



SLOVENSKI STANDARD

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Neporušitveno preskušanje jeklenih izkovkov - 1. del: Preiskave z magnetnimi prahovi

Non-destructive testing of steel forgings - Part 1: Magnetic particle inspection

Zerstörungsfreie Prüfung von Schmiedestücken aus Stahl - Teil 1: Magnetpulverprüfung

Essais non destructifs des pièces forgées en acier - Partie 1 : Contrôle par magnétoscopie

Ta slovenski standard je istoveten z: prEN 10228-1

ICS:

77.040.20	Neporušitveno preskušanje kovin	Non-destructive testing of metals
77.140.85	Železni in jekleni kovani izdelki	Iron and steel forgings

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English Version

Non-destructive testing of steel forgings - Part 1: Magnetic particle inspection

Essais non destructifs des pièces forgées en acier - Partie
1: Contrôle par magnétoscopie

Zerstörungsfreie Prüfung von Schmiedestücken aus Stahl -
Teil 1: Magnetpulverprüfung

This draft European Standard is submitted to ECISS/COCOR before submission to CEN members for formal vote. It has been drawn up by the Technical Committee ECISS/TC 111.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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Foreword

This document (prEN 10228-1:2014) has been prepared by Technical Committee ECISS/TC 111 "Steel castings and forgings", the secretariat of which is held by AFNOR.

This document is currently submitted to the COCOR Vote.

This document will supersede EN 10228-1:1999.

EN 10228 consists of the following parts under the general title "*Non-destructive testing of steel forgings*":

- *Part 1: Magnetic particle inspection*
- *Part 2 : Penetrant testing*
- *Part 3 : Ultrasonic testing of ferritic or martensitic steel forgings*
- *Part 4 : Ultrasonic testing of austenitic and ferritic-austenitic stainless steel forgings*

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<https://standards.iteh.ai/catalog/standards/sist/e4423129-12bf-4063-b5e0-b94a827dec6e/sist-en-10228-1-2016>

prEN 10228-1:2014 (E)**1 Scope**

This Part of EN 10228 describes techniques and acceptance criteria to be used for the magnetic particle testing of forgings manufactured from ferromagnetic materials. The method described is used for the detection of surface discontinuities. It can also detect discontinuities just below the surface but the sensitivity to such discontinuities decreases rapidly with depth.

NOTE A steel forging is considered to be ferromagnetic if the magnetic flux density is greater than 1 T for a tangential magnetic field strength of 2,4 kA/m.

2 Normative references

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

EN ISO 3059, *Non-destructive testing -- Penetrant testing and magnetic particle testing - Viewing conditions (ISO 3059)*

EN ISO 9172, *Non-destructive testing -- Qualification and certification of NDT personnel (ISO 9172)*

EN ISO 9934-1, *Non-destructive testing - Magnetic particle testing - Part 1: General principles (ISO 9934-1)*

EN ISO 9934-2, *Non-destructive testing - Magnetic particle testing - Part 2: Detection media (ISO 9934-2)*

EN ISO 9934-3, *Non-destructive testing - Magnetic particle testing - Part 3: Equipment (ISO 9934-3)*

3 Items for agreement

The following aspects concerning magnetic particle inspection shall be agreed between the purchaser and the supplier at the time of enquiry and order:

- a) the manufacturing stages(s) at which magnetic particle inspection is to be performed (see clause 7);
- b) the surface areas to be examined (see clause 8);
- c) the quality class required, or the quality classes and the surface areas to which they apply (see clauses 8.2, and 14);
- d) whether the testing shall be performed with the specified detection media (see 6.2);
- e) whether a particular current waveform is required (see 10.2);
- f) the applicable recording and acceptance criteria if different from those detailed in Table 2.
- g) whether demagnetization is to be carried out after testing, together with the maximum level of residual magnetism (see clause 16);
- h) whether testing is to be conducted in the presence of the purchaser or his representative;
- i) whether a written procedure shall be submitted for approval by the purchaser (see clause 4).

4 Test procedure

4.1 General

Magnetic particle testing shall be performed in accordance with a written test procedure. Where specified in the enquiry or order, the written procedure shall be submitted to the purchaser for approval prior to the test.

4.2 Description

This written procedure shall be one of the following:

- a) a product specification;
- b) a procedure written specifically for the application;
- c) this Part of EN 10228 may be used if it is accompanied by testing details specific to the application.

4.3 Content

The procedure shall contain the following details as minimum requirements:

- a) description of the forgings to be tested;
- b) reference documents;
- c) qualification and certification of testing personnel;
- d) stage of manufacture at which the test is carried out;
- e) surface areas specified in terms of the applicable quality classes;
- f) magnetizing technique(s);
- g) description of the testing equipment;
- h) calibration and checking of equipment;
- i) waveform and flux density and/or tangential field strength required for each technique used;
- j) detection media, and contrast paint if used;
- k) surface condition required;
- l) viewing conditions;
- m) method of marking or recording indications;
- n) whether demagnetization is required; if so the method to be used and required maximum level of residual magnetism;
- o) acceptance criteria;
- p) testing report.

prEN 10228-1:2014 (E)**5 Personnel qualification**

Personnel shall be qualified and certified in accordance with EN ISO 9712.

