
**Vickers hardness testing of resistance
spot, projection and seam welds (low load
and microhardness)**

*Essai de dureté Vickers sur soudures par résistance par points, par
bossages et à la molette (essai sous charge réduite et essai de
microdureté)*

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Printed in Switzerland

Foreword

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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 14271 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.

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Vickers hardness testing of resistance spot, projection and seam welds (low load and microhardness)

1 Scope

This International Standard specifies the procedures for the hardness testing of etched cross sections of resistance spot, projection and seam welds.

The aim of the hardness tests is to determine the Vickers hardness, in the low load or microhardness range, of the weld nugget, the heat affected zone and parent metal in ferrous or non-ferrous metals for welds made in sheets of thickness $\geq 0,5$ mm.

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.

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ISO 6507-1:1997, *Metallic materials — Vickers hardness test — Part 1: Test method*¹⁾.

3 Terms and definitions

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

3.1

Vickers hardness

value proportional to the quotient obtained by dividing the test force by the sloping area of the indentation which is assumed to be a right pyramid with a square base and having at the vertex the same angle as the indenter

3.2

low-load range test

Vickers hardness test using an applied force less than 1,96 N (symbol < HV 0,2)²⁾

NOTE Vickers hardness in the low-load range and microhardness testing give different values which are not easily correlated.

1) Cancels and replaces ISO 6507-2:1983.

2) See ASTM E384-89.

4 Recommended forces for testing resistance welds

When the low-load Vickers hardness test is used, an applied force of either 1,961 or 9,807 N shall be used (HV 0,2 or HV 1).

In the case of the Vickers microhardness test an applied force of 0,98 N (HV 0,1) shall be used.

5 Test pieces

Hardness tests shall be performed on a test piece containing a cross section taken through the weld. The thickness of the test piece shall be at least $\times 1,5$ the diagonal length of the hardness indentation. In principle the cross section shall lie on a plane passing through the centre of the fused nugget.

In the case where the weld is essentially circular in a planar view, i.e. the ratio between the maximum and minimum diameter is less than 1,3, the section can be taken in any direction as shown in Figure 1.

In the case where the weld nugget is elongated as indicated in a planar view, e.g. seam and some projection welds, the section shall be taken perpendicular to the sheet surfaces along the longitudinal axis of the welds as in Figures 2 and 3. With seam welds sections can be taken transverse to or along the direction of welding.

If specified in the application standard, supplementary cross sections at right angles can be made.

In the case of projection welds which are non-circular or non-elongated special agreement shall be reached by the parties concerned as to the direction of the cross section.

The test piece shall be in accordance with ISO 6507-1.

Etched test pieces shall be used in both cases. When determining microhardness the weld structure shall be revealed.

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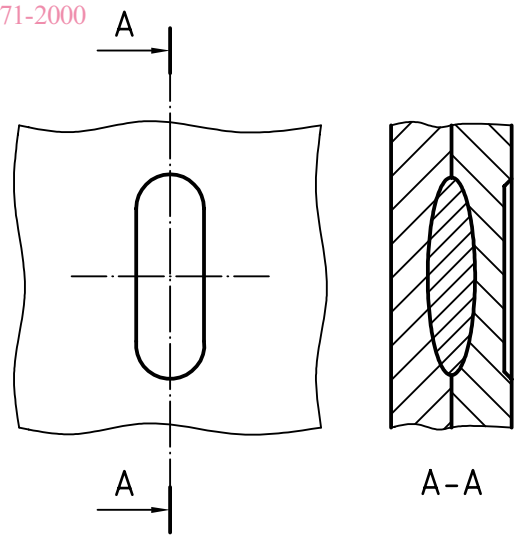
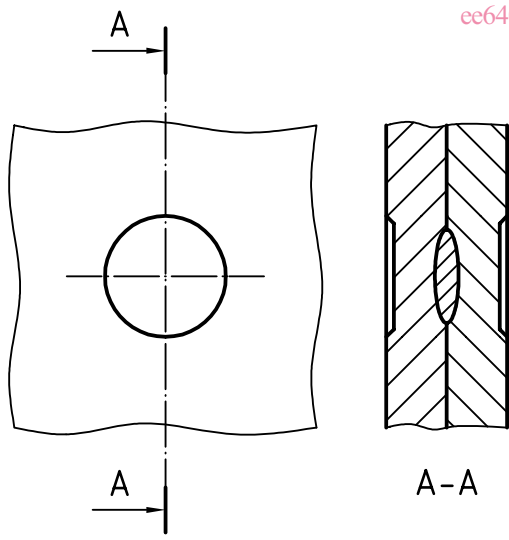


