



SLOVENSKI STANDARD

SIST EN 14730-1:2017

01-maj-2017

Nadomešča:

SIST EN 14730-1:2007+A1:2010

**Železniške naprave - Zgornji ustroj proge - Aluminotermično varjenje tirnic - 1. del:
Odobritev varilnega postopka**

Railway applications - Track - Aluminothermic welding of rails - Part 1: Approval of welding processes

Bahnanwendungen - Oberbau - Aluminothermisches Schweißen von Schienen - Teil 1:
Zulassung der Schweißverfahren

Applications ferroviaires - Voie - Soudage des rails par aluminothermie - Partie 1:
Approbation des procédés de soudage

Ta slovenski standard je istoveten z: EN 14730-1:2017

ICS:

| | | |
|-----------|------------------------------|------------------------------|
| 25.160.10 | Varilni postopki in varjenje | Welding processes |
| 45.080 | Tračnice in železniški deli | Rails and railway components |

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EUROPEAN STANDARD

EN 14730-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2017

ICS 25.160.10; 93.100

Supersedes EN 14730-1:2006+A1:2010

English Version

Railway applications - Track - Aluminothermic welding of rails - Part 1: Approval of welding processes

Applications ferroviaires - Voie - Soudage des rails par aluminothermie - Partie 1: Approbation des procédés de soudage

Bahnanwendungen - Oberbau - Aluminothermisches Schweißen von Schienen - Teil 1: Zulassung der Schweißverfahren

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European foreword

This document (EN 14730-1:2017) has been prepared by Technical Committee CEN/TC 256 "Railway applications", 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of an identical text or by endorsement, at the latest by September 2017, and conflicting national standards shall be withdrawn at the latest by September 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14730-1:2006+A1:2010.

The European Standard EN 14730 "Railway applications – Track – Aluminothermic welding of rails" is composed of two parts:

- *Part 1: Approval of welding processes*
- *Part 2: Qualification of aluminothermic welders, approval of contractors and acceptance of welds*

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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EN 14730-1:2017 (E)**Introduction**

This standard defines the approval procedure for aluminothermic welding processes for rail welding through laboratory tests of welds produced in a workshop. This laboratory approval will provide the railway authority with sufficient information for tests in the track if required.

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1 Scope

This European Standard defines the laboratory tests and requirements for approval of an aluminothermic welding process using welds produced in workshop conditions.

It applies to the joining of new Vignole rails as described in EN 13674-1 of the same profile and steel grade.

Compliance with the requirements of this standard does not of itself ensure the suitability of a welding process for specific conditions of track and traffic.

The standard does not cover welds made between different rail sections, differently worn rails and different rail grades.

In addition to the definitive requirements this standard also requires the items detailed in Clause 4 to be documented. For compliance with this standard, it is important that both the definitive requirements and the documented items be satisfied.

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.

EN 13674-1, *Railway applications - Track - Rail - Part 1: Vignole railway rails 46 kg/m and above*

EN ISO 6506-1, *Metallic materials - Brinell hardness test - Part 1: Test method (ISO 6506-1:2014)*

EN ISO 6507-1, *Metallic materials - Vickers hardness test - Part 1: Test method (ISO 6507-1:2005)*

EN ISO 9712, *Non-destructive testing - Qualification and certification of NDT personnel (ISO 9712:2012)*

3 Terms and definitions

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

3.1

fusion zone

area of the weld which has been in a liquid state and which is revealed by etching sections cut through the weld

3.2

visible heat-affected zone

areas on either side of the fusion zone within which rail steel microstructure has been visibly modified by the heat of the welding process as revealed by Fry macro-etching

3.3

heat softened zone

part of the Heat Affected Zone (HAZ) characterised by a lower hardness

3.4

weld collar

external profile of the as-cast weld metal that remains after removal of the moulds

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3.5 flashing
flat fin of weld metal located on the rail surface adjacent to the weld collar caused by gaps between the mould and the rail

3.6 surface defect
any defect visible on the weld surface after normal finishing operations

3.7 internal defect
any defect that is revealed by sectioning or on a fracture face following bend or fatigue testing that has not already been identified as a surface defect

3.8 stress range
stress range for the fatigue test is the maximum stress minus minimum stress

3.9 railway authority
either the railway regulator or the owner of a railway infrastructure or the custodian with a delegated responsibility for a railway infrastructure

3.10 process supplier
company which provides an aluminothermic welding process in accordance with this standard and which is approved by the railway authority to supply consumables and tools for the execution of aluminothermic welds

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4 Information to be supplied by the railway authority

The following information shall be fully documented by the railway authority. For compliance with the standard both the definitive requirements specified throughout the standard and the following documented items shall be satisfied.

