a statistically significant average for spot and projection welding, several specimens shall be tested.



a) Multiple weld test piece **b) Single weld test specimen**

Key

1	cuts	*c*	discarded
2	welds	*N*	number of welds tested
a	overlap	l_c	clamping length
b	specimen/clamping width	l_s, l_t, l_f	see Table 1

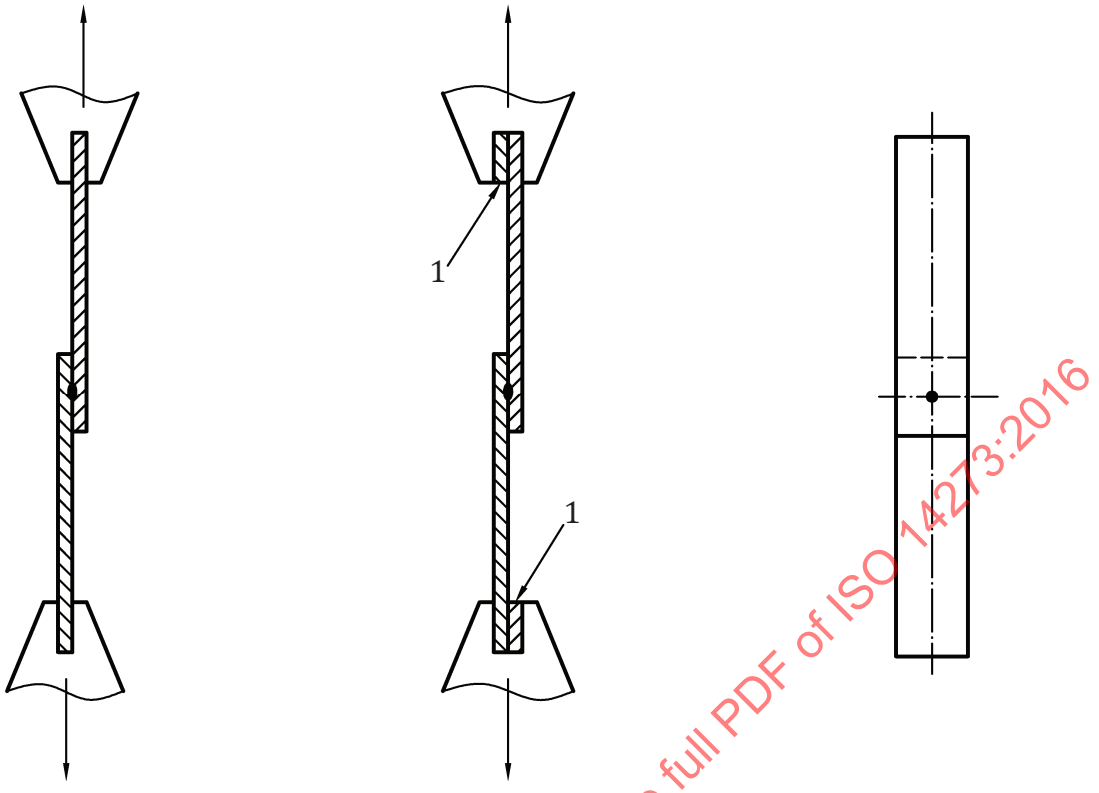
Figure 2 — Test specimen dimensions and sampling position for multiple and single welds

5 Test equipment and testing procedure

The specimen is clamped in a tensile testing machine, which shall satisfy the requirements of ISO 7500-1.

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 3.

Testing shall be carried out at room temperature.



a) Profile without shim plates **b) Profile with shim plates** **c) Front view**

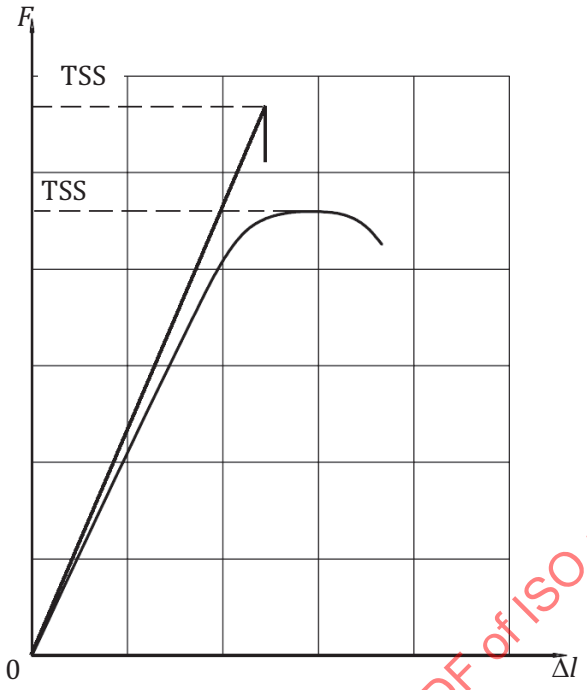
Key

1 shim plate

Figure 3 — Tensile shear test configuration

A load-displacement curve shall be plotted in order to give information on the deformation of the test specimen. Examples are shown in Figure 4.

