SLOVENSKI STANDARD

SIST EN 583-1

prva izdaja
februar 2000

Neporušitvene preiskave - Ultrazvočne preiskave - 1. del: Splošna načela (prevzet EN 583-1:1998 z metodo platnice)

Non destructive testing - Ultrasonic examination - Part 1: General principles

Essais non destructifs - Contrôle ultrasonore - Partie 1: Principes généraux

Zerstörungsfreie Prüfung - Ultraschallprüfung - Teil 3: Allgemeine Grundsätze

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ICS 19.100

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SIST EN 583-1:2000 (en)

Nadaljevanje na straneh od II do III in od 1 do 17

NACIONALNI UVOD

Standard SIST EN 583-1 ((sl),en), Neporušitvene preiskave - Ultrazvočne preiskave - 1. del: Splošni principi, prva izdaja, 2000, ima status slovenskega standarda in je z metodo platnice prevzet evropski standard EN 583-1 (en), Non destructive testing - Ultrasonic examination - Part 1: General principles, 1998-11.

NACIONALNI PREDGOVOR

Evropski standard EN 583-1:1998 je pripravil tehnični odbor Evropske organizacije za standardizacijo CEN/TC 138 Neporušitvene preiskave.

Odločitev za prevzem tega standarda po metodi platnice je dne 1999-11-16 sprejel tehnični odbor USM/TC PKG Preskušanje kovinskih gradiv.

Ta slovenski standard je dne 1999-12-21 odobril direktor USM.

OPOMBI

- Povsod, kjer se v besedilu standarda uporablja izraz "evropski standard", v SIST EN 583-1:2000 to pomeni "slovenski standard".

- Nacionalni uvod in nacionalni predgovor nista sestavni del standarda.

VSEBINA **Stran**

Predgovor 3
1 Namen standarda 4
2 Zveze s standardi 4
3 Kvalificiranje in certificiranje osebja 5
4 Informacije, potrebne pred začetkom preiskave 5
5 Načela ultrazvočne preiskave 6
6 Oprema 7
7 Nastavitve 11
8 Priprave na preiskavo 12
9 Preiskava 13
10 Karakterizacija nepopolnosti 14
11 Postopek preiskave 15
12 Poročilo o preiskavi 16
Dodatek ZA (informativen) Točke tega evropskega standarda, ki obravnavajo bistvene zahteve ali druga določila EU direktiv 17

EUROPEAN STANDARD
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English version

Non-destructive testing - Ultrasonic examination - Part 1: General principles

Essais non destructifs - Contrôle ultrasonore - Partie 1: Principes généraux

Zerstörungsfreie Prüfung - Ultraschallprüfung - Teil 1: Allgemeine Grundsätze

This European Standard was approved by CEN on 14 October 1998.

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.

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Contents

Page

Foreword 3

1 Scope 4

2 Normative references 4

3 Qualification and certification of personnel 5

4 Information required prior to examination 5

5 Principles of ultrasonic examination 6

6 Equipment 7

7 Settings 11

8 Preparation for examination 12

9 Examination 13

10 Characterization of imperfections 14

11 Examination procedure 15

12 Examination report 16

Annex ZA (informative) Clauses of this European Standard addressing essential requirements or other provisions of EU directives . . 17

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 138 "Non-destructive testing", the secretariat of which is held by AFNOR.

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 May 1999, and conflicting national standards shall be withdrawn at the latest by May 1999.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

This standard consists of the following parts:

EN 583-1	Non-destructive testing - Ultrasonic examination - Part 1: General principles
EN 583-2	Non-destructive testing - Ultrasonic examination - Part 2: Sensitivity and range setting
EN 583-3	Non-destructive testing - Ultrasonic examination - Part 3: Transmission technique
EN 583-4	Non-destructive testing - Ultrasonic examination - Part 4: Examination for imperfections perpendicular to the surface
EN 583-5	Non-destructive testing - Ultrasonic examination - Part 5: Characterization and sizing of imperfections
ENV 583-6	Non-destructive testing - Ultrasonic examination - Part 6: Time-of-flight diffraction technique as a method for detection and sizing of imperfections

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 standard defines the general principles required for the ultrasonic examination of industrial products that permit the transmission of ultrasound.

The specific conditions of application and use of ultrasonic examination, which depend on the type of product examined, are described in documents which could include:

- product standards;
- specifications;
- codes;
- contractual documents;
- written procedures.

Unless otherwise specified in the referencing documents the minimum requirements of this standard are applicable.

This standard does not define:

- extent of examination and scanning plans;
- acceptance criteria.

2 Normative references

This European Standard 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 European Standard 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 - General principles

EN 27963 Welds in steel - Calibration block No. 2 for ultrasonic examination of welds (ISO 7963:1985)

prEN 583-2[1)]	Non-destructive testing - Ultrasonic examination - Part 2: Sensitivity and range setting
EN 583-3	Non-destructive testing - Ultrasonic examination - Part 3: Transmission technique
prEN 12223[1)]	Non-destructive testing - Ultrasonic examination - Specification for calibration block No. 1
prEN 12668-1[1)]	Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 1: Instruments
prEN 12668-2[1)]	Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 2: Probes
prEN 12668-3[1)]	Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 3: Combined equipment

3 Qualification and certification of personnel

The examination shall be performed by personnel qualified in accordance with EN 473.