- a) Pre-heating shall comply with any limitations of the railway authority.
- b) Which of the width levels of heat-softened zone is required (7.4.4).
- c) The fatigue test, if required by the railway authority, either past the post or staircase method, shall be carried out in accordance to Annex J and to the requirements as specified in 7.5.

5 Approval procedure**5.1 General**

An outline of the steps required for compliance to this standard is given in informative Annex A.

5.2 Process identification

The approval shall involve a single process identified by:

- a) The process name.
- b) A drawing of the pouring system.

- c) The characteristic geometry of the weld collar and riser configuration as given in 5.4.2 and Figure 1.
- d) The process manual in accordance with 5.4.1.

5.3 General requirements

The following requirements shall be met.

- The process shall be capable of being carried out on track where the maximum cant can be 180 mm. It shall be capable of being carried out in track, at or near trackside or in a workshop.
- The aluminothermic welding portion shall be packed to avoid the risk of moisture contamination in prescribed storage conditions. The portion shall be identified by markings on the package.
- The mould shall be pre-fabricated for the rail profiles to be welded and be identified by markings on the package.
- The crucible shall be tapped automatically (automatic tapping) and shall have a device to limit spattering.

5.4 Documents to be submitted with the request for approval

When applying for approval, the following documents shall be submitted:

5.4.1 The process manual

The supplier shall produce a manual identifying all the consumable materials and equipment used, as well as the operating method to be followed for all steps of welding. The approval procedure for laboratory tests shall not include means of alignment or finishing operations. The manual shall specify the critical parameters of the welding process and their safe bounds, and shall include the following:

- a) number of people required to carry out the operations;
- b) diagram of equipment;
- c) portion for each rail grade and profile;
- d) rail end preparation requirements;
- e) nominal gap shall have a tolerance of:
 - ± 2 mm for a gap ≤ 30 mm
 - ± 3 mm for gaps > 30 mm and \leq to 50 mm
 - ± 5 mm for gaps > 50 mm
- f) preheating details;
- g) range of ignition to tap times for the portion;
- h) critical process timings;
- i) time (or temperature) before trains can pass;
- j) safety information.

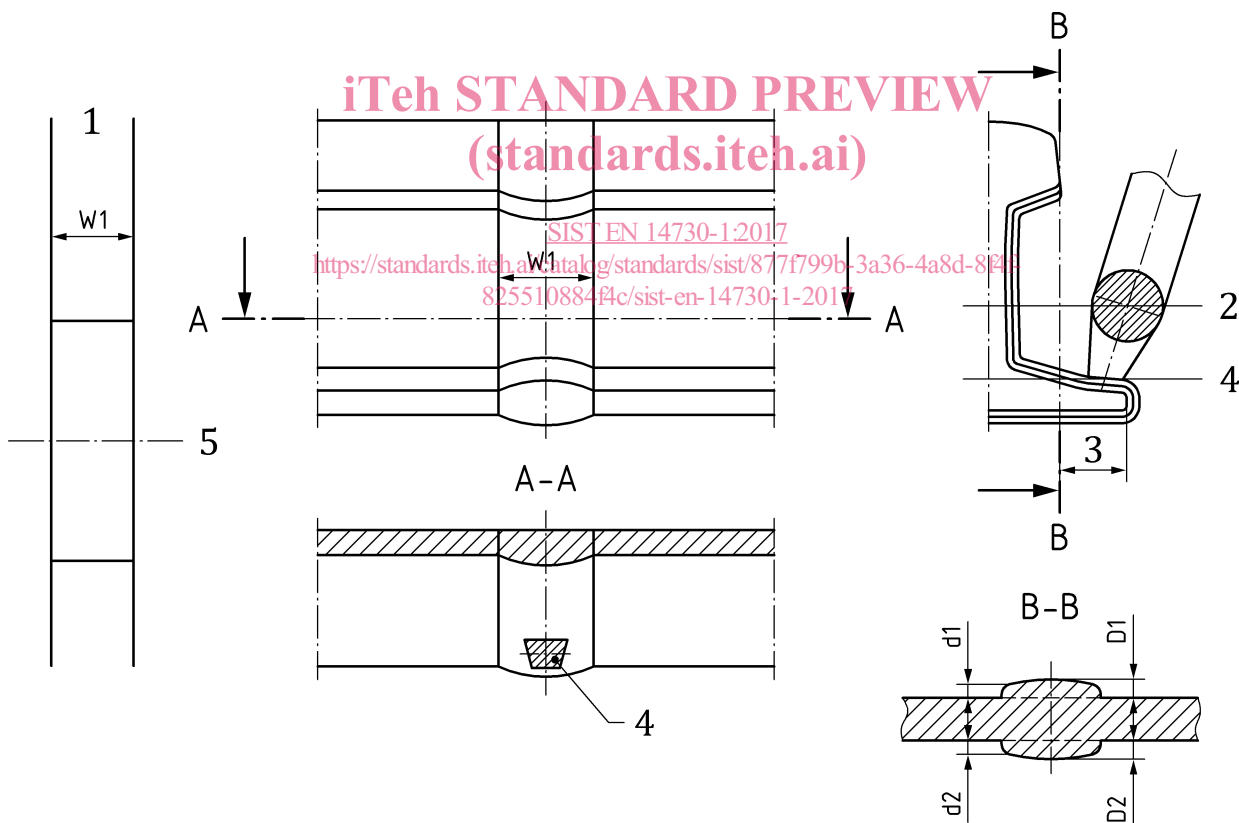
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5.4.2 Drawing with the required measurements

