SLOVENSKI STANDARD
SIST EN 16729-2:2020

01-maj-2020

Železniške naprave - Infrastruktura - Neporušitveno preskušanje na progi - 2. del: Preskušanje z vrtinčnimi tokovi na progi

Railway applications - Infrastructure - Non-destructive testing on rails in track - Part 2: Eddy current testing of rails in track

Bahnanwendungen - Infrastruktur - Zerstörungsfreie Prüfung an Schienen im Gleis - Teil 2: Wirbelstromprüfung an Schienen im Gleis

Applications ferroviaires - Infrastructure - Essais non destructifs sur les rails de voie - Partie 2 : Contrôle par courant de Foucault des rails en voie

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ICS:

19.100	Neporušitveno preskušanje	Non-destructive testing
93.100	Gradnja železnic	Construction of railways

SIST EN 16729-2:2020 **en,fr,de**

EUROPEAN STANDARD

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EN 16729-2

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ICS 93.100

English Version

Railway applications - Infrastructure - Non-destructive testing on rails in track - Part 2: Eddy current testing of rails in track

Applications ferroviaires - Infrastructure - Test non-destructive sur des rails

Bahnanwendungen - Infrastruktur - Zerstörungsfreie Prüfung an Schienen im Gleis - Teil 2: Wirbelstromprüfung an Schienen im Gleis

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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 16729-2:2020) 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of an identical text or by endorsement, at the latest by September 2020, and conflicting national standards shall be withdrawn at the latest by September 2020.

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 EN 16729 series, *Railway applications – Infrastructure – Non-destructive testing on rails in track*, consists of:

— *Part 1: Requirements for ultrasonic inspection and evaluation principles*;

— *Part 2: Eddy current testing of rails in track*;

— *Part 3: Requirements for identifying internal and surface rail defects*;

— *Part 4: Qualification of personnel for non-destructive testing on rails*.

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.

Introduction

This document represents the actual state of the art of eddy current testing for surface cracks on rails in track applied by European railway companies.

1 Scope

This document is applicable to testing of rails installed in track for detecting rail surface cracks. This document applies to testing equipment in inspection-trains or reprofiling machines and manual systems. This document specifies the requirement for testing principles and systems in order to produce comparable results in respect to the location and the characteristic of surface cracks. This document is not aiming to give any guidelines for managing the result of eddy current rail testing. This document does not define the requirements for vehicle acceptance. This document is not concerned with production testing of rails in a production plant. This document applies only to rail profiles meeting the requirements of EN 13674-1.

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 13231-5, *Railway applications — Track — Acceptance of works — Part 5: Procedures for rail reprofiling in plain line, switches, crossings and expansion devices*

EN 16729-1:2016, *Railway applications — Infrastructure — Non-destructive testing on rails in track — Part 1: Requirements for ultrasonic inspection and evaluation principles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16729-1:2016 and the following apply.

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

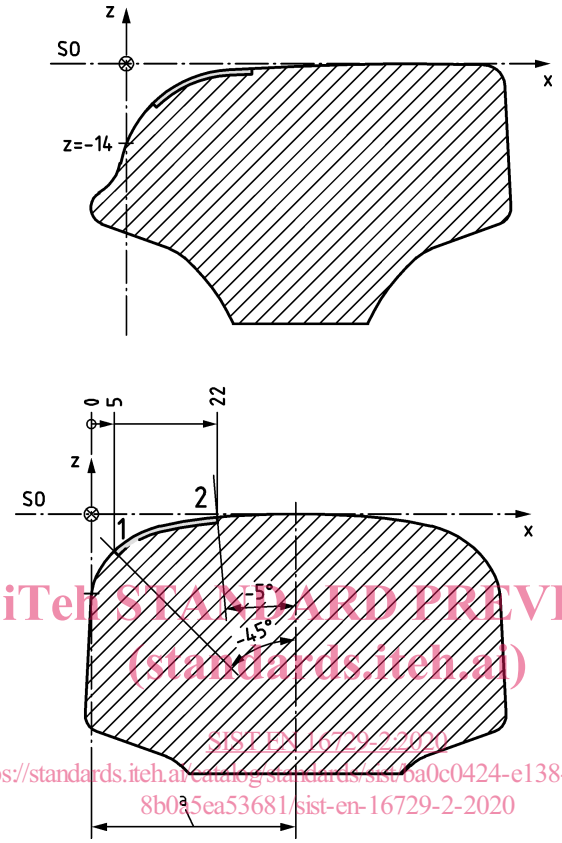
- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
real crack
crack caused by traffic loads or production induced

