

SLOVENSKI STANDARD

SIST EN 14587-1:2007

01-september-2007

**Železniške naprave - Zgornji ustroj - Elektro uporabno varjenje tirnic - 1. del:
Varjenje novih tirnic kakovosti R 220, R 260, R 260 Mn in R 350 HT v varilnici**

Railway applications - Track - Flash butt welding of rails - Part 1: New R220, R260, R260Mn and R350HT grade rails in a fixed plant

Bahnanwendungen - Oberbau - Abbrennstumpfschweißen von Schienen -Teil 1:
Abbrennstumpfschweißen neuer Schienen der Güte R220, R260, R260Mn und R350HT
in einem Schweißwerk

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Applications ferroviaires - Voie - Soudage des rails par étincelage - Partie 1: Rails neufs
de nuances R220, R260, R260Mn et R350HT dans une installation fixe

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ICS:

25.160.10	Varilni postopki in varjenje	Welding processes
93.100	Gradnja železnic	Construction of railways

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 14587-1

June 2007

ICS 25.160.10; 93.100

English Version

**Railway applications - Track - Flash butt welding of rails - Part 1:
New R220, R260, R260Mn and R350HT grade rails in a fixed
plant**

Applications ferroviaires - Voie - Soudage des rails par
étincelage - Partie 1: Rails neufs de nuances R220, R260,
R260Mn et R350HT dans une installation fixe

Bahnanwendungen - Oberbau - Abbrennstumpfschweißen
von Schienen - Teil 1: Abbrennstumpfschweißen neuer
Schienen der Güte R220, R260, R260Mn und R350HT in
einem Schweißwerk

This European Standard was approved by CEN on 3 May 2007.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 14587-1:2007) 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of an identical text or by endorsement, at the latest by December 2007, and conflicting national standards shall be withdrawn at the latest by December 2007.

This document is one of a series of three parts of the EN 14587 *Railway applications – Track – Flash butt welding of rails*. The list of parts is as follows:

- Part 1: New R220, R260, R260Mn and R350HT grade rails in a fixed plant
- Part 2: New R220, R260, R260Mn and R350HT grade rails by mobile welding machines at sites other than a fixed plant
- Part 3: Welding in association with crossing construction

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Introduction

This part of EN 14587 has five main topics:

- a) requirements of a welding process;
- b) procedure approval for a fixed plant;
- c) approval of other rail profiles or grade;
- d) approval of the welding contractor;
- e) weld production following approval.

This part of EN 14587 has been occasioned by a European Directive that will permit the freedom of an open European market. To enable this perception to become a reality, it is essential a standard is in place that satisfies the needs of the infrastructure owners or custodians and reflects the production capabilities of the manufacturers in technical and quality terms.

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EN 14587-1:2007 (E)

1 Scope

This European Standard specifies requirements for the approval of a welding process in a fixed plant, together with the requirements for subsequent welding production.

It applies to new Vignole railway rails R220, R260, R260Mn and R350HT grade rails of 46 kg/m and above, as contained in EN 13674-1, welded by flash butt welding in a fixed plant and intended for use on railway infrastructure.

This European Standard applies to the welding of rails into welded strings.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 571-1, *Non destructive testing — Penetrant testing — Part 1: General principles*

EN 1290, *Non-destructive examination of welds — Magnetic particle examination of welds*

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

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

EN ISO 7500-1:2004, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system (ISO 7500-1:2004)*

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3 Terms and definitions

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

3.1

as welded condition

rails that have been welded and trimmed only

3.2

contractor

company approved by a railway authority to provide staff and machinery to execute the production of FB weld in a fixed plant

NOTE This may include staff and machinery from within the railway authority

3.3

die burn

damage caused by localised overheating on the surface of the rail caused by poor contact between the rail and the electrode during welding

3.4

dressing

removing trimmed upset by grinding or other similar process

3.5

finished condition

welded, trimmed, dressed and profile finished

3.6**fixed plant**

stationary production line for flash butt welding of rails

3.7**flat spot**

process driven discontinuity showing as a small lens like shape in vertical longitudinal section, or a generally circular/elliptical shape having a localised smooth texture when viewed in a vertical transverse section

3.8**lack of bond**

area of incomplete fusion between the rails in the joint. This may appear as crack like or line discontinuity at the interface either on the surface after removal of the upset or in a weld section

3.9**profile finishing**

operation by which the rail head or relevant part of the rail head at the weld is returned to rail profile

NOTE The operation can be by grinding, milling, planing or any other suitable means.