A drawing, as illustrated in Figure 1, which provides the measurements listed below:

- weld collar width ($W1$). The development of the weld collar shall be fully dimensioned around the weld;
- maximum depth of collar at section B-B ($D1$ and $D2$);
- minimum depth of collar at section B-B ($d1$ and $d2$);
- riser cross section at foot;
- riser cross section at neutral axis;
- number of risers;
- position of risers.

The dimensions $W1$, $D1$ and $d1$ and cross sectional areas of the risers shall be the nominal dimensions taken from the drawing of the pattern used to produce the moulds.



Key

- Figure showing the width of the weld collar ($W1$) around the weld
- Riser cross section on the neutral axis mm²
- 25 % of the foot width
- Riser cross section at the foot mm²
- Longitudinal axis under the rail foot

Figure 1 — Dimensions taken from mould pattern

5.4.3 Chemical analysis ranges and tolerances

The chemical analysis ranges and tolerances shall be in accordance with 7.6.

5.5 Initial compliance testing

- a) For the purposes of approval the standard rail profiles (see EN 13674-1) shall be grouped as follows:

Table 1 — Rail profile groups

| Group | Rail profiles |
|-------|--|
| 1 | 60E1, 60E2 |
| 2 | 54E1, 54E2, 54E3, 54E4, 54E5, 55E1, 56E1 |
| 3 | 46E1, 46E2, 46E3, 46E4, 49E1, 49E2, 49E3, 49E5, 50E1, 50E2, 50E3, 50E4, 50E5, 50E6, 52E1 |

- b) Initial compliance with the present standard shall be achieved by undertaking the tests specified in category 1 of Table 2 using grade R260 rail of one profile in group 1 of Table 1. Compliance with all the criteria specified and with the railway authority's documented requirements specified in Clause 4 shall be demonstrated. A test sequence is outlined in informative Annex B. A test specimen can be used for several different tests.

Table 2 — Testing scheme

| Test | Section reference | Number of tests | | |
|-----------------------------------|---------------------|-------------------------|-------------------------|--|
| | | Category 1 ^a | Category 2 ^b | Category 3 ^c |
| | | R260 only | R260 only | R200/R220/R260Mn/R350HT/ R320Cr/R350LHT/R370CrHT/R400HT |
| A Hardness Test | 7.2 | 6 | Nil | 6 |
| B Surface Examination – Visual | 7.1.1 7.1.2 | All | All | All |
| C Visible Heat Affected Zone | 7.1.3 | 2 | 2 | 2 |
| D Slow Bend Test | 7.3 | 6 | 2 | 4 |
| E Ultrasonic Inspection – Annex G | 7.4.1 | 5 | 2 | Nil |
| F Fatigue Test (Optional) | 7.5 | n* | Nil | Nil |
| G Fusion Zone – Weld Soundness | 7.3 7.4.1 7.5 | (6) 5 (n*) | (2) 2 Nil | (4) Nil Nil |