



SLOVENSKI STANDARD

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SIST EN 13231-3:2006

Železniške naprave - Zgornji ustroj - Prevzem del - 3. del: Prevzemni kriteriji za reprofiliranje vgrajenih tirnic

Railway applications - Track - Acceptance of works - Part 3: Acceptance of reprofiling rails in track

Bahnanwendungen - Oberbau - Abnahme von Arbeiten - Teil 3: Abnahme von reprofilierten Schienen im Gleis

Applications ferroviaires - Voies - Réception des travaux - Partie 3 : Critères de réception des rails reprofilés en voie

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93.100	Gradnja železnic	Construction of railways

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EUROPEAN STANDARD

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Railway applications - Track - Acceptance of works - Part 3: Acceptance of reprofiling rails in track

Applications ferroviaires - Voie - Réception des travaux -
Partie 3: Critères de réception des travaux de reprofilage
des rails en voie

Bahnanwendungen - Oberbau - Abnahme von Arbeiten -
Teil 3: Abnahme von reprofilierten Schienen im Gleis

This European Standard was approved by CEN on 20 August 2011.

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EN 13231-3:2012 (E)**Foreword**

This document (EN 13231-3:2012) 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of an identical text or by endorsement, at the latest by July 2012, and conflicting national standards shall be withdrawn at the latest by July 2012.

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

This document supersedes EN 13231-3:2006.

The changes with respect to the previous document (EN 13231-3:2006) include:

- a) a reduced number of acceptance criteria for the longitudinal profile (only one instead of three) in line with current European practice;
- b) reference points for interpretation of transverse profiles corresponding with the gauge recording points;
- c) simplified methods to prove measurement systems (for reference and approved instruments as described in Annexes A and B);
- d) introduction of a procedure to routinely demonstrate acceptability of approached instruments in Annex D;
- e) integration of normative Annexes A, B, C and D.

This European Standard is one of the series EN 13231 "Railway applications — Track — Acceptance of works" as listed below:

- *Part 1: Works on ballasted track — Plain line, switches and crossings*
- *Part 3: Acceptance of reprofiling rails in track*
- *Part 4: Acceptance of reprofiling rails in switches and crossings*

NOTE Part 2 does not exist in this series.

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, Croatia, 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, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the technical requirements and the measurements to be made for the acceptance of work to reprofile longitudinally and/or transversely the heads of railway rails. For acceptance purposes, two classes of longitudinal profile and three classes of transverse profile tolerance are defined.

Annexes describe procedures to verify reference instruments to be used for these measurements as well as methods to approve non-reference instruments to be used for measurements.

This European Standard applies to reprofiled vignole railway rails 46 kg/m and above.

It does not apply for acoustic rail reprofiling.

A form of acceptance documentation that may be used is given in Annex E.

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 ISO 3274, *Geometrical product specifications (GPS) — Surface texture: Profile method — Nominal characteristics of contact (stylus) instruments (ISO 3274:1996)*

EN ISO 3611, *Geometrical product specifications (GPS) — Dimensional measuring equipment: Micrometers for external measurements — Design and metrological characteristics (ISO 3611:2010)*

EN ISO 4287, *Geometrical product specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters (ISO 4287:1997)*

EN ISO 4288, *Geometrical product specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture (ISO 4288:1996)*

EN ISO 10360-2, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 2: CMMs used for measuring linear dimensions (ISO 10360-2:2009)*

3 Terms and definitions

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

3.1

angle of inclination of rail

nominal angle at which rail is laid (see Figure 1 b)), e.g. 0° (vertical rails), 2,86° (1:20 inclination), 1,91° (1:30 inclination), 1,43° (1:40 inclination), etc., inclined towards the centre of the track

NOTE For rail which is laid in non-canted track, the angle of inclination of the rail is equal to the angle between the vertical and the centre-line of the inclined rail.

