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

The European Standard EN 12668-2:2001 has the status of a Swedish Standard. This document contains the official English version of EN 12668-2: 2001.

Swedish Standards corresponding to documents referred to in this Standard are listed in ”Catalogue of Swedish Standards”, issued by SIS. The Catalogue lists, with reference number and year of Swedish approval, International and European Standards approved as Swedish Standards as well as other Swedish Standards.

Oförstörande provning – Karakterisering och kontroll av utrustning för ultraljudprovning – Del 2: Sökare

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ICS 19.100

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English version

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

Essais non destructifs - Caractérisation et vérification de l'appareillage de contrôle par ultrasons - Partie 2: Traducteurs

Zerstörungsfreie Prüfung - Charakterisierung und Verifizierung der Ultraschall-Prüfausrüstung - Teil 2: Prüfköpfe

This European Standard was approved by CEN on 16 April 2001.

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 Management Centre 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 Management Centre 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

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Contents

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 November 2001, and conflicting national standards shall be withdrawn at the latest by November 2001.

This standard consists of the following parts :

— *EN 12668-1, Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 1: Instruments*

— *EN 12668-2, Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 2: Probes*

— *EN 12668-3, Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 3: Combined equipment*

Annex A is normative. Annex B is informative.

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 European standard covers probes used for ultrasonic non-destructive examination in the following categories with centre frequencies in the range 0,5 MHz to 15 MHz, focusing and without focusing means:

a) single or dual transducer contact probes generating compressional or shear waves ;

b) immersion probes.

Where material dependent ultrasonic values are specified in this standard they are based on steels having an ultrasonic sound velocity of (5 920 ± 50) m/s for longitudinal waves, and (3 255 ± 30) m/s for transverse waves.

Periodic tests for probes are not included in this standard. Routine tests for the verification of probes using on-site methods are given in EN 12668-3.

If parameters in addition to those specified in EN 12668-3 are to be verified during the probe's life time, as agreed upon by the contracting parties, the methods of verification for these additional parameters should be selected from those given in this standard.

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 (including amendments).

EN 1330-4, *Non destructive testing - Terminology - Part 4 : Terms used in ultrasonic testing.*

EN 12223, *Non-destructive testing - Ultrasonic examination - Specification for calibration block No. 1.*

EN 12668-1, *Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 1 : Instruments.*

EN 12668-3, *Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 3 : Combined equipment.*

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

EN ISO 9001, *Quality systems - Model for quality assurance in design, development, production, installation and servicing (ISO 9001:1994).*

EN ISO 9002, *Quality systems - Model for quality assurance in production, installation and servicing (ISO 9002:1994).*

3 Terms, definitions, symbols and abbreviations

For the purposes of this European Standard the terms and definitions given in EN 1330-4 apply, together with the following terms and definitions.

3.1
dead zone
depth of the zone immediately beneath the coupling surface of the work piece, in which it is not possible to detect a given reflector

3.2
focal distance; (nearfield length)
point on the acoustical axis where the acoustic pressure is at its maximum

3.3
horizontal plane of a sound beam
with angle-beam probes the plane perpendicular to the vertical plane of sound beam including the acoustical axis in the material

3.4
operating frequency, f_o; (centre frequency)
in the frequency spectrum of an echo the upper and lower cut-off-frequencies are determined at -6 dB compared to the maximum amplitude. With these upper and lower frequencies f_u and f_l the centre frequency is calculated as :

$$f_o = \sqrt{f_u \cdot f_l}$$

3.5
peak-to-peak amplitude, h
maximum deviation between the largest positive and the largest negative cycles of the pulse (see Figure 1)

3.6
probe data sheet
sheet giving information on probe performance which accompanies each probe. The data sheet need not necessarily be a test certificate of individual probe performance

3.7
pulse duration
time interval over which the modulus of the unrectified pulse amplitude exceeds 10 % of its maximum amplitude, as shown in Figure 1

3.8
reference side
reference side is the right side of an angle beam probe looking in the direction of the beam, unless otherwise specified by the manufacturer

3.9
relative bandwidth, Δf_{rel}
ratio of the difference of the upper and lower cut-off frequencies f_u and f_l and the centre frequency f_o in percent

$$\Delta f_{rel} = [(f_u - f_l)/f_o] \times 100\ \%$$

3.10
squint angle for straight-beam probes, δ
deviation between the axis of the beam and a perpendicular to the coupling surface at the emission point (see Figure 2)

For angle-beam probes
angle between the sides of the probe housing and the measured beam axis, projected onto the plane of the probe face (see Figure 3)

