



**SLOVENSKI STANDARD**  
**SIST EN 16771:2017**  
**01-januar-2017**

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**Železniške naprave - Infrastruktura - Aluminotermično varjenje tirnice z žlebom**

Railway applications - Infrastructure - Aluminothermic welding of grooved rails

Bahnanwendungen - Infrastruktur - Aluminiothermisches Schweißen von Rillenschienen

Applications ferroviaires - Infrastructures - Soudage par aluminothermie des rails à gorge

**Ta slovenski standard je istoveten z: EN 16771:2016**

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## Railway applications - Infrastructure - Aluminothermic welding of grooved rails

Applications ferroviaires - Infrastructures - Soudage  
par aluminothermie des rails à gorge

Bahnanwendungen - Infrastruktur -  
Aluminothermisches Schweißen von Rillenschienen

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

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EN 16771:2016 (E)

## European foreword

This document (EN 16771:2016) 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of an identical text or by endorsement, at the latest by May 2017, and conflicting national standards shall be withdrawn at the latest by May 2017.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.

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## Introduction

This standard defines the approval procedure for aluminothermic welding processes for grooved 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 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, grooved rails as described in EN 14811 of the same profile and steel grade. Welding of construction profiles and machined profiles are not covered in this standard.

Compliance with the requirements of this standard does not in 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, worn rails or 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 14811, *Railway applications – Track – Special purpose rail – Grooved and associated construction*

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

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

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

## 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**

##### **HAZ**

areas on either side of the fusion zone within the 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 HAZ (Heat Affected Zone) characterised by a lower hardness

### 3.4

#### **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



### 3.5

#### **surface defect**

any defect visible on the weld surface after normal finishing operations

### 3.6

#### **internal defect**

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

### 3.7

#### **railway authority**

railway regulator, or owner of a railway infrastructure, or custodian with a delegated responsibility for a railway infrastructure

### 3.8

#### **process supplier**

company which provides an approved aluminothermic welding process in accordance with this standard

## **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) which of the width levels of heat-softened zone is required (7.4.4);
- b) limitations on the pre-heat to comply with the railway authority regulations.

## **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 and the casting 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:

- a) the process shall be capable of being carried out on track and at or near trackside or in a workshop;

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- b) 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;
- c) the mould shall be pre-fabricated for the rail profiles to be welded and be identified by markings on the package;
- d) the crucible shall be tapped automatically (automatic tapping) and shall have a device to limit spattering;
- e) pre-heating shall comply with any limitations of the railway authority as specified in Clause 4, b).

**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 will 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  $\pm 2$  mm for a  $\leq 30$  mm gap and  $\pm 3$  mm for  $> 30$  mm to 50 mm gaps and  $\pm 5$  mm for  $> 50$  mm gaps;
- f) preheating details;
- g) range of ignition to tap times for the portions;
- h) critical process timings;
- i) time (or temperature) before trains can pass;
- j) safety information.

