SLOVENSKI STANDARD
SIST EN 13848-3:2022

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Nadomešča:
SIST EN 13848-3:2009

Železniške naprave - Zgornji ustroj proge - Kakovost tirne geometrije - 3. del: Merilni sistemi - Tirna mehanizacija za gradnjo in vzdrževanje

Railway applications - Track - Track geometry quality - Part 3: Measuring systems - Track construction and maintenance machines

Bahnanwendungen - Oberbau - Gleislagequalität - Teil 3: Messsysteme - Gleisbau- und Instandhaltungsmaschinen

Applications ferroviaires - Voie - Qualité géométrique de la voie - Partie 3 : Systèmes de mesure - Engins de travaux et de maintenance de la voie

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45.080	Tračnice in železniški deli	Rails and railway components
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Railway applications - Track - Track geometry quality - Part 3: Measuring systems - Track construction and maintenance machines

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 13848-3:2021) 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of an identical text or by endorsement, at the latest by June 2022, and conflicting national standards shall be withdrawn at the latest by June 2022.

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 13848-3:2009.

The main differences between this version and the previous version are the following:

— Formula (1) has been revised using the Math Type tool.

— Table D.1 has been drafted as a table rather than a figure.

This document is one of the series EN 13848 “*Railway applications — Track — Track Geometry quality*” as listed below:

— *Part 1: Characterization of track geometry*

— *Part 2: Measuring systems — Track recording vehicles*

— *Part 3: Measuring systems — Track construction and maintenance machines*

— *Part 4: Measuring systems — Manual and lightweight devices*

— *Part 5: Geometric quality levels*

— *Part 6: Characterization of track geometry quality*

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document specifies the minimum requirements for measuring systems fitted on track construction and maintenance machines to give an evaluation of track geometry quality when they measure any one or several of the parameters described in EN 13848-1.

This document also gives the acceptable differences from EN 13848-1 when using chord measurements.

This document does not specify:

— requirements for vehicle acceptance;

— criteria for track works acceptance;

— requirements for Urban Rail Systems.

Only systems put into service after the document comes into force are concerned.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 13848-1:2019, *Railway applications — Track — Track geometry quality — Part 1: Characterization of track geometry*

EN 13848-2:2020, *Railway applications — Track — Track geometry quality — Part 2: Measuring systems — Track recording vehicles*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
track construction and maintenance machine
OTMM
self-propelled or hauled machine/vehicle which is used in construction, maintenance and/or improvement of the quality of the infrastructure and which is equipped with a track geometry measuring system

Note 1 to entry: Track construction and maintenance machines are part of on-track machines (OTM).

3.2
sensor
device which detects, measures and translates characteristics of track geometry into quantities that can be used for further data processing

3.3
measuring direction
course between two points on a track, independent of orientation of the OTMM

Note 1 to entry: Between two given points A and B, there are two opposite directions: A to B and B to A.

3.4
orientation
physical positioning of an OTMM, with regards to which end of the vehicle is leading or trailing

3.5
repeatability
degree of agreement between the values of successive measurements of the same parameter made under the same conditions, within a short period of time, where the individual measurements are carried out on the same section of track using the same measurement and interpretation methods, subject to the following:

— similar speed;

— same measuring direction;

— same OTMM orientation;

— similar environmental conditions

3.6
reproducibility
degree of agreement between the values of successive measurements of the same parameter made under varying conditions, within a short period of time, where the individual measurements are carried out on the same section of track using the same measurement and interpretation methods, subject to one or more of the following:

— variation of speed;

— different measuring directions;

— different OTMM orientations;

— different environmental conditions

3.7
validation
set of tests for determining if the measuring system of an OTMM complies with the requirements of this document

3.8
calibration
set of procedures for adjusting the measuring devices of OTMMs in order to meet the requirements of this document as defined in [14]

3.9
event
record of a track or line-side feature that can be either technical, physical or natural

3.10
localization
information required to locate events and the measured track geometry

3.11
reference track
track with known characteristics, to allow adequate testing of the track geometry measuring and recording system

3.12
transfer function
refer to Annex A of EN 13848-2:2020

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

Table 1 — Symbols and abbreviations

No.	Symbol	Designation	Unit
1	*D1*	Wavelength range 3 m < λ ≤ 25 m	m
2	*D2*	Wavelength range 25 m < λ ≤ 70 m	m
3	*D3*	Wavelength range 70 m < λ ≤ 150 m for longitudinal level Wavelength range 70 m < λ ≤ 200 m for alignment	m
4	*Lo*	Lower limit of wavelength range *D1, D2, D3*	m
5	*Lu*	Upper limit of wavelength range *D1, D2, D3*	m
6	λ	Wavelength	m
7	ℓ	Twist base-length	m
8	OTMM	Track construction and maintenance machine	-
9	Vmax	Maximum possible measuring speed of an OTMM	km/h
10	Vmin	Minimum possible measuring speed of an OTMM	km/h
11	Vwork	Working speed of an OTMM	km/h

5 Track geometry measuring system fitted on OTMMs

5.1 General description

This document concerns only the track geometry measuring systems installed on the OTMMs used to measure the parameters described in EN 13848-1. It does not cover the other measurement systems; for example those used for the tamping process.