3.2

approved instrument

instrument for measurement of longitudinal or transverse profile the usage of which is justified by correlation of its performance with that of a reference instrument in accordance with the defined procedure

NOTE For procedure to demonstrate correlation, see Annex B.

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- 3.3
characteristic length**
length on the rail travelled during one rotation of a grinding stone or milling wheel
- 3.4
class 1, class 2**
classes of longitudinal profile differentiated by the proportion of a reprofiling site reaching a specified standard
- NOTE For longitudinal profile, see 4.3.
- 3.5
class Q, class R, class S**
classes of transverse profile differentiated by the proportion of a reprofiling site reaching a specified standard
- NOTE For transverse profile, see 5.3.
- 3.6
cut-off wavelength**
wavelength of a sinusoidal profile of which 50 % of the amplitude is transmitted by the profile filter
- NOTE Profile filters are identified by their cut-off wavelength value, see EN ISO 11562.
- 3.7
deviation of the measured profile**
deviation between the measured transverse profile and the reference rail, measured normal to the surface of the reference rail when the measured transverse profile and the reference rail are aligned at points A and B₁ or A and B₂, without rotation of either profile; the deviation is considered positive when the measured transverse profile is above the reference rail
- NOTE For deviation, see Figure 3.
- 3.8
facet**
approximately plane sector of the profile of a reprofiled rail produced by the reprofiling tool
- 3.9
filtered profile**
profile which results from applying a profile filter to the primary profile
- 3.10
percentage exceedance**
percentage length of a test site over which a measurement of the amplitude of the filtered profile exceeds a prescribed limit
- 3.11
phase correct profile filter**
profile filter which does not cause phase shifts which lead to asymmetrical profile distortions
- NOTE For profile filter, see EN ISO 11562.
- 3.12
primary profile**
representation of the measured longitudinal profile before application of any profile filter
- 3.13
profile filter**
electronic device or signal processing which separates profiles into long-wave and short-wave components, or into components within a specified wavelength range

3.14**rail crown line**

that line on the rail head surface that is corresponding to the Y-Y axis of the rail profile

3.15**range of deviation**

difference between the maximum and minimum values of the deviation of the measured transverse profile

NOTE For measured profile, see Figure 3.

3.16**reference instrument**

instrument for the measurement of longitudinal or transverse profile the performance of which has been verified in accordance with the procedure defined in Annex A

3.17**reference line**

line normal to the track's longitudinal axis and tangent to the heads of both rails

3.18**reference point A**

point towards the gauge side of a reference rail at which the angle between the reference line and the tangent to the profile is equal to the specified angle of inclination

NOTE For specified angle of inclination, see Figure 1.

3.19**reference point B₁**

point on the gauge face of a reference rail which lies 14 mm below that line that is parallel to the reference line and which passes through reference point A

NOTE For reference point, see Figure 1 a).
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3.20**reference point B₂**

point on the gauge corner of a reference rail at which a line which is tangent to the rail lies at an angle of 45° to the reference line

NOTE For reference point, see Figure 1 b).

3.21**reference profile**

transverse profile to which rail is to be reprofiled, within the specified tolerances

3.22**reference rail**

rail with the reference profile, at the desired angle of inclination relative to the reference line

NOTE For reference rail, see Figure 1 a).

3.23**reprofiling**

action that is undertaken to modify the longitudinal or transverse profile of a rail

3.24**reprofiling site**

continuous length of track where the rail is to be reprofiled excluding level crossings and switches and crossing work within the length of track

EN 13231-3:2012 (E)**3.25****reprofiling zone**

area of the railhead of a reference rail between the point at which the tangent to the rail lies at an angle of 70° to the reference line, measured towards the gauge side of the rail, and the point at which the tangent to the rail lies at an angle of 5° to the reference line, measured towards the field side of the rail

NOTE For side of the rail, see Figure 2.