Figure 1 — Recommended positions for taking sections through welds: circular weld

Figure 2 — Recommended positions for taking sections through welds: elongated projection weld

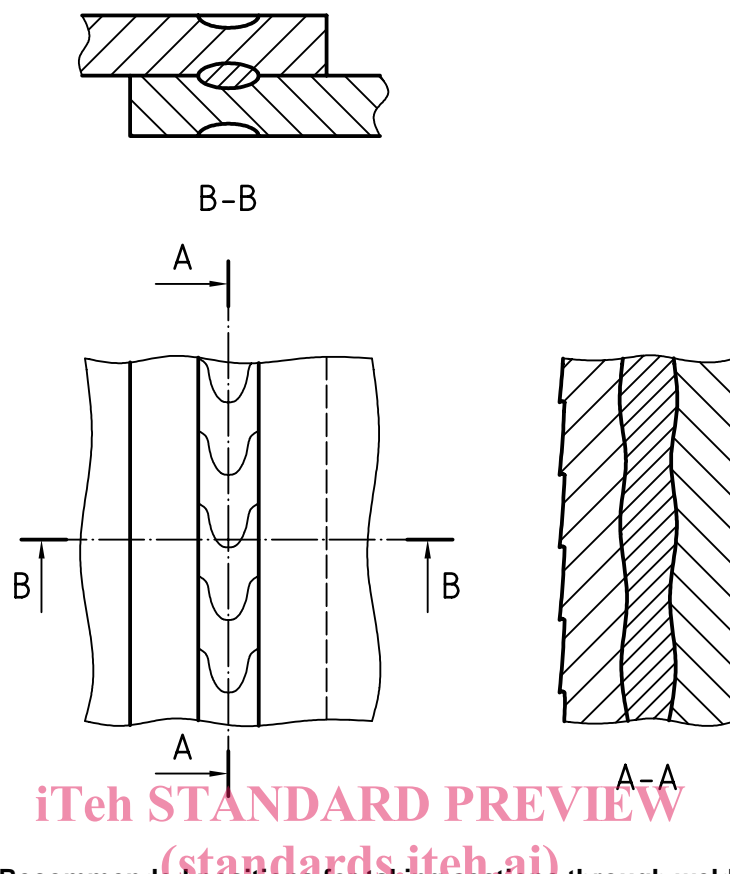


Figure 3 — Recommended positions for taking sections through welds: seam weld

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6 Test equipment <https://standards.iteh.ai/catalog/standards/sist/d7fd840-e057-43fc-a01e-ee640727c7dc/iso-14271-2000>

The test equipment shall comply with ISO 6507-1.

7 Testing

7.1 Choice of test

The hardness of the parent metal, the heat affected zone and the weld nugget shall be determined by using the Vickers test (low-load range). The microhardness test should be used for the detection of hardness variations within these regions (see clause 3).

7.2 Position of the indentations for the Vickers hardness test (low-load range)

Guidelines for positioning of the hardness indentations in order to permit measurement of the hardness of the parent metal, the weld heat affected zone and the weld nugget are shown in Figure 4. Additional measurements to those indicated can be made in particular locations subject to agreement between the contracting parties.

NOTE 1 In the case of central discontinuities in the nugget, the line of indentations can be displaced from the central position. When discontinuities are present a minimum distance from the centre of the indentation to the closer edge of the discontinuity has to be maintained.

According to ISO 6507-1 the distance between the centre of any indentation and the edge of the test piece shall be at least $\times 2,5$ the mean diagonal of the indentation in the case of steel, copper and copper alloys and at least $\times 3$ the mean diagonal of the indentation in the case of light metals, lead and tin and their alloys.

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NOTE 2 Titanium, nickel and their alloys should be treated in a similar manner to steel and copper alloys. They are not considered in ISO 6507-1.

