

# Non-destructive testing — Ultrasonic examination — Specification for calibration block No.1

The European Standard EN 12223:1999 has the status of a  
British Standard

ICS 19.100

# National foreword

This British Standard is the official English language version of EN 12223:1999. Together with BS EN 27963:1992 it supersedes BS 2704:1978 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee WEE/46, Non-destructive testing, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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## Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 10, an inside back cover and a back cover.

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**Non-destructive testing – Ultrasonic examination – Specification  
for calibration block No. 1**

Essais non destructifs - Contrôle par ultrasons -  
Spécifications relatives au bloc d'étalonnage n° 1

Zerstörungsfreie Prüfung - Ultraschallprüfung -  
Beschreibung des Kalibrierkörpers Nr 1

This European Standard was approved by CEN on 29 October 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.



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 June 2000, and conflicting national standards shall be withdrawn at the latest by June 2000.

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 specifies requirements for the dimensions, material and manufacture of a steel block for calibrating ultrasonic flaw detection and inspection equipment used in manual testing. The calibration block dealt with in this standard is identified as calibration block No. 1 to distinguish it from other calibration blocks.

## 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.

prEN 1330-4:1999, *Non-destructive testing - Terminology - Part 4 : Terms used in ultrasonic testing*.

EN 10025+A1, *Hot rolled products of non-alloy structural steels - Technical delivery conditions (Includes amendment A1:1993)*.

## 3 Terms and definitions

For this standard the definitions given in prEN 1330-4:1999 apply.

## 4 Manufacture

### 4.1 Steel

Blocks shall be manufactured from steel grade S355JO specified in EN 10025 +A1.

### 4.2 Dimensions

The dimensions of calibration block No. 1 shall be as shown in figure 1.

NOTE This standard does not include any requirement for a plastics insert.

### 4.3 Machining, heat treatment and surface finish

Blocks shall be rough-machined to a dimension of 320 mm x 120 mm x 30 mm before heat treatment which shall consist of:

- austenitizing at 920 °C for 30 min;
- rapid cooling (quenching) in water;
- tempering by heating to 650 °C for 3 h; and then
- cooling in air.

All external surfaces shall be machined to an  $R_a$  value not greater than 0,8  $\mu\text{m}$ . It is permissible to chromium plate or electroless nickel plate the surfaces of the block.

NOTE If chromium plating is used, care should be taken to use a thickness of plating that will avoid separation.

Prior to final machining, the block shall be proved free from internal discontinuities. For this purpose, an ultrasonic examination shall be carried out after the heat treatment, with a compressional wave probe of at least 10 MHz frequency and having a crystal size of 10 mm to 15 mm. The block shall be checked on the basis of all four long faces to cover the complete volume. With the probe positioned on the largest face of the block, the equipment gain shall be set to achieve a grain scatter noise of 10 % of the screen height. No echo shall have an amplitude greater than that of the grain scatter noise.

#### 4.4 Reference marks

Reference marks shall be permanently marked as shown in figure 1 and in table 1.

### 5 Velocities

The velocities shall be measured as described in Annex A. The velocities shall be measured within a tolerance of  $\pm 0,2$  %, i.e. with an uncertainty of  $\pm 6$  m/s for transverse waves and  $\pm 12$  m/s for compressional waves.

The measured longitudinal wave velocity,  $v_l$ , shall be  $5\,920\text{ m/s} \pm 30\text{ m/s}$  and the transverse wave velocity,  $v_t$ , shall be  $3\,255\text{ m/s} \pm 15\text{ m/s}$ .

### 6 Marking

The block shall be permanently marked in the area shown in figure 1, as follows:

- EN 12223;
- manufacturer's serial number and trade mark.

### 7 Certificate

A certificate shall be issued by the manufacturer for each block, detailing:

- statement that the block complies with EN 12223;
- the mean value of the measured longitudinal wave velocities,  $v_l$ ; see clause 5;
- the mean value of the measured transverse wave velocities,  $v_t$ ; see clause 5.

### 8 Possible modifications to block no. 1

#### 8.1 General

If required the modifications in 8.2 to 8.4 may be made to the block.