For the purpose of this document, the track geometry measuring system fitted on OTMMs is divided into several units as represented in Figure 1 below:

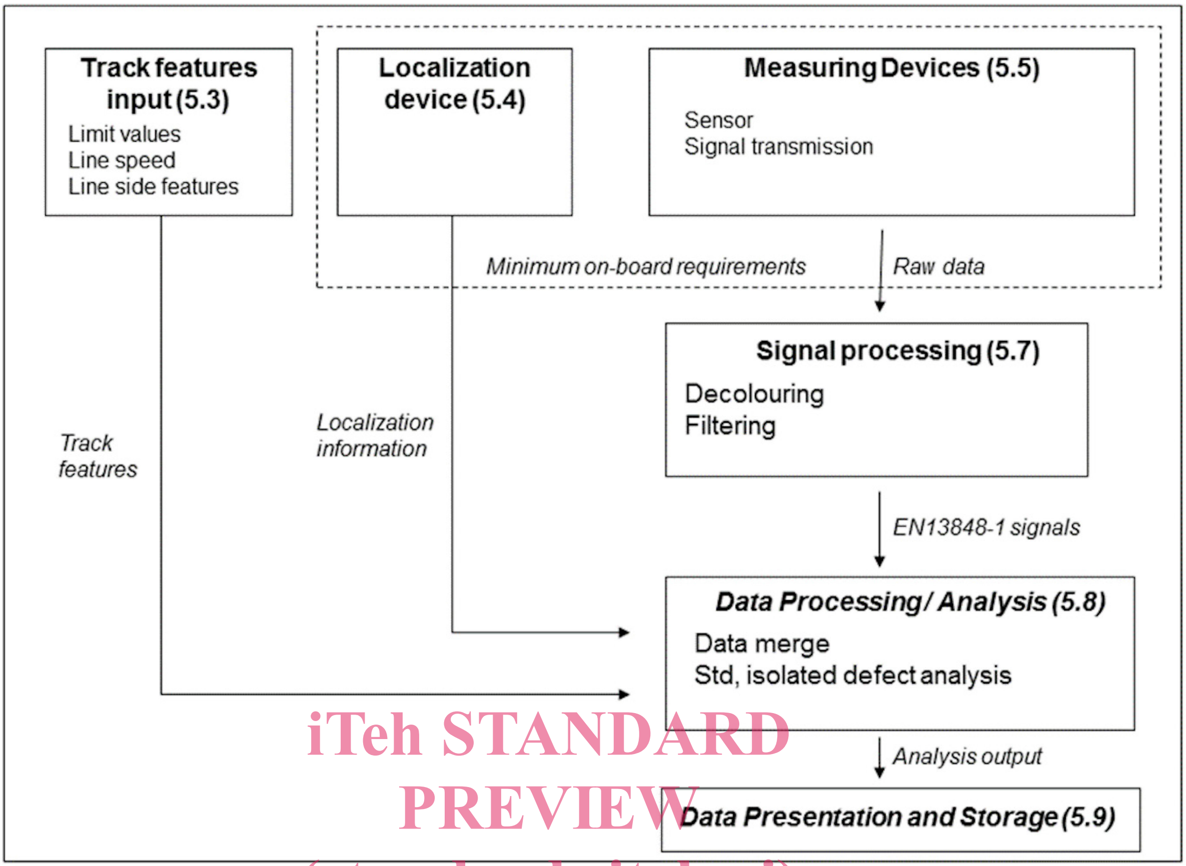

Figure 1 — Track geometry measuring system

The track geometry measuring system installed on an OTMM is required to:

— measure track geometry parameters;

— measure the distance run by the OTMM during measuring operations;

— associate these two measurements in order to set up a precise location and process the measured data, preferably on board, in order to analyse the track geometry parameters;

— record these parameters on computer readable media;

— calculate, based on the direct measured parameters, other parameters of the track geometry (e.g. twist, curvature);

— process the measured data, in order to analyse the track geometry parameters;

— present and store the results.

The track geometry measuring system shall produce reliable results under normal operating conditions of machine.

OTMMs, compliant to this document, can be used for track quality monitoring and safety assurance on track sections where maintenance works are carried out.

OTMMs can be also used for track geometry quality assessment. This can be done:

— in compliance with the requirements of EN 13848-2 or

— in compliance with the requirements of this document. In this case the reduced quality level of the measurements has to be taken into account.

