SLOVENSKI STANDARD

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Železniške naprave – Zgornji ustroj – Prevzem del – 3. del: Prevzemni kriteriji za brušenje, profiliranje in skobljanje vgrajenih tirnic

Railway applications - Track - Acceptance of works - Part 3: Acceptance of rail grinding, milling and planing work in track

Bahnanwendungen - Oberbau - Abnahme von Arbeiten - Teil 3: Abnahme von Schleif-, Fräs- und Hobelarbeiten an Schienen im Gleis

Applications ferroviaires - Voie - Réception des travaux - Partie 3: Criteres de réception des travaux de meulage, fraisage et rabotage des rails en voie

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Railway applications - Track - Acceptance of works - Part 3: Acceptance of rail grinding, milling and planing work in track

Applications ferroviaires - Voie - Réception des travaux - Partie 3: Critères de réception des travaux de meulage, fraisage et rabotage des rails en voie

Bahnanwendungen - Oberbau - Abnahme von Arbeiten - Teil 3: Abnahme von Schleif-, Fräs- und Hobelarbeiten an Schienen im Gleis

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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Foreword

This document (EN 13231-3:2006) 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of an identical text or by endorsement, at the latest by November 2006, and conflicting national standards shall be withdrawn at the latest by November 2006.

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*

— *Part 2: Works on ballasted track - Switches and crossings*

— *Part 3: Acceptance of rail grinding, milling and planing work in track*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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.

1 Scope

This part of this European Standard lays down the technical requirements and the measurements to be made for the acceptance of work to re-profile both longitudinally and transversely the heads of railway rails, including the parts of switches and crossings that can be reprofiled.

For acceptance purposes, two classes of longitudinal profile and three classes of transverse profile tolerance are defined.

It also informs about procedures to verify reference instruments to be used for these measurements and informs about a method to approve non-reference instruments to be used for measurements.

It applies to reprofiled vignole railway rails 40 kg/m and above.

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

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 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 11562:1997, *Geometrical product specifications (GPS) – Surface texture: Profile method – Metrological characteristics of phase correct filters (ISO 11562:1996)*

ISO 3611, *Micrometer callipers for external measurement*

3 Terms and definitions

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

3.1
angle of inclination of rail
the 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) 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 agreement between the contractor and the customer (an example is given in Annex B)

3.3
characteristic length
length on the rail travelled during one rotation of a grinding stone

3.4
class 1, class 2
classes of longitudinal profile differentiated by the proportion of a grinding site reaching a specified standard (see 4.3)

3.5
class Q, class R, class S
classes of transverse profile differentiated by the proportion of a grinding site reaching a specified standard (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 profile and the reference rail, measured normal to the surface of the reference rail when the measured profile and the reference rail are aligned at points A and B_1 or A and B_2, without rotation of either profile. The deviation is considered positive when the measured profile is above the reference rail (see Figure 3)

3.8
filtered profile
profile which results from applying a profile filter to the primary profile

3.9
grinding facet
approximately plane sector of the profile of a rail reprofiled by grinding, which is produced by a single grinding stone whose axis of rotation is normal to the rail's longitudinal axis

3.10
moving average of peak-to-peak amplitudes
average depth of individual irregularities in a profile which is calculated as a quasi-continuous function of distance along the track; the depth is calculated for that section of the profile which lies within a window of specified length (see Annex D); the function with distance is calculated by incrementing the window along the profile by a distance equal to the sampling interval

3.11
moving average of root-mean-square (RMS) amplitudes
root-mean-square amplitude of a profile which is calculated as a quasi-continuous function of distance along the track; the average is calculated for that section of the profile which lies within a window of specified length (see Annex D); the function with distance is calculated by incrementing the window along the profile by a distance equal to the sampling interval

3.12
percentage exceedance
percentage length of a test site over which a measurement of the amplitude of the filtered profile exceeds a prescribed limit

3.13
phase correct profile filter
profile filter which does not cause phase shifts which lead to asymmetrical profile distortions (see EN ISO 11562:1997)

3.14
primary profile
representation of the measured longitudinal profile before application of any profile filter

3.15
profile filter
electronic device which separates profiles into long-wave and short-wave components, or into components within a specified wavelength range

3.16
rail crown
that point on the rail-head surface that is aligned with the centre-line of the web

3.17
range of deviation
difference between the maximum and minimum values of the deviation of the measured profile (see Figure 3)

3.18
reference instrument
instrument for the measurement of longitudinal or transverse profile the performance of which has been verified in accordance with the procedure agreed upon between the contractor and the customer (an example is given in Annex A)

3.19
reference line
line normal to the track's longitudinal axis and tangent to the heads of both rails

3.20
reference point A
that 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 (see Figure 1)

3.21
reference point B_1
that 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 (see Figure 1(a))

3.22
reference point B_2
that 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 (see Figure 1(b))

3.23
reference profile
transverse profile to which rail is to be reprofiled, within the specified tolerances

3.24
reference rail
rail with the reference profile, at the desired angle of inclination relative to the reference line (see Figure 1(a))

NOTE In switch and crossing work, with rails laid vertically, it may be desired to reprofile the rail so that its head profile matches that of the adjacent plain line in which rails are inclined at, for example, 1 in 20. In this case, the angle of inclination of the reference rail will be 2,86° (1 in 20).