#### 8.2 Slots at zero point

One or two slots at the zero point can be provided, see figure 2, which will give calibrating signals at intervals of 100 mm.



### 8.3 Alternative reflector

An alternative reflector, in the form of a circular arc and accessible from the longer sides of the block, can be provided, see figure 3. This will give calibrating signals at beam path lengths of 25 mm, 225 mm, 350 mm, etc.

### 8.4 Greater block thicknesses

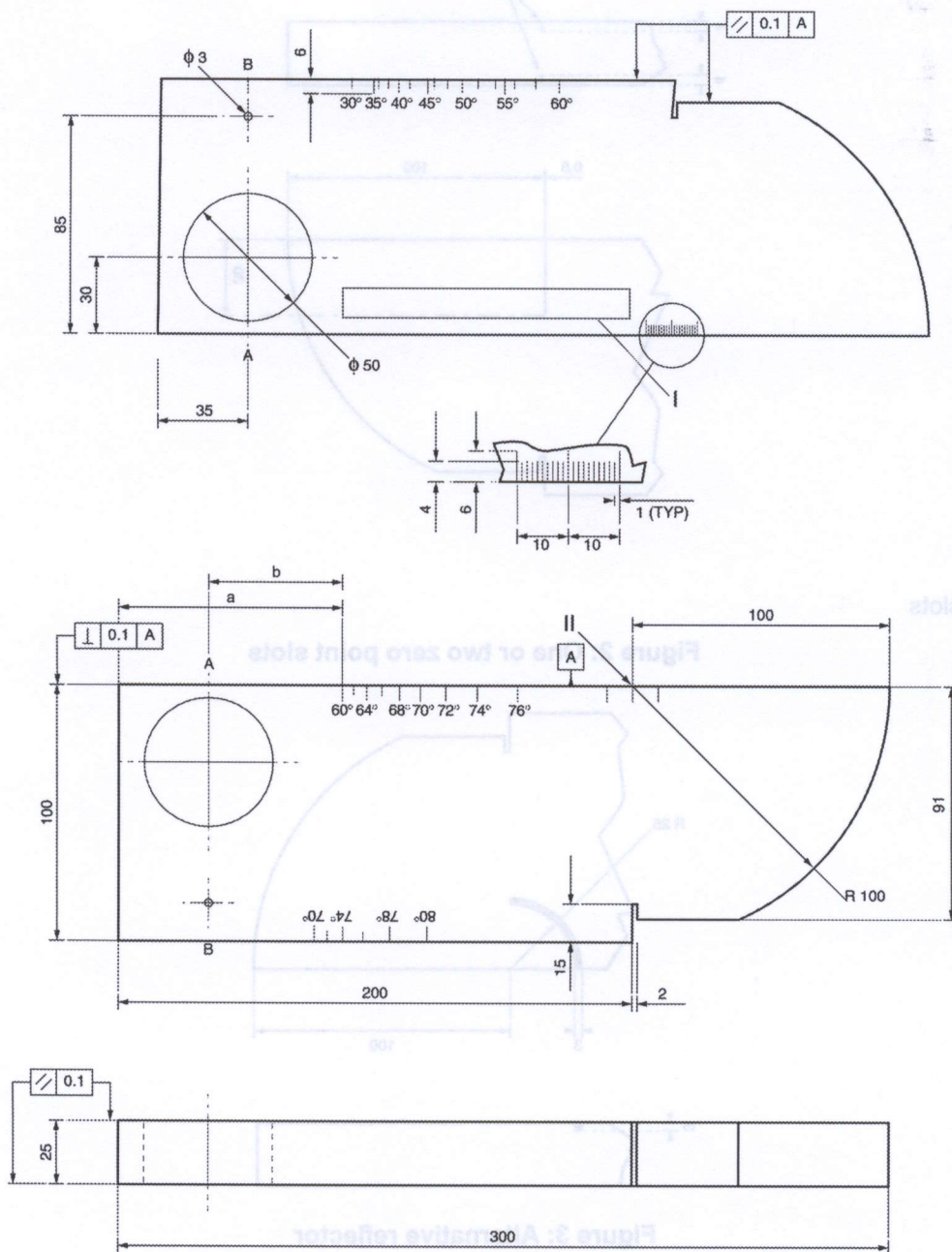
Blocks with greater thicknesses are permitted.