This document takes account of the capabilities of the equipment on existing OTMMs in its requirements and as a consequence some of the requirements of EN 13848-1 have been modified.

There is no requirement for an OTMM to measure all the parameters listed in EN 13848-1. However, the measured parameters and their processing shall at least meet the requirements stated in this document.

If OTMMs, compliant to this standard, are used as track geometry recording vehicles, any reduced quality level of the measurements compared to those compliant with EN 13848-2 has to be considered.

NOTE Due to OTMMs having a short chord length (10 m to 15 m), decolouring the signal into longer wavelengths than *D1* is not practised.

The track geometry measurement should be made on a loaded track as defined in EN 13848-1. It has to be considered that load changes over time or differences in the load distribution over the chord length affect the measurement.

Contrarily to the measuring systems fitted to track recording vehicles, the measuring systems fitted to OTMMs are not required to measure in both orientations.

Any measurements made during the working mode as defined in EN 14033-1:2017 (3.10) shall not constrain the working process of the OTMM, e.g. the measuring and the working speed are complementary.

5.2 Environmental conditions

5.2.1 Introduction

All the measuring devices and hardware components fitted on an OTMM shall produce reliable results under the environmental conditions specified below.

5.2.2 Climatic conditions

The effects of climatic conditions on components outside and inside the OTMM shall be considered. These shall include:

— **Outside components:**

  — ambient temperature;

  — condensation, particularly with sudden variation of temperature at the entrance or at the exit of a tunnel;

  — possibility of extreme weather conditions (heavy rain, snow, direct sunlight …);

  — ambient relative humidity.

— **Inside components:**

  — ambient temperature for operating and storage conditions;

  — ambient relative humidity.

5.2.3 Operating conditions

The effects of operating conditions shall be considered. These shall include:

— ballast or iron fragments impacts;

— grease on the rail;

— reflection condition of the rail;

— characteristic light conditions;

— dust, water and snow in connection with aerodynamic conditions;

— safety requirements (e.g. laser beam);

— vibrations and shocks;

— electromagnetic environment;

— compatibility with signalling and communication systems.

5.3 Track features input

The track features input supports the data analysis (see 5.8) and shall include at least:

— set of limit values of track geometry parameters as defined by the infrastructure manager;

— line speed.

Other inputs can be beneficial as, for example:

— geo-spatial positioning;

— line side features such as switches, level crossings, bridges, tunnels;

— track components and track alignment design parameters.

All this data should be able to be entered by manual or automatic means.

5.4 Localization device

Data localization shall be referenced either to track axis or to a reference rail.

The reference point for the data localization system may be the kilometre post or other fixed points.

The localization device gives the OTMM's position along the track and shall fulfil the following functions:

— synchronises the position with the reference point by various methods, using for example the satellite based positioning system, active or passive beacons, track layout or other singular points;

— measures the distance covered by the OTMM, compensating for any backward movement, and is generally based on sampling signals, which could be given by a wheel-mounted encoder or any other equivalent method;

— corrects manually or automatically the inaccuracies caused by:

— wear, sliding, conicity of the OTMM wheels;

— non-homogeneous reference post distances (e.g. posts that are greater or less than one kilometre apart);

— uncertainty (refer to EN 13848-1:2019, 3.5) of the distance run transducer.

5.5 Measuring devices

5.5.1 General

Track geometry measuring relies on sensors, signal transmission and signal processing following various measuring principles as described in Annex B.

The maximum and the minimum speed shall be specified and documented according to the characteristics of the measurement system and the used OTMM.

The speed range shall be from standstill to the maximum permissible measuring speed of the OTMM if a chord-type measuring system is used. This maximum permissible measuring speed can be different if performed during or before/after the work.

If an inertial-type measurement system is used, a minimum speed may be necessary to measure some parameters.

5.5.2 Sensors

The sensors shall measure in real time the track geometry parameters or their components. In order to measure the parameters under track loaded conditions, the sensors placed under the vehicle's frame should be as close as possible to one of the vehicle's loaded axles to respect measurement conditions indicated in EN 13848-1. The sensors can be either contact type or non-contact type sensors.

The sensors' mechanical and electrical characteristics (frequency response, signal-to-noise ratio, gain, etc.) shall be adequate to enable the generation of track geometry parameters, independently of the environmental conditions on the railway network and the working mode.

5.5.3 Signal transmission

Signal transmission comprises all components which are necessary for data interchange between the sensors and the signal processing unit.

It shall at least comply with the following requirements:

— no phase shift;

— no distortion of results data;

— compliance with current industry-accepted data interchange standards.

The transmission characteristics shall be appropriate to the maximum measuring speed of the OTMM and the data volume.

5.6 Resolution

The resolution, as defined in EN 13848-1, shall be ≤ 0,5 mm for every measured principal track geometric parameter.