3.25
reprofiling site
continuous length of track where the rail is to be reprofiled

3.26
reprofiling zone
that 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 (see Figure 2)

3.27
sampling interval
distance between successive points at which a continuous record of the traced profile is sampled in order to produce the primary profile

3.28
test instrument
instrument whose use as a reference instrument or an approved instrument is being tested

3.29
traced profile
profile of the rail as recorded by the measuring system

3.30
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

3.31
window
that section of a record of longitudinal profile within which an average amplitude of the record is calculated, and whose length is specified

4 Longitudinal profile

4.1 Principle

Measurements are made using either a reference instrument (see 3.18) 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 standard.

NOTE An example of an approved instrument is the type of system used for routine measurements on grinding trains. Some of the systems used for routine measurements 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 top faults, such as wheelburn, 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 – 30 mm) and very long (300 mm – 1 000 mm) wavelength residual irregularities; these are not included in Class 2. Where corrugations in these wavebands are required to be removed it will also be necessary to specify Class 1.

This standard permits the quality of the longitudinal profile to be characterised in any one of the three ways, at the discretion of the client. These are the moving average RMS amplitude of the irregularities in a given waveband, the moving average peak-to-peak amplitude of irregularities in a given waveband and the number

of irregularities exceeding the specified limit per 100 m of track. Except in borderline cases all three methods are expected to give similar results.

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.

NOTE 1 For measurements in the (10 mm to 30 mm) wavelength range, it is at present unlikely that instruments other than reference instruments will have sufficient accuracy.

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

NOTE 2 It is preferable for measurements to be made immediately after reprofiling.

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

4.3 Acceptance criteria for longitudinal profile

4.3.1 General

The acceptance of re-profiled sites shall be on the basis of one of the following sets of criteria, as specified in the contract:

— moving average of RMS amplitudes (see 4.3.2);

— moving average of peak-to-peak amplitudes (see 4.3.3);

— number of irregularities exceeding a specified amplitude (see 4.3.4).

4.3.2 Moving average of RMS amplitudes

The primary or traced profile shall be processed to provide a filtered profile within each of the wavelength ranges given in Table 1. The cut-off wavelengths for each wavelength range and the length of the corresponding window within which the pertinent moving average is to be calculated are also given in Table 1.

The percentages of any site in which the moving average RMS amplitudes exceed the values specified in Table 2 shall be calculated. These percentages shall not exceed the limits given in Table 4 for the Class specified.

4.3.3 Moving average of peak-to-peak amplitude

The primary or traced profile shall be processed to provide a filtered profile within each of the wavelength ranges given in Table 1. The cut-off wavelengths for each wavelength range and the length of the corresponding window within which the pertinent moving average is to be calculated are also given in Table 1.

The percentage of any site in which the moving average of peak-to-peak amplitude exceeds the value specified in Table 3 shall be calculated. These percentages shall not exceed the limits given in Table 4 for the class specified.

4.3.4 Number of irregularities exceeding a specified amplitude

The primary or traced profile shall be processed to provide a filtered profile within each of the wavelength ranges given in Table 1. The cut-off wavelengths for each wavelength range are also given in Table 1.

Irregularities in any filtered profile, the peak-to-peak amplitude of which exceeds the limits specified in Table 5 shall be identified. The number of irregularities exceeding these limits in any 100 m of rail shall not exceed the limits given in Table 5 for the class specified.

Table 1 — Window lengths

Wavelength range (mm)	10 - 30	30 - 100	100 - 300	300 - 1 000
Window length (m)	0,15	0,5	1,5	5

Table 2 — Moving average of RMS amplitude limits

Wavelength range (mm)	10 - 30	30 - 100	100 - 300	300 - 1 000
Limit of moving average of RMS amplitude (mm)	0,004	0,004	0,012	0,040

Table 3 — Moving average of peak-to-peak amplitude limits

Wavelength range (mm)	10 - 30	30 - 100	100 - 300	300 - 1 000
Limit of moving average of peak-to-peak amplitude (mm)	0,010	0,010	0,030	0,100

Table 4 — Acceptance criteria for longitudinal profile expressed in terms of allowable percentages of track exceeding moving average RMS or peak-to-peak amplitude limits

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