The test results shall be recorded with values of the tensile shear strength in accordance with this test and type of failure mode and weld diameter of each weld in accordance with ISO 17677-1. Force measurement accuracy shall be equal or less than ±1 %.



Key

TSS tensile shear strength

F force (load)

Δ*l* crosshead displacement

Figure 4 — Examples of load-displacement curves for the tensile shear test (Not to scale)

6 Test report

The test report shall contain at least the following information:

a) a reference to this International Standard, i.e. ISO 14273:2016;

b) the welding process used;

c) the welding conditions and equipment;

d) the material and its condition;

e) the dimensions of the test piece and of the test specimen;

f) individual values, mean value and standard deviation of the tensile shear strength in kN;

g) failure description (symmetrical plug failure, asymmetrical plug failure, partial failure, plug failure, interfacial failure, etc.);

h) individual values, mean value and standard deviation of the weld diameter;

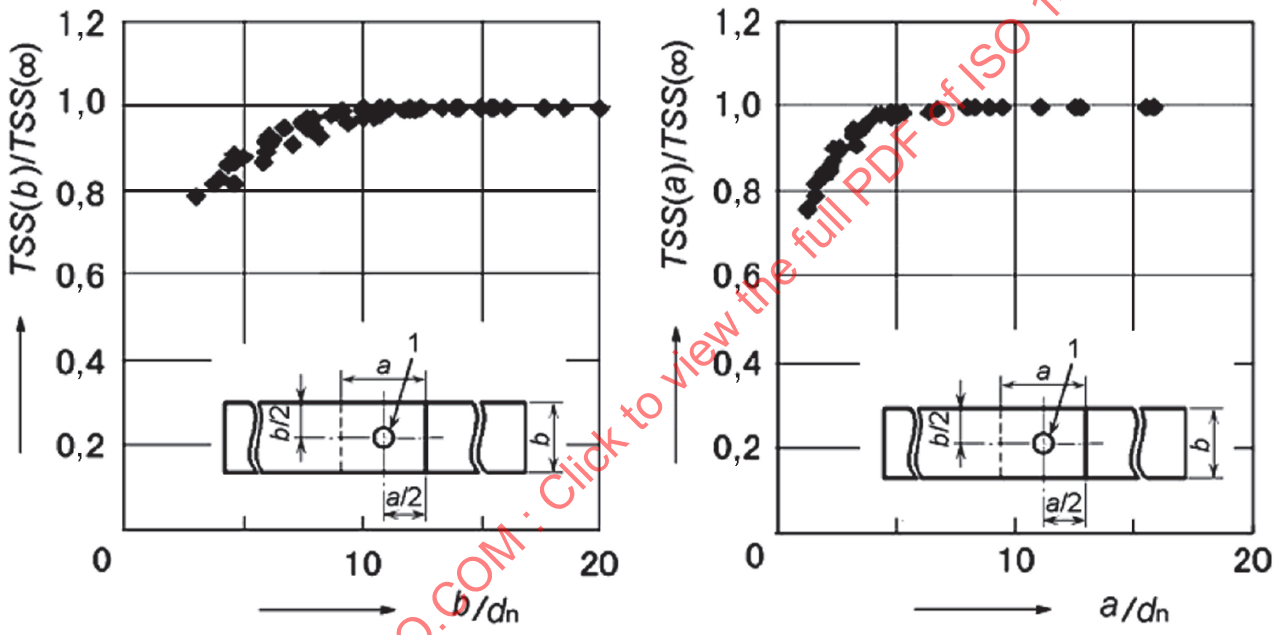
i) special remarks if any.

Annex A
(informative)

Specimen size — Saturated strength condition

The test specimen dimensions specified in this standard are larger than normal test specimen sizes. This is in order to obtain the maximum measured strength of the welds in the saturated strength condition. Specimen width values, *b*, in parentheses given in Table 1 indicate around a 10 % reduction in test piece size.

The relationship between the test piece size and measured weld strength (tensile shear strength) is shown in Figure A.1.



a) TSS vs. test specimen width (Mild steel sheets, t = 0,8 ~ 3,2 mm, a = 100 mm[a])

b) TSS vs. overlap length of test specimen (Mild steel sheets, t = 0,8 ~ 2,3 mm, b = 80 ~ 100 mm[b])

Key

1	weld
d_n	nugget diameter
a/d_n	non-dimensional overlap length
b/d_n	non-dimensional width
TSS(x)/TSS(∞)	non-dimensional weld strength
x	a or b

NOTE Superscripts "a" and "b" indicating the overlap length and the width of the test specimens used for the tests are in their saturated strength conditions, respectively.

Figure A.1 — Relationship between weld strength and test specimen size