3.10**purchaser**

purchaser of the welds

3.11**railway authority**

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

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3.12**trimmed upset**

metal remaining around the rail profile following trimming

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3.13**trimming**

removal of upset

3.14**upset**

metal extruded around the rail profile as a result of forging

3.15**welded string**

long rail comprising a number of shorter rails flashbutt welded together

3.16**welding process**

part of the sequence from the selection of the rail prior to welding through to the finishing of the welded string

4 Quality management system

The contractor shall operate an independently approved and audited quality management system. A quality management system conforming to EN ISO 9001 will be deemed to satisfy the requirements. Additionally, a product quality plan shall be validated by the purchaser.

5 Requirements for the welding process

5.1 General

All welding shall be carried out on a flash butt welding machine (FBWM) using an automatic, programmed welding sequence.

5.2 Clamping force

Rails shall be secured in the FBWM by clamps of such a surface shape or contour, that when a clamping force is exerted on the rails, it shall not damage the rail in such a way that subsequent cracking in the rail in operation is generated, see 6.4.1.

5.3 Pre-heating

The fronts of the heating area shall progress uniformly perpendicularly to the running surface during the whole cycle.

There shall be no evidence of local melting on the ends of the rails during pre-heating.

5.4 Flashing

Once initiated, flashing shall be continuous.

5.5 Upsetting

Upsetting shall immediately follow flashing. Sufficient forging pressure shall be applied to ensure that voids are closed and oxides are expelled such that they are kept to a minimum at the weld interface. The weld interface shall extend into the upset.

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5.6 Upset current

The upset welding current shall be maintained until the rapid forge has finished and the progressive forging commences.

5.7 Unclamping

In order to maintain the alignment, the time between completion of forging and unclamping shall be a minimum of 4 s.

5.8 Welding parameters

5.8.1 The welding machine and/or management system equipment shall be capable of displaying the following;

- a) programme identification and setting details;
- b) welding current;
- c) upset force or pressure;
- d) displacement;
- e) welding time.

5.8.2 The welding parameters shall be determined during procedural trials. Once approval has been granted, the welding parameters shall not be changed, with the exception of changes concerning the environments in 5.8.4.

5.8.3 The welding parameters shall be monitored and recorded. These records shall be referenced to the appropriate welds.

5.8.4 The welding parameters shall permit the production of welds without any alteration to the program, at rail temperatures of $-10\text{ }^{\circ}\text{C}$ and above. Alterations of preheating parameters due to various rail temperatures are not considered as alterations to the welding program. A bending test according to 6.4.5 shall be carried out in this case.

NOTE Owing to extreme variations in seasonal temperatures, the manufacturer may request the use of alternative welding programs.

5.9 Steps across the weld

5.9.1 Any step between the rails across the weld in the trimmed but not dressed condition shall not exceed those dimensions shown in Table 1.

5.9.2 Checks shall be made at a position 20 mm on each side of the weld upset centreline using a 1 m nibbed straight edge and feeler shims as shown in Figure 1.

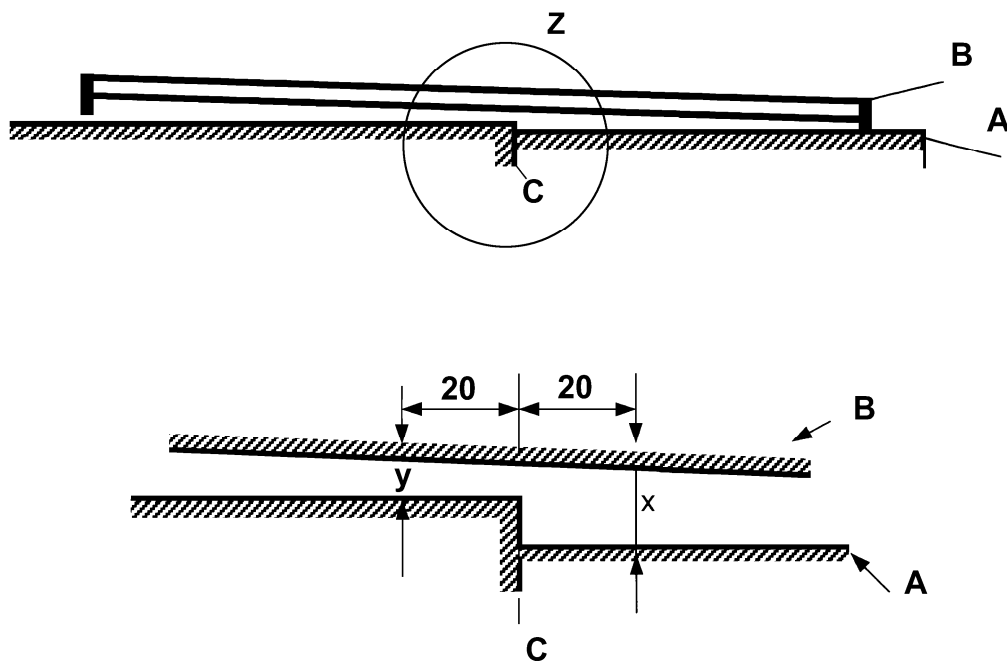
Table 1 — Maximum permitted steps

Position of step on the rail	Maximum permitted step (in mm)
Vertically on the longitudinal centreline of the running surface	0,5
Horizontally on the aligned face or edge 14 mm below the running surface	0,5
Horizontally on the edge of the rail foot	2,0

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NOTE Where the step arises from the rail dimensions the rail foot tips may be dressed locally to achieve this requirement.