## 9 Existing blocks manufactured to other standards or specifications

Existing blocks fulfil the requirements of this standard provided that they meet the requirements on velocities (see clause 5) and dimensions (see 4.2) with the exception that the small drill hole may have a diameter of 1,5 mm.

After verification of the above parameters these blocks shall be marked in accordance with clause 6.



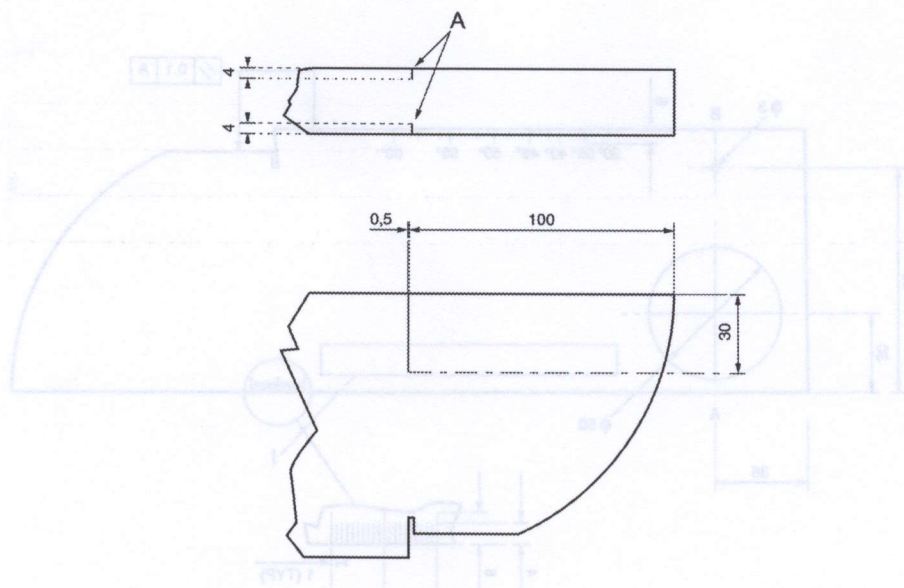


## Key

- I Area for marking
- II Zero point

NOTE : Tolerances unless otherwise stated  $\pm 0,10$  mm. Angle identification and index mark lengths  $\pm 0,4$  mm. Angle indents should be in 5 mm high characters. Surface finish  $0,8 \mu\text{m}$  all over.