Note 1 to entry: Cracks may also be simulated. They then constitute an artificial feature designed to represent a real defect of a known size, orientation and position.

3.2
testing area for gauge corner cracks
see Figure 1

Dimensions in mm



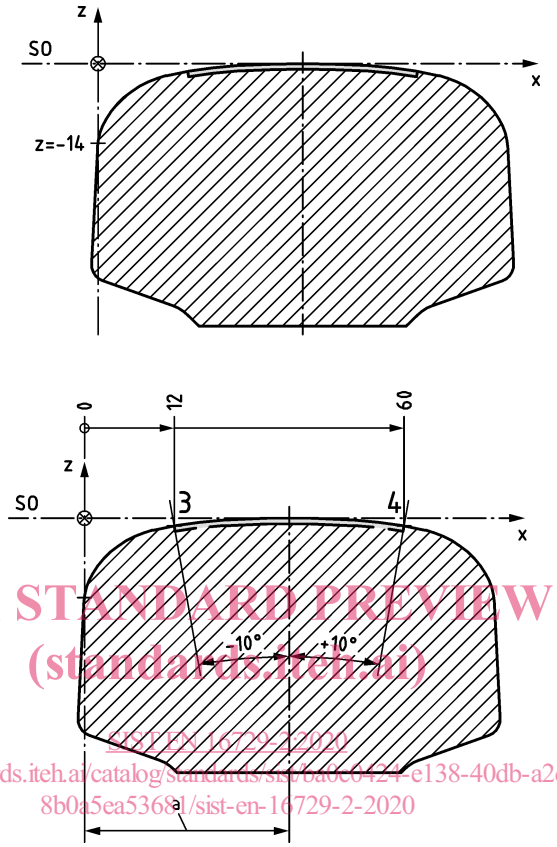
Key

x	horizontal coordinate
z	vertical coordinate
SO	top of rail
a	distance between contact point of wheelset and centre of rail
1-2	minimum gauge inspection area

Figure 1 — Testing area for gauge corner cracks

3.3
testing area for running surface cracks
see Figure 2

Dimensions in mm



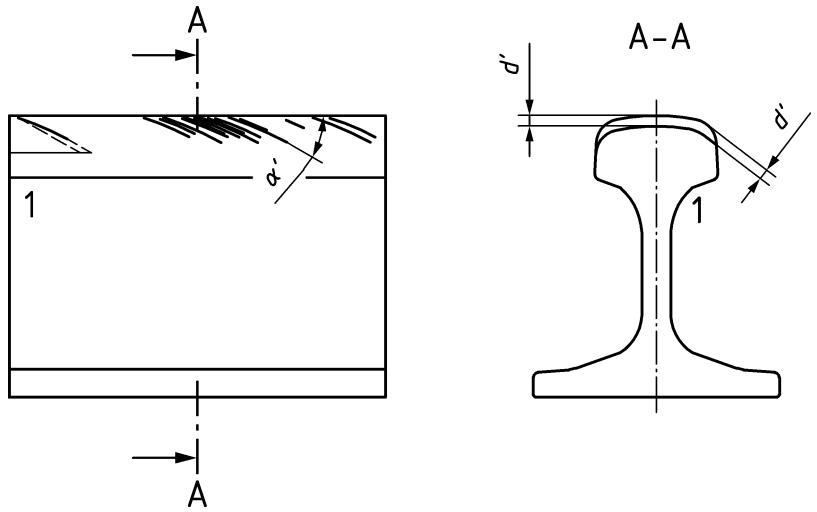
Key

x	horizontal coordinate
z	vertical coordinate
SO	top of rail
a	distance between contact point of wheelset and centre of rail
3-4	minimum running surface inspection area

