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Destructive tests on welds in metallic materials – Hot cracking tests for weldments – Arc welding processes – Part 2: Self-restraint tests (ISO 17641-2:2015)

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Denna standard ersätter SS-EN ISO 17641-2:2005, utgåva 1.

The European Standard EN ISO 17641-2:2015 has the status of a Swedish Standard. This document contains the official English version of EN ISO 17641-2:2015.

This standard supersedes the Swedish Standard SS-EN ISO 17641-2:2005, edition 1.

**Förhållandet till övriga delar under samma huvudtitel - Utdrag ur Förord i ISO 17641-2:2015/
Relations to other parts under the same general title - Extract from the Foreword of ISO 17641-2:2015**

ISO 17641 consists of the following parts, under the general title *Destructive tests on welds in metallic materials — Hot cracking tests for weldments — Arc welding processes*:

- Part 1: *General*
- Part 2: *Self-restraint tests*
- Part 3: *Externally loaded tests* [Technical Report]

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EUROPEAN STANDARD

EN ISO 17641-2

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 2015

ICS 25.160.40

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English Version

Destructive tests on welds in metallic materials - Hot
cracking tests for weldments - Arc welding processes -
Part 2: Self-restraint tests (ISO 17641-2:2015)

Essais destructifs des soudures sur matériaux
métalliques - Essais de fissuration à chaud des
assemblages soudés - Procédés de soudage à l'arc -
Partie 2: Essais sur éprouvettes auto-bridées (ISO
17641-2:2015)

Zerstörende Prüfung von Schweißverbindungen an
metallischen Werkstoffen - Heißrissprüfungen für
Schweißungen - Lichtbogenschweißprozesse - Teil 2:
Selbstbeanspruchende Prüfungen (ISO 17641-2:2015)

This European Standard was approved by CEN on 26 September 2015.

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN ISO 17641-2:2015) has been prepared by Technical Committee ISO/TC 44 “Welding and allied processes” in collaboration with Technical Committee CEN/TC 121 “Welding and allied processes” the secretariat of which is held by DIN.

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 May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.

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Endorsement notice

The text of ISO 17641-2:2015 has been approved by CEN as EN ISO 17641-2:2015 without any modification.

Destructive tests on welds in metallic materials — Hot cracking tests for weldments — Arc welding processes —

Part 2: Self-restraint tests

1 Scope

This part of ISO 17641 specifies the required specimens, the test piece dimensions, and the procedures to be followed to carry out self-restraint hot cracking tests.

The following tests are described:

- T-joint weld cracking test;
- weld metal tensile test;
- longitudinal bend test.

The tests are designed to provide information about the hot cracking sensitivity of weld metals. The tests are not suitable for the assessment of parent materials.

This part of ISO 17641 applies primarily to fully austenitic stainless steels, nickel, nickel base, and nickel copper weld metals. This part of ISO 17641 can also be used for other weld metals.

This part of ISO 17641 describes only how to carry out the tests and report the results. It does not give any acceptance criteria.

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 5173, *Destructive tests on welds in metallic materials — Bend tests*

ISO 5178, *Destructive tests on welds in metallic materials — Longitudinal tensile test on weld metal in fusion welded joints*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

ISO 15792-1, *Welding consumables — Test methods — Part 1: Test methods for all-weld metal test specimens in steel, nickel and nickel alloys*

ISO 17641-1:2004, *Destructive tests on welds in metallic materials — Hot cracking tests for weldments — Arc welding processes — Part 1: General*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17641-1:2004 apply.

4 Symbols, designations, and units

For the purposes of this part of ISO 17641, the symbols and units given in [Table 1](#) apply.

Table 1 — Symbols, designations, and units

Symbol	Designation	Unit
T-joint weld cracking test		
a_1	Throat thickness of weld bead 1	mm
a_2	Throat thickness of weld bead 2	mm
t_1	Thickness of vertical plate, form C	mm
t_2	Thickness of horizontal plate, form C	mm
Weld metal tensile test		
d	Specimen diameter	mm
L_c	Test length	mm
L_o	Measuring length on the test specimen	mm
L_e	Measuring length on the test specimen after fracture ^a	mm
L_t	Total length	mm
L_{MF}	Total crack length of all detected cracks >0,1 mm	mm
l_1	Length of an individual crack	mm
$MSI_{(TT)}$	Microcracks sensitivity indicator (tensile test) ^b	mm/mm ²
Longitudinal bend test (LBT)		
R	Radius of the test specimen edges >1	mm
B	Width of the test specimen	mm
b_1	Width of outside fusion line	mm
l_1	Length of an individual crack	mm
l_o	Length of crack examination area before bending	mm
L_{MF}	Total crack length of all detected cracks >0,1	mm
L_s	Maximum width of the weld after machining	mm
$MSI_{(LBT)}$	Microcrack sensitivity indicator (longitudinal bend test) ^c	mm/mm ²
^a $X_1 + X_2 = L_e$ (see Figure 4). ^b $MSI = L_{MF}/(L_o \times d \times \pi)$. ^c $MSI = L_{MF}/(b \times l_o)$.		

5 Principle

Three test methods are described which are designed to measure the sensitivity of weld metals to the types of hot cracking described in [Clause 3](#). These test methods are described in [Table 2](#).

In all cases, the cracks are generated during the welding of the test pieces. The tensile test and longitudinal bend test are subjected to additional straining which does not generate any new cracks, but widens the cracks formed during the welding which enables them to be more easily detected and measured.

Table 2 — Self-restraint hot cracking tests and applications

Type of test	Types of cracking	Results	Applications
T-joint weld cracking test	Solidification	Qualitative	Qualification of welding consumables Qualification test for welding consumables
Weld metal tensile tests	Solidification	Qualitative or quantitative if microcrack sensitivity index, $MSI_{(TT)}$, is used	Welding procedure qualification
	Liquation		Production weld coupon test
	Ductility dip		Qualification of consumables Qualification test for welding consumables
Longitudinal bend test	Solidification	Qualitative or quantitative if $MSI_{(LBT)}$ is used	Welding procedure qualification
	Liquation		Production weld coupon test
	Ductility dip		Qualification of welding consumables Qualification test for welding consumables

6 Description of the tests

6.1 T-joint weld cracking tests

6.1.1 General

The test procedure applies to a single pass restrained fillet weld. It can be used with the manual shielded metal arc, gas metal arc, and tungsten arc welding processes. It is not suitable for high current processes such as submerged arc.

The test method only provides a qualitative assessment (cracks or no cracks) and has a comparatively low sensitivity.

6.1.2 Dimension of the test pieces

Three types of test (A, B, and C) are specified. Type A is the standard test piece. Types B and C are more highly restrained and are used to simulate more severe conditions.

The dimensions of the test pieces shall be as shown in [Figure 1](#).

The test pieces shall be made from the parent material for which the consumable is designed (consumable approval test) or that which is to be used in a fabrication (procedure qualification test).

Type B requires the use of a 40 mm thick horizontal plate. If this is not available, then Type C which uses 10 mm thick stiffeners welded on the horizontal plate may be used. The thickness of the horizontal and vertical plate and/or the stiffeners can be modified.