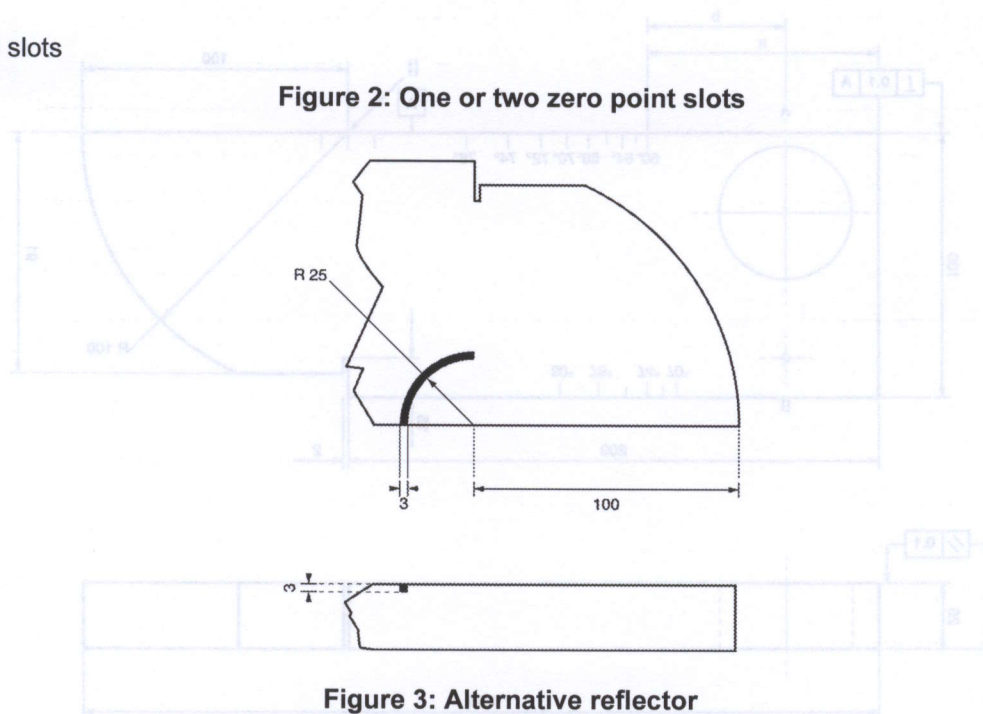
### Figure 1: Block dimensions



**Key**

A Machined slots

**Figure 2: One or two zero point slots**



**Figure 3: Alternative reflector**

Key  
I Area for marking  
II Zero point

NOTE: Tolerances unless otherwise stated  $\pm 0.10$  mm. Angle identification and index mark lengths  $\pm 0.4$  mm. Angle tolerance should be in 5 mm high characters. Surface finish 0.8  $\mu$ m all over.

**Figure 1: Block dimensions**



Table 1 – Indent distance

Distance <i>b</i> from hole A in mm	Distance <i>a</i> from the edge in mm	Indent with label	Indent without label
52,0	87,0	60 °	
56,4	91,4		62 °
61,5	96,5	64 °	
67,4	102,4		66 °
74,3	109,3	68 °	
82,4	117,4	70 °	
92,3	127,3	72 °	
104,6	139,6	74 °	
120,3	155,3	76 °	
Distance <i>b</i> from hole B in mm	Distance <i>a</i> from the edge in mm	Indent with label	Indent without label
41,2	76,2	70 °	
46,2	81,2		72 °
52,3	87,3	74 °	
60,2	95,2		76 °
70,6	105,6	78 °	
85,1	120,1	80 °	
Distance <i>b</i> from hole A in mm	Distance <i>a</i> from the edge in mm	Indent with label	Indent without label
40,4	75,4	30 °	
49,0	84,0	35 °	
50,9	85,9		36 °
56,7	91,7		39 °
58,7	93,7	40 °	
63,0	98,0		42 °
67,6	102,6		44 °
70,0	105,0	45 °	
72,5	107,5		46 °
77,7	112,7		48 °
83,4	118,4	50 °	
89,6	124,6		52 °
96,3	131,3		54 °
100,0	135,0	55 °	
103,8	138,8		56 °
112,0	147,0		58 °
121,2	156,2	60 °	



## Annex A (normative)

### Measurement of velocities

#### A.1 General

This method first measures the physical dimensions to an accuracy of 0,01 mm. The areas to be used are checked to ensure that there are no variations in thickness greater than 0,01 mm over the area of the probe face. An apparatus in conjunction with a straight beam probe is then used to measure the time-of-flight (to an accuracy in the measurement of time difference of 0,2 %). Velocities are then calculated (i.e. path/time)<sup>1)</sup>. The time-of-flight is measured in different directions, i.e. at two well separated positions through the 25 mm thickness (one at the quadrant and one close to the large hole) and one position through the 100 mm thickness. The measurements shall be carried out at ambient temperature.

#### A.2 Longitudinal waves

Use a probe with frequency of at least 5 MHz, broadband pulse and having a crystal size of 10 mm to 15 mm diameter. Measure the time difference between the first and second backwall echoes.

#### A.3 Transverse waves

For all directions, use a 0° shear wave probe of frequency of 4 MHz to 5 MHz, broadband pulse, and having a crystal size of 10 mm to 15 mm diameter. Measure the time difference between the first and second backwall echoes.

Because shear waves are polarized, in each location of the probe make two measurements with the plane of polarization in the second measurement perpendicular to the first measurement and parallel to one side of the block. Therefore for each calibration block there are at least six values for shear wave velocity.

1)  $1 \text{ mm}/\mu\text{s} = 1 \times 10^3 \text{ m/s}$ .