SLOVENSKI STANDARD
SIST EN 10228-4:2000

01-november-2000

Neporuġitveno preskuġanje jeklenih izkovkov - 4. del: Ultrazvoļ no preskuġanje avstenitnih in avstenitno-feritnih nerjavnih jeklenih izkovkov

Non-destructive testing of steel forgings - Part 4: Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings

Zerstörungsfreie Prüfung von Schmiedestücken aus Stahl - Teil 4: Ultraschallprüfung von Schmiedestücken aus austenitischem und austenitisch-ferritischem nichtrostenden Stahl

Essais non destructifs des pieces forgées en acier - Partie 4: Contrôle par ultrasons des pieces forgées en aciers inoxydables austénitiques et austéno-ferritiques

Ta slovenski standard je istoveten z: **EN 10228-4:1999**

ICS:

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

SIST EN 10228-4:2000 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 10228-4

August 1999

ICS 77.040.20; 77.140.85

English version

Non-destructive testing of steel forgings - Part 4: Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings

Essais non destructifs des pièces forgées en acier - Partie 4: Contrôle par ultrasons des pièces forgées en aciers inoxydables austénitiques et austéno-ferritiques

Zerstörungsfreie Prüfung von Schmiedestücken aus Stahl - Teil 4: Ultraschallprüfung von Schmiedestücken aus austenitischem und austenitisch-ferritischem nichtrostendem Stahl

This European Standard was approved by CEN on 9 July 1999.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 10228-4:1999 E

Contents

Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 28 "Steel forgings", the secretariat of which is held by BSI.

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 February 2000, and conflicting national standards shall be withdrawn at the latest by February 2000.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. This European Standard is considered to be a supporting standard to those application and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European Standard.

The titles of the other Parts of this European Standard are:

Part 1: Magnetic particle inspection.

Part 2: Penetrant testing.

Part 3: Ultrasonic testing of ferritic and martensitic steel forgings

Part 4: Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This Part of EN 10228 specifies methods for the manual, pulse-echo, ultrasonic testing of forgings manufactured from austenitic and austenitic-ferritic stainless steels. Mechanised scanning techniques, such as immersion testing, may be used but should be agreed between the purchaser and supplier.

This Part of EN 10228 applies to four types of forgings, classified according to their shape and method of production. Types 1, 2 and 3 are essentially simple shapes. Type 4 covers complex shapes.

This Part of EN 10228 does not apply to

- rolled bars;
- closed die forgings;
- turbine rotor and generator forgings.

Ultrasonic testing of ferritic and martensitic steel forgings is the subject of Part 3 of this European Standard.

2 Normative references

This Part of EN 10228 incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Part of EN 10228 only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 473	Qualification and certification of NDT personnel
prEN 583-2	Non-destructive testing – Ultrasonic examination – Part 2: Sensitivity and range setting
prEN 583-5	Non-destructive testing – Ultrasonic examination – Part 5: Characterisation and sizing of discontinuities
EN 1330-1	Non destructive testing – Terminology – Part 1: List of general terms
prEN 1330-4	Non destructive testing – Terminology – Part 4: Terms used in ultrasonic testing
prEN 12223	Ultrasonic examination – Calibration blocks

prEN 12668-1 Non-destructive testing – Characterization and verification of ultrasonic examination equipment – Part 1: Instruments

prEN 12668-2 Non-destructive testing – Characterization and verification of ultrasonic examination equipment – Part 2: Probes

prEN 12668-3 Non-destructive testing – Characterization and verification of ultrasonic examination equipment – Part 3: Combined equipment

3 Definitions

The definitions given in EN 1330-1 and prEN 1330-4 apply.

4 Items for agreement

The following aspects concerning ultrasonic testing shall be agreed between the purchaser and supplier at the time of the enquiry or order:

a) the volume(s) to be tested and whether grid scanning coverage or 100 % scanning coverage is required (see clause 12);

b) whether near surface examination is required (see 7.2.6);

c) the quality class required, or the quality classes and the zones to which they apply (see clause 14);

d) whether any special scanning coverage, equipment or couplant is required in addition to that detailed in clauses 7 and 12;

e) the scanning technique to be used if not manual (see clause 1);

f) the sizing techniques to be used for extended discontinuities (see clause 15);

g) the technique(s) to be used for setting sensitivity (see clause 11);

h) whether the test 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 5);

j) whether examination by shear wave probes is required (see 11.3);

k) the remaining examination requirements for complex forgings (type 4) (see 12.2).

5 Written procedure

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

This written procedure shall be in the form of:

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

The written procedure shall contain the following details as a minimum requirement:

a) a) description of the item to be examined;

b) reference documents;

c) qualification and certification of examination personnel;

d) stage of manufacture at which the examination is carried out;

e) examination zones specified in terms of the applicable quality classes;

f) preparation of scanning surfaces;

g) couplant;

h) description of examination equipment;

i) calibration and settings;

j) scanning plan;

k) description and sequence of examination operations;

l) recording levels;

m) characterisation of discontinuities;

n) acceptance criteria;

o) examination report.