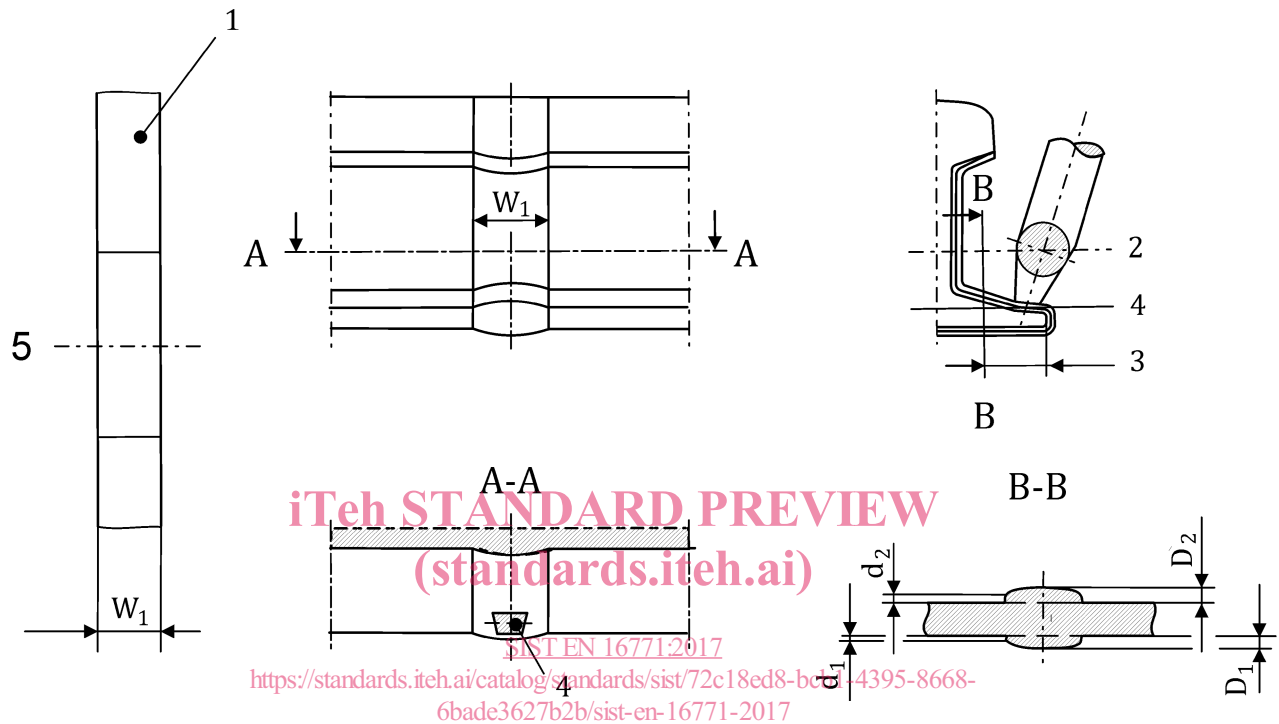
**5.4.2 Drawing with the required measurements.**

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

- a) weld collar width ( $W1$ ). The development of the weld collar shall be fully dimensioned around the weld;
- b) maximum depth of collar at section B-B ( $D1$  and  $D2$ );
- c) minimum depth of collar at section B-B ( $d1$  and  $d2$ );
- d) riser cross section at foot;

- e) riser cross section at neutral axis;
- f) number of risers;
- g) position of risers.

The dimensions  $W$ ,  $D$  and  $d$  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

- 1 figure showing the width of the weld collar around the weld
- 2 riser cross section on the neutral axis mm<sup>2</sup>
- 3 25 % of the foot width
- 4 riser cross section at the foot mm<sup>2</sup>
- 5 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 7.5.1.

#### 5.5 Initial compliance testing

- a) For the purposes of approval the standard, rail profiles (see EN 14811) shall be grouped as follows.

**Table 1 — Rail profile groups 1**

New names	Former names
57R1	Ph 37
59R1	Ri 59-R10, Ri 59
59R2	Ri 59-R13, Ri 59N
60R1	Ri 60-R10, Ri 60
60R2	Ri 60-R13, Ri 60 N
60R3	Ri 210/95+80
62R1	NP4aM
62R2	NP4aS
63R1	Ri 210/95+80a
67R1	Ph 37a
68G1	70 G

**Table 2 — Rail profile groups 2**

New names	Former names
46G1	60 G
51R1	Ri 52-R13, Ri 52
52R1	Ri 1r
53R1	Ri 53-R13, Ri 53
55G1	35 GP
55G2	41 GP
56R1	Ri 1c

- b) Initial compliance with the present standard shall be achieved by undertaking the tests specified in category 1 of Table 3 using not heat treated rail, by using either R200 or R220G1 or R260 grade. Results are valid for the three grades of all rail profiles in either group 1 or group 2. 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.