3.26**sampling interval**

distance between successive points on the rail at which a continuous record of the traced profile is sampled in order to produce the primary profile

3.27**test instrument**

instrument whose use as a reference instrument or an approved instrument is being tested

3.28**traced profile**

profile of the rail as recorded by the measuring system

3.29**transition length**

initial or final section of a length of track where the validity of a measurement of longitudinal or transverse profile is questionable for a variety of reasons, including settling of electronic and digital components and circuits

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4 Longitudinal profile

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4.1 Principle

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Measurements are made using either a reference instrument, see 3.16, or an approved instrument, see 3.2. Approved instruments do not offer the same accuracy as reference instruments but are generally adequate for the purpose of demonstrating compliance with the requirements of this European Standard.

NOTE An example of an approved instrument is the type of system used for routine corrugation measurement. Some of the systems used on reprofiling trains fall into this category.

In accordance with current practice, limits are set on the magnitude of the irregularities that can remain in track after a reprofiling operation. It is recognised, however, that it can be uneconomic to achieve 100 % compliance with these, particularly where isolated rail running surface defects, such as wheel burn, exist prior to reprofiling. Two classes are therefore offered, differentiated by the percentage of the reprofiled track meeting the specified criteria. Where isolated top faults exist, class 2 offers a lower cost option compared to class 1 as it will be achieved with fewer passes. However, a larger number of isolated non-compliant zones will remain in the reprofiled site.

Class 1 also includes limits for very short (10 mm to 30 mm) and very long (300 mm to 1 000 mm) wavelength residual irregularities; these are not included in class 2. Where it is required that corrugations in these shall be removed it will also be necessary to specify class 1.

For the necessary annual metrological check, see Annex D.

4.2 Measurements required

The longitudinal profile of the finished reprofiled rail shall be recorded continuously using either a reference instrument or an approved instrument. Where independent verification is required a reference instrument shall be used. All measurements undertaken in order to demonstrate compliance with 4.3 shall be recorded.

Longitudinal profile measurements shall be made within a distance of 15 mm laterally on the rail from the rail crown, to produce the traced profile.

NOTE It is recommended that a digital form of the traced profile, the primary profile, be used for subsequent analysis.

Measurements should be undertaken immediately after work. Measurements shall be undertaken at the latest within 8 days of reprofiling or before the track has carried 0,3 MGT (Million Gross Tonnes) of traffic, whichever occurs sooner.

4.3 Acceptance criteria for longitudinal profile

4.3.1 General

The acceptance of reprofiled sites shall be on the basis of percentage of irregularities shown in Table 1.

4.3.2 Peak-to-peak value

The percentage of any site in which the amplitude of the filtered profile exceeds the value specified in Table 1 shall be calculated.

The primary or traced profile shall be processed to provide a filtered profile within each of the wavelength ranges given in Table 2.

Table 1 — Acceptance criteria for longitudinal profile expressed in terms of allowable percentages of exceeding

Wavelength range (mm)	10 to 30	30 to 100	100 to 300	300 to 1 000
Class 1	5 %	5 %	5 %	5 %
Class 2	No requirement	10 %	10 %	No requirement

Table 2 — Acceptance criteria for peak to peak limits

Wavelength range (mm)	10 to 30	30 to 100	100 to 300	300 to 1 000
Limit of peak-to-peak values (mm)	± 0,010	± 0,010	± 0,015	± 0,075

The classification concerns the total length of each reprofiling section, where level crossings and switches and crossing work within the length of track are to be excluded.

5 Transverse profile

5.1 Principle

Measurements are made using either a reference instrument, see 3.16, or an approved instrument, see 3.2. Approved instruments do not offer the same accuracy as reference instruments but are generally adequate for the purpose of demonstrating compliance with the requirements of this European Standard.

Reprofiling can be undertaken for a variety of reasons. Where reprofiling is undertaken purely for the removal of corrugation, there may be less need for the rail to be reprofiled with precision. In other cases, it may be necessary for the reprofiled rail to match closely the ideal profile, represented by the reference rail, see 3.22. A range of classes is therefore included to enable the client to specify the level of precision that is appropriate for the site to be reprofiled.