6 Personnel qualification

Personnel shall be qualified and certificated in accordance with the requirements detailed in EN 473.

7 Equipment and accessories

7.1 Flaw detector

The flaw detector shall feature A-scan presentation and shall conform to the requirements of prEN 12668-1.

7.2 Probes

7.2.1 *General*

Probes used for the intial detection of defects shall conform to prEN 12668-2. Where supplementary probes are used for purposes other than the initial detection of defects, they need not conform to prEN 12668-2.

7.2.2 *Contouring*

When required, probes shall be contoured in accordance with prEN 583-2.

7.2.3 *Nominal frequency*

Probes shall have a nominal frequency in the range from 0,5 MHz to 6 MHz.

7.2.4 *Normal probes*

Effective crystal diameter shall be in the range from 10 mm to 40 mm.

7.2.5 *Shear wave probes*

Shear wave probe beam angles shall be in the range from 35° to 70°.

Effective crystal area shall be in the range from 20 mm^2 to 625 mm^2.

7.2.6 *Twin crystal probes*

If near-surface examination is required, then twin crystal probes shall be used.

7.3 Calibration blocks

Calibration blocks shall conform to the requirements detailed in prEN 12223.

7.4 Reference blocks

Reference blocks shall be used when sensitivity is to be established by the distance amplitude curve (DAC) technique and/or when defects are to be sized in terms of amplitude relative to reference reflectors by the DAC technique. The surface condition of the reference block shall be representative of the surface condition of the part to be examined. Unless otherwise specified the reference block shall contain at least three reflectors covering the entire depth range under examination.

The reference block shall be manufactured from one of the following:

a) an excess length of the part to be examined, or

b) a part of the same material and with the same heat treatment condition as part to be examined; or

c) a part having similar acoustic properties to the part to be examined.

Reference blocks shall not be used for the distance gain size (DGS) technique other than for checking the accuracy of a particular DGS diagram.

NOTE: Different sizes of reflectors from those detailed in tables 5 and 6 may be used as long as the test sensitivity is corrected accordingly.

7.5 Couplant

The same type of couplant shall be used for calibration, setting sensitivity, scanning and defect assessment.

NOTE: Examples of suitable couplants are: water (with or without corrosion inhibitor or softener), grease, oil, glycerol and water.cellulose paste.

After examination, couplant shall be removed if its presence could adversely affect later manufacturing or inspection operations or the integrity of the component.

8 Routine calibration and checking

The combined equipment (flaw detector and probes) shall be calibrated and checked in accordance with the requirements detailed in prEN 12668-3.

9 Stage of manufacture

Ultrasonic testing shall be performed after the final quality heat treatment or at the latest stage of manufacture at which the required ultrasonic coverage can be achieved.

NOTE: For both cylindrical and rectangular forgings, which are to be bored, it is recommended to carry out ultrasonic testing before boring.

10 Surface condition

10.1 General

Surfaces to be scanned shall be free from paint, non-adhering scale, dry couplant, surface irregularities or any other substance which could reduce coupling efficiency, hinder the free movement of the probe or cause errors in interpretation.

10.2 Surface finish related to quality class

In the machined condition, for testing to quality classes 1 and 2, a surface finish corresponding to a roughness Ra ≤ 12,5 µm shall be produced and for testing of quality class 3, a surface finish corresponding to a roughness Ra ≤ 6,3 µm shall be produced.

10.3 As-forged surface condition

Where forgings are supplied in the as-forged surface condition they shall be considered acceptable providing the specified quality class can be achieved. When it is not practical to perform a comprhensive examination on as forged surfaces, shot blasting, sand blasting or surface grinding shall be used to ensure that acoustic coupling can be maintained.

NOTE. Only quality class 1 is normally applicable.

11 Sensitivity

11.1 General

Sensitivity shall be sufficient to ensure the detection of the smallest discontinuities required by the recording levels. (see table 4 and when required, tables 5 or 6.). If the required sensitivity cannot be acheived due to coarse grain size, acceptance of the forging shall be subject to agreement between the purchaser and supplier.

11.2 Normal probes

For normal probes one of the following techniques shall be used to establish sensitivity for scanning:

a) Distance amplitude curve (DAC) technique, based upon the use of flat bottomed holes;

b) Distance gain size (DGS) technique.

The procedure to be used in each case shall be in accordance with prEN 583-2.

11.3 Shear-wave probes (see 4.j)

For shear-wave probes one of the following techniques shall be used to establish sensitivity for scanning:

a) DAC technique using 3 mm diameter side-drilled holes.

b) DGS technique.

The procedure to be used in each case shall be as detailed in prEN 583-2.

The DAC and DGS techniques shall not be compared for shear wave probes.

11.4 Repeat inspection

Where repeat inspection is performed the same method of establishing sensitivity (DAC or DGS) shall be used as was initially used.