The distance between the centres of two adjacent indentations shall be at least $\times 3$ the mean diagonal in the case of steel, copper and copper alloys, and at least $\times 6$ the mean diagonal in the case of light metals, lead, tin and their alloys. If two adjacent indentations differ in size the spacing shall be based on the mean diagonal of the largest indentation. No deformation shall be visible on the back of the test piece after the test.

The procedure shall be carried out in accordance with ISO 6507-1.

7.3 Position of indentations for the microhardness test

The positioning of the hardness indentations shall depend on the zones being tested as agreed between the contracting parties.

8 Test report

The test report shall contain the following information:

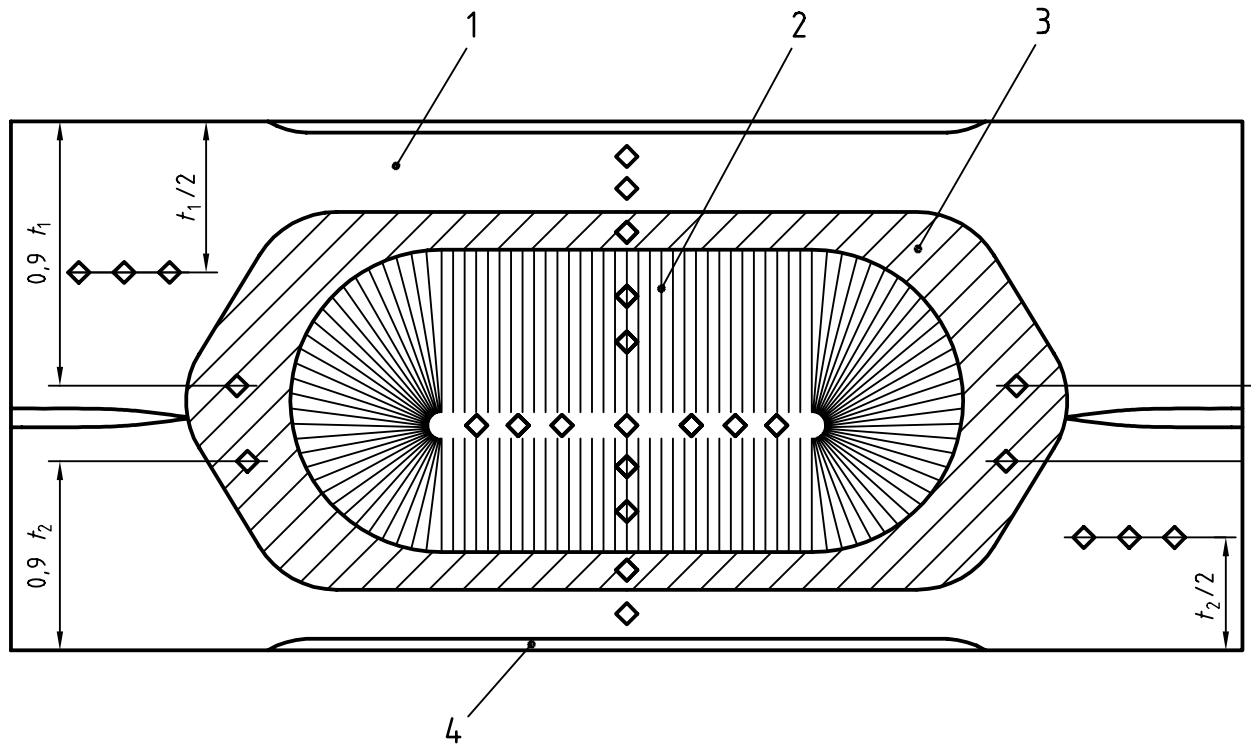
- a) hardness test type and load applied;
- b) position of indentations (sketch or photograph);
- c) single values of hardness and mean value;

and, whenever possible,

- d) welding process;
- e) welding conditions and equipment;
- f) material and its condition;
- g) other information by agreement.

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**Key**

- 1 Base material
- 2 Nugget
- 3 HAZ (heat affected zone)
- 4 Electrode indentation

NOTE $t_1 > t_2$.

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Figure 4 — Guidelines for positioning the indentations in base material, heat affected zone and nugget