NOTE Where reprofiling is undertaken to improve conicity, class Q, see 5.3, is likely to be appropriate.

The match between the reprofiled rail and the profile of the reference rail is determined by aligning the two at two points and measuring maximum difference between them, see Figure 3. For straight track, these points of alignment generally approximate to the rail crown and the gauge point. On the high rail of curves, this method is not applicable if side wear has occurred and an alternative method of alignment is therefore used.

For the necessary annual metrological check, see Annex D.

5.2 Measurements required

The rail's transverse profile shall be measured using either a reference instrument or an approved instrument. Where independent verification is required a reference instrument shall be used. All measurements undertaken in order to demonstrate compliance with 5.3 shall be recorded.

Measurements should be undertaken immediately after work. Measurements shall be undertaken at the latest within 8 days of reprofiling or before the track has carried 0,3 MGT (Million Gross Tonnes) of traffic, which ever occurs sooner.

NOTE It is preferable for measurements to be made immediately after reprofiling.

The transverse profile of each finished, reprofiled rail shall be measured sufficiently frequently to ensure compliance with the requirements stated in 5.3. The transverse profile shall be recorded at least once per reprofiling site or at an interval of not more than 500 m on a reprofiling site greater than 500 m long.

Where independent verification is required, measurements of each rail shall be made at an interval of not less than 10 m throughout the reprofiling site.

5.3 Acceptance criteria for the transverse profile

Each measured profile shall be aligned with the appropriate reference rail so that the reference points A and B₁, or A and B₂, on the reference rail coincide with points on the measured profile. The alignment shall be undertaken without rotation of either profile.

Reference points A and B₂ shall be used on side-worn rails and A and B₁ elsewhere.

The transverse reprofiling shall be specified as one of three classes as shown in Table 3. For each class one range of deviation and division of this range between a positive and negative tolerance shall also be specified. The percentage of measurements for which the deviation exceeds the stated range shall not exceed the value given in Table 3 for the class specified.

E.g. if reprofiling of class R and a tolerance range of 1,0 mm apportioned as + 0,4 mm/- 0,6 mm were specified, at least 85 % of measurements should deviate by less than + 0,4 mm/- 0,6 mm from the prescribed reference profile.

The maximum positive deviations shall be specified, e.g. for the range of deviation 0,6 mm: + 0,3 mm/- 0,3 mm, + 0,2 mm/- 0,4 mm.

Table 3 — Minimum proportion of measurements within the specified range

Range of deviation (mm)	0,6	1,0	1,7
Class Q	90 %	95 %	98 %
Class R	No requirement	85 %	98 %
Class S	No requirement	No requirement	75 %

On the field side of the rail outside the reprofiling zone, see 3.25, reprofiling shall be undertaken to – 0,8 mm tolerance.

6 Metal removal

6.1 Measurements required

Measurements of metal removal from the railhead are required only if there is a requirement in the contract to demonstrate a minimum or maximum depth of metal removal. All measurements undertaken in order to demonstrate compliance with 6.2 shall be recorded.

The height of the rail shall be measured using a micrometer whose accuracy is in accordance with EN ISO 3611.

The rail height or height of the rail-head shall be measured before and after reprofiling at a minimum of 5 positions on each rail at distance of no less than 0,5 m apart. Measurements shall be made within a month of reprofiling or one MGT what ever comes first. The rail shall be marked to ensure that measurements before and after reprofiling are made within a distance of 10 mm of each other along the rail. If the rail is initially corrugated, measurements shall be undertaken in the trough of the corrugation.

Measurement of the rail height or depth of the railhead shall be processed so as to provide the depth of metal removed within 15 mm transversely of the rail crown, or elsewhere on the railhead as agreed between client and contractor.

NOTE Measurements should be recorded once per week or as required by the contract.