Dimensions in millimetres



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Detail Z

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Key

- A running surface
- B nibbed straight edge
- C weld upset centre line

NOTE Step = $|x-y|$ mm.

Figure 1 — Measurement of the step

5.10 Removal of excess upset

5.10.1 Excess upset shall be automatically trimmed.

5.10.2 Removal of the excess upset shall not cause any mechanical or thermal damage to the rails.

5.10.3 The surface of the trimmed area shall be free from visible cracking.

5.10.4 The weld shall be in compression during the removal of excess upset.

5.10.5 Any dressing of the weld following the removal of upset shall not cause damage to the rail or weld nor reduce either to a dimension below the original rail profile.

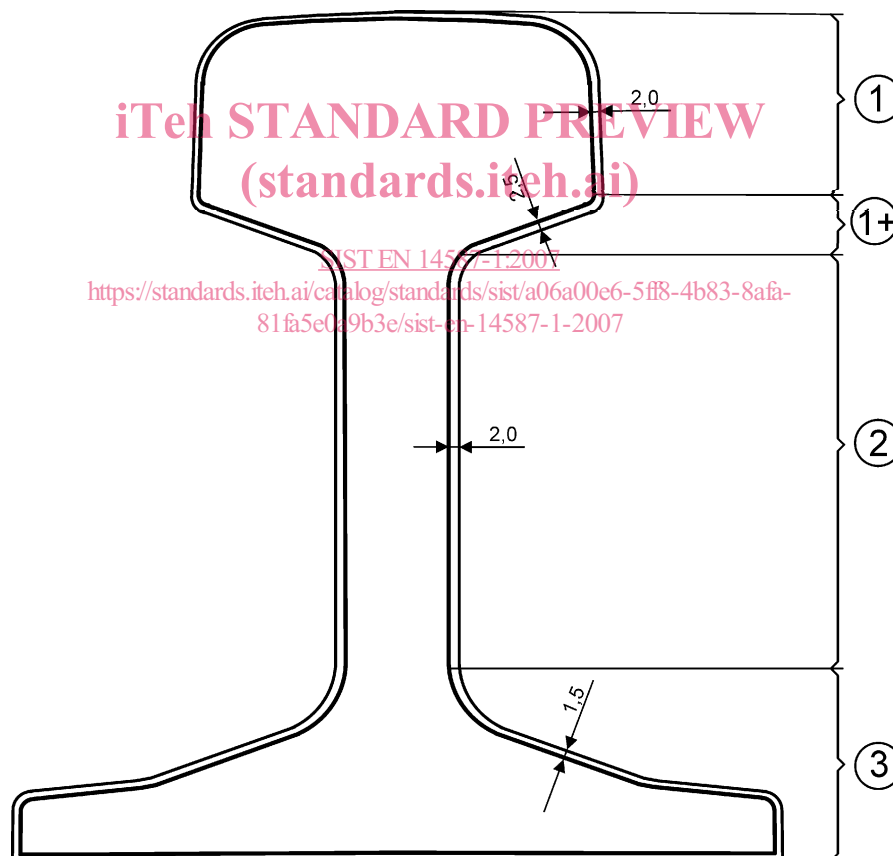
5.10.6 The maximum thickness of the trimmed upset shall be as set out in Table 2 below and shown in Figure 2.

Table 2 — Maximum permitted trimmed upset

Zone	Position of trimmed upset about the weld	Maximum permitted upset (in mm)
①	Full head profile from the lower corner on the gauge face to the lower corner on the opposite face	2
①+	The fishing surface on the underside of the head	2,5
②	The web, including the top fillet radius and extending down to the start of the bottom fillet radius	2
③	The foot, including the start of the bottom fillet radii in the web and extending to the foot tips and completely across the underside of the rail foot	1,5

Where there is a difference in the rail dimensions, the trimmed upset shall be measured in relation to the rail giving the maximum protruding surface. If the values of the trimmed upset are above the maximum values, the trimmed upset shall be dressed locally to the required values without damaging the parent rails.

Dimensions in millimetres



Key

- ① Zone ① – rail head
- ①+ Zone ①+ – on the underside of the rail head
- ② Zone ② – web of the rail
- ③ Zone ③ – foot of the rail

Figure 2 — Maximum permitted trimmed upset