Figure 2 — Testing area for running surface cracks

3.4
depth to be machined
depth to be machined to remove cracks

Note 1 to entry: see Figure 3



Key

d'	depth to be machined (depth of the crack rectangular to the surface including to a safety distance to ensure the removal of the crack)
α'	penetrating angle
1	gauge side
A	sectional plane
	Pocket length

Figure 3 — Depth to be machined depending on the head checks position

3.5
detectability
capability to recognize, discover and register surface cracks with the help of a testing system

3.6
reproducibility
conformity of several results from the verified test system

4 Symbols and abbreviations

Symbol	Definition	Unit
d'	Depth to be machined (from each probe)	mm
α'	penetrating angle	°
d'_{max}	Maximum depth to be machined (maximum of all probes)	mm
d_{median}	Depth of the cluster (median value)	mm
IM	Infrastructure manager	
ET	Eddy Current Testing	
LH	Left Rail	
RH	Right Rail	

5 Basic principles

5.1 General

With the help of eddy current testing, surface cracks can be detected in electrically conducting materials (ferromagnetic or non-ferromagnetic materials).

Eddy current testing is based on the induction of electric current in electrically conducting material. The measured and analysed size refers to the distribution of the induced currents (eddy currents).

The distribution of the eddy currents in the material is governed by physical laws; the density of these eddy currents drastically decreases with the distance to the surface.

To determine the depth of a head check crack, the pocket length of the crack and the penetrating angle are used. The penetrating angle can vary depending on steel grade, traffic, tonnage and support conditions of the rail. The penetrating angle α' (see Figure 3) commonly used for testing head checks in rail is 25 °.

Parameters influencing the testing results are:

— conductivity of the material;

— permeability of the material;

— dimension and geometry of the defect;

— geometry between the eddy current probe and the material surface;

— design and size of the probe;

— setting of the excitation frequency.

More detailed information on the eddy current method can be found in EN ISO 15549.

5.2 Purpose of testing

The purpose of eddy current testing on rails is to detect, quantify or classify rail defects in the material surface mainly due to rolling contact fatigue which can affect the structural integrity of the rails in track and which are defined in EN 13231-5. This is not limited to, but generally covers the following defects:

— head checks;

— squats;

— flaking;

— spalling.

6 Requirements for the eddy current testing system on rails

Inspection of the rail surface can be carried out manually or by using mechanized devices.

When testing with an eddy current probe, it is placed above the rail head. The impedance of the probe is influenced by the interaction of the electromagnetic field generated by the probe and the rail head. This influence recorded by the complex voltage of the probe can be calculated to the severity of cracking on rail surface.

The minimum requirements for a test system are:

— suitable for the test task;

— capable of dealing with various material characteristics (e.g. welds, steel grades);

— probes optimized to the position, direction, depth and distance between cracks;

— probes optimized to test non-planar rail surfaces;

— capable of testing rough and rusty surfaces;

— capable of recording the correct location of the defect;

— capable of testing forwards and backwards in track independent of the direction of the traffic (if mounted on vehicle, independent of the orientation of the vehicle).

NOTE The list does not include the requirements for operational use of the test system in track.

7 Requirements for testing procedure

The IM shall define:

— inspection area;

— defect type;

— minimum and maximum defect size;

— frequency and requirements of system verification;

— testing speed;

— rail profiles and wear limits to be inspected;

— rail grades to be inspected;

— penetrating angle.