6 Testing system**6.1 Magnetizing equipment**

If the contact current flow (prods) magnetization method is used on a finished machined surface, then the prod contact points shall be checked after magnetization for damage, using an alternative magnetization technique, penetrant testing or visual examination.

All equipment shall be calibrated and checked in accordance with EN ISO 9934-3.

One or more of the following types of magnetizing equipment shall be used:

- a) alternating current electromagnetic yokes (see Annex A);
- b) current flow equipment with prods (see Annex A);
- c) permanent magnets;
- d) magnetic flow equipment with flexible cable or coil;
- e) central conductor;
- f) magnetic induction
- g) equipment enabling multiple magnetizing techniques, either coincidentally or in sequence

6.2 Detection media

Detection media shall conform to the requirements detailed in EN ISO 9934-2.

6.3 Function checks

A function check shall be carried out prior to the test to ensure the proper functioning of the testing system. The check shall be performed as detailed in EN ISO 9934-1

NOTE The temperature of the forging should be checked to ensure that it is within the detection media manufacturer's specified temperature limits.

7 Stage of manufacture

Where practicable, final acceptance testing shall be performed on the forging in its delivery condition (see clause 3).

8 Surface condition**8.1 General**

Surfaces to be examined shall be clean and free from scale, oil, grease, machining marks, heavy paint and any other contaminant that could adversely affect the testing sensitivity or the interpretation of indications.

Cleaning and preparation of the surfaces shall not be detrimental to the material, the surface finish or the detection media.

8.2 Surface condition related to quality class

The finish of surfaces to be tested shall conform to the requirements detailed in Table 1 for the applicable quality class.

Table 1 — Surface condition

Surface roughness parameter R_a *), in μm	Quality classes ^a			
	1	2	3	4
$6,3 \mu\text{m} < R_a \leq 12,5 \mu\text{m}$	X	X	–	–
$R_a \leq 6,3 \mu\text{m}$	X	X	X ^b	X ^c
^a X signifies the quality class that can be achieved for the specified surface finish. ^b Quality class not applicable to the testing of surfaces with a machining allowance greater than 3 mm per face. ^c Quality class not applicable to the testing of surfaces with a machining allowance greater than 1 mm per face. *) R_a = arithmetical mean deviation of the profile.				

8.3 As-forged surface condition

It is difficult to carry out a comprehensive test on a forged surface. The surface to be tested shall be prepared by shot-blasting, sand-blasting or surface grinding so that defects can be clearly distinguished from indications resulting from surface irregularities.

For general applications quality classes 1 and 2 shall be applicable. For closed die forgings quality class 3 shall be the minimum requirement.

9 Coverage

Where practicable, the test shall be performed in such a way that 100 % coverage of the surface to be tested is achieved.

Viewing of the area under testing shall be completed before proceeding to the next area or the next stage of magnetization.

10 Magnetization

10.1 Direction of magnetization

Magnetization shall be performed in accordance with the requirements detailed in EN ISO 9934-1

The surface shall be tested in at least two approximately perpendicular directions to detect defects lying in any orientation.

NOTE 1 Where the probable nature and orientation of flaws in a forging can be forecast with confidence as, for example, in certain long forged parts, and where specified in the enquiry or order, magnetization may be performed in a single direction.

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NOTE 2 Where magnetization is performed by locally applying the current flow method or using the magnetic flow method with a portable electromagnetic yoke, it is recommended that the surface under examination should be marked in a grid to ensure 100 % coverage. The recommended size of the grid and magnetizing directions are detailed in Annex A.

10.2 Current waveform

The supplier shall decide which waveform to use unless a specific current waveform (e.g. alternating current or half-wave rectified alternating current) has been agreed between the purchaser and supplier.

NOTE Reference should be made to EN ISO 9934-1 for guidance.

10.3 Flux density and field strength

The tangential flux density shall be at least 1,0 T. The adequacy of the flux density and/or field strength shall be verified on the surface under testing, in each magnetizing direction, prior to or during the test, using one or more of the methods detailed in EN ISO 9934-3

A flux density of 1,0 T is generally achieved with a tangential field strength from 2kA/m to 6kA/m, dependent upon the magnetic permeability of the material being tested.

11 Use of detection media

The continuous method of application shall be used. The ink or powder shall be applied immediately prior to and during magnetization. Magnetization shall be continued for at least two seconds after the application has ceased to allow indications to build up and for the ink, if applicable, to drain.

The ink shall be thoroughly mixed prior to application.

NOTE 1 Large forgings may be tested in sections to ensure adequate ink application.

NOTE 2 Pre-wetting of the forging accelerates distribution of the ink.

12 Viewing conditions

Viewing conditions shall be in accordance with EN ISO 3059:

a) Non-fluorescent detection media

The surface under examination shall be viewed under white light of at least 500 lx intensity on the surface. Glare and reflections shall be avoided.

NOTE Lower illuminances may be agreed between the purchaser and supplier.

b) Fluorescent detection media

Viewing conditions shall be in accordance with EN ISO 3059

Prior to the examination at least 5 min shall be allowed for the Inspector's eyes to become adapted to the reduced background lighting.

UV-A lamps shall be allowed to warm up for at least 5 min.