The requirements for qualification and certification shall be specified in the product standards and/or other applicable documents.

4 Information required prior to examination

Prior to examination the following information shall be available, as applicable:

- purpose of examination;
- qualification and certification of personnel;
- environmental conditions and state of examination object;
- requirement for a written examination procedure;
- any special requirements for preparation of scanning surface;
- examination volume;
- examination sensitivity and method of setting-up sensitivity;
- requirements for evaluation and recording level;
- acceptance criteria;
- extent of examination including scanning plan;
- requirements for a written examination report.

[1)] In preparation

5 Principles of ultrasonic examination

5.1 General

An ultrasonic examination is based on propagation of ultrasonic waves through the object to be examined, and monitoring either the transmitted signal (termed the transmission technique), or the signal reflected or diffracted from any surface or discontinuity (termed the pulse echo technique).

Both techniques can employ a single probe acting as both transmitter and receiver, or double (twin) transducer probe, or separate transmitting and receiving probes. Similarly, both techniques can involve intermediate reflection from one or more surfaces of the object under examination.

The examination can be performed manually or by the use of semi-automatic or fully automatic equipment, and can use contact, gap or immersion scanning, or other coupling methods adapted to specific problems.

5.2 Vibration mode and direction of sound propagation

The most commonly used types of waves are longitudinal and transverse, and these can be propagated either perpendiculary, or at an angle, to the test surface. Other types of modes, e.g. Lamb waves or Rayleigh waves can also be used for special applications.

The choice of wave mode and direction of propagation will depend on the purpose of the examination, and should take into account the specular nature of reflection from planar reflectors. Except when using Lamb waves, the direction of sound propagation, for single probe pulse echo scanning, should be as nearly perpendicular to the plane of the reflector as possible.

5.3 Transmission technique

This technique is based on measuring the signal attenuation after the passage of an ultrasonic wave through the examination object.

The signal used for measurement can be either:

a) a backwall echo, or;

b) any other signal transmitted either directly, or after intermediate reflection from the surfaces of the object.

Further details of this technique are contained in EN 583-3.

5.4 Pulse echo technique

This technique utilises the reflected or diffracted signal from any interface of interest within the object under examination. This signal is characterised by its amplitude and position along the timebase; the latter related to the distance between the reflector and the probe. The location of the reflector is determined from the knowledge of its distance, the direction of sound propagation, and the position of the probe.

It is recommended that the signal amplitude be measured by comparison with either:

a) a distance amplitude correction (DAC) curve, or a series of DAC curves, obtained by using artificial reflectors (sidedrilled holes, flat-bottomed holes or notches etc.) within one or more reference blocks;

b) an equivalent reflector diagram (DGS system);

c) echoes from suitable notches; or

d) echoes from large planar reflectors perpendicular to the acoustic axis (e.g. back wall echo).

These techniques are described in prEN 583-2.

In order to obtain further information about the shape and size of reflectors, other techniques may be used. Such techniques are based, for example on variations in signal amplitude with movement of the probe, measurement of sound path or frequency analysis.

6 Equipment

6.1 Ultrasonic instrument

The ultrasonic instrument shall fulfil the requirements of prEN 12668-1.

6.2 Ultrasonic probes

The probe shall fulfil the requirements of prEN 12668-2.

6.2.1 Probe selection

The choice of the probe depends on the purpose of the examination and the requirements of the referencing standard or specification. It depends on:

- the material thickness, shape and surface condition;
- the type and metallurgical condition of the examined material;
- the type, position and orientation of imperfections to be identified.

The probe parameters listed in clauses 6.2.2, 6.2.3 and 6.2.4 shall be considered in relation to the characteristics of the examination object stated above.

6.2.2 Frequency and dimensions of transducer

The frequency and dimensions of a transducer determine the shape of the beam (near field and beam divergence). The selection shall assure that the characteristics of the beam are the optimum for the examination by a compromise between the following:

- the near field length which shall remain, whenever possible, smaller than the thickness of the object under examination;

NOTE: It is possible to detect imperfections in the near field, but their characterization is less accurate and less reproduceable.

- the beam width, which shall be sufficiently small within the examination zone furthest from the probe to maintain an adequate detection level;

- the beam divergence, which shall be sufficiently large to detect planar imperfections that are unfavorably orientated.

Apart from the above considerations the selection of frequency shall take into account the sound attenuation in the material and the reflectivity of imperfections. The higher this frequency, the greater the examination resolution, but the sound waves are more attenuated (or the spurious signals due to the structure are greater). The choice of frequency thus represents a compromise between these two factors. Most examinations are performed at frequencies between 1 MHz and 10 MHz.

6.2.3 Dead zone

The choice of the probe shall take into account the dead zone in relation to the examination volume.

6.2.4 Damping

The selection of probe shall also include consideration of the damping which influences the resolution as well as the frequency spectrum.