3.11
transducer
element in the probe which transforms electrical oscillations to mechanical oscillations and vice versa, in most cases piezoelectric elements

3.12
vertical plane of a sound beam
with angle-beam probes the plane in which the sound beam axis in the probe wedge and the sound beam axis in the inspected component both lie

4 General requirements for compliance

A probe complies with this standard if it satisfies the following conditions:

a) the probe shall meet the technical requirements of this standard ;

b) the probe carries a unique serial number, showing operating frequency, transducer size, angle, and wave mode, or a permanent reference number from which this information can be traced ;

c) a data sheet is available for the appropriate type and series of probes which gives the performance in accordance with clause 5 of this standard.

The quality of probes will be assured in one of the following ways :

a) where a large number of identical probes are manufactured under a quality management system, e.g. EN ISO 9001 and EN ISO 9002, measurements are made on a statistically selected number of probes. The manufacturer supplies a data sheet which includes the values of the specified parameters with tolerances ;

b) by issuing a declaration of conformity quoting the results of measurements made on an individual probe. This is suitable where only a small number of probes of each type is manufactured or where probes are required for special applications.

5 Manufacturer's technical specification for probes

Table 1 gives the list of information to be reported by a manufacturer in a data sheet for all probes within the scope of this standard (I = Information, M = Measurement, C = Calculation). The data sheet shall also contain information concerning the instrument used for the test, its settings and coupling conditions etc.

The manufacturer shall also state the operating temperature range of the probe, and any special conditions for storage or protection during transport.

The supplier and the customer can agree where necessary to preclude some of the information and/or include some other details not included in Table 1.

For probes intended for use at elevated temperatures the manufacturer shall provide information on the maximum operating temperature in relation to the time of use, and the effect of temperature on the sensitivity and on the beam angle.

Table 1 — List of information to be given in a data sheet

Information to be given	Category of probe														
	Contact													Immersion	
	Straight beam					Angle beam								Straight	
	Compressional				Shear	Compressional				Shear				Compressional	
	Single		Double		Single	Single		Double		Single		Double		Single	
	non-f.	focus.	non-f.	focus.	non-f.	non-f.	focus.	non-f.	focus.	non-f.	focus.	non-f.	focus.	non-f.	focus.
Manufacturer's name	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Type of probe	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Weight & size of probe	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Type of connectors	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
TR connect. interchangeable			I	I				I	I			I	I		
Material of transducers	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Shape & size of transducers	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Material of wedge, delay	I	I	I	I		I	I	I	I	I	I	I	I		
Material of wear plate	I														
Wear allowance	I	I	I	I		I	I	I	I	I	I	I	I		

I = Information ;

M = Measurement ;

C = Calculation

continued

Table 1 *(continued)*

Parameters to be measured or calculated	Category of probe														
	Contact													Immersion	
	Straight beam					Angle beam								Straight	
	Compressional				Shear	Compressional				Shear				Compressional	
	Single		Double		Single	Single		Double		Single		Double		Single	
	non-f.	focus.	non-f.	focus.	non-f.	non-f.	focus.	non-f.	focus.	non-f.	focus.	non-f.	focus.	non-f.	focus.
Cross talk damping			M	M				M	M			M	M		
Pulse shape (time & frequency)	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Centre frequency, band width	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Pulse-echo sensitivity	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Distance-amplitude curve	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C
Impedance, static capacitance	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M

I = Information ;
M = Measurement ;
C = Calculation ;
M,C = Measurement or calculation

continued

Table 1 *(concluded)*

Parameters to be measured or calculated	Category of probe														
	Contact													Immersion	
	Straight beam					Angle beam								Straight	
	Compressional				Shear	Compressional				Shear				Compressional	
	Single		Double		Single	Single		Double		Single		Double		Single	
	non-f.	focus.	non-f.	focus.	non-f.	non-f.	focus.	non-f.	focus.	non-f.	focus.	non-f.	focus.	non-f.	focus.
Probe index						M	M	M	M	M	M	M	M		
Beam angle						M	M	M	M	M	M	M	M		
Angles of divergence	M				M	M				M				M	
Beam axis offset	M	M	M	M	M	M	M	M	M	M	M	M	M		
Squint angle	M	M	M	M	M	M	M	M	M	M	M	M	M		
Focal distance, nearfield	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C	M,C
Focal width	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Focal length	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Physical aspects	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M

I = Information ;

M = Measurement ;

C = Calculation ;

M,C = Measurement or calculation

Non-f. = non-focusing