INTERNATIONAL STANDARD

ISO 2400

Second edition
2012-09-15

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

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

Reference number
ISO 2400:2012(E)

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Published in Switzerland

Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 2400 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 138, *Non-destructive testing*, in collaboration with Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 3, *Ultrasonic testing*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 2400:1972), which has been technically revised.

Changes from the first edition include the addition of:

— a new clause on manufacture of the block;

— a new clause on sound velocities;

— a new clause on marking and certification of the blocks;

— a new clause on possible modifications to block No. 1;

— a new clause on the use of existing blocks;

— a normative annex on the determination of velocities.

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

1 Scope

This International Standard specifies requirements for the dimensions, material and manufacture of a steel block for calibrating ultrasonic test equipment used in manual testing.

2 Normative references

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

ISO 5577, *Non-destructive testing — Ultrasonic inspection — Vocabulary*

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

EN 10025-2, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5577 and EN 1330-4 apply.

4 Manufacture

4.1 Steel

Blocks shall be manufactured from steel grade S355J0, specified in EN 10025-2, or from steel of an equivalent grade.

4.2 Dimensions

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

NOTE This International Standard does not include any requirement for a plastic insert.

4.3 Machining, heat treatment and surface finish

Blocks shall be rough-machined to a dimension of 320 mm × 120 mm × 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;

— cooling in still air.

All external surfaces shall be machined to an Ra value not greater than 0,8 µm.

Prior to final machining, the block shall be proven to be free from internal discontinuities. For this purpose, an ultrasonic examination shall be carried out after the heat treatment, with a longitudinal wave probe of at least 10 MHz nominal centre frequency and having a transducer 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 Table 1.

5 Velocities

The velocities of longitudinal and transverse waves shall be determined as specified in Annex A. The velocities shall be determined within a maximum permissible error of ±0,2 %, i.e. with an uncertainty of ±6 m/s for transverse waves and ±12 m/s for longitudinal waves.

The determined longitudinal wave velocity, v_l, shall be 5 920 m/s ± 30 m/s and the transverse wave velocity, v_t, shall be 3 255 m/s ± 15 m/s.

6 Marking

The block shall be permanently marked, in the area shown in Figure 1, with:

a) the number of this International Standard, i.e. ISO 2400;

b) the manufacturer's serial number and trade mark.

7 Declaration of conformity

A declaration shall be issued by the manufacturer for each block, containing:

a) a statement that the block complies with this International Standard, i.e. ISO 2400;

b) the mean value of the determined longitudinal wave velocities, v_l; see Clause 5;

c) the mean value of the determined transverse wave velocities, v_t; see Clause 5.

8 Possible modifications to block No. 1

8.1 General

One of the modifications in 8.2 or 8.3 shall be made to the block.

8.2 Slots at zero point

If this modification is chosen, two slots at the zero point shall be machined (see Figure 2), which for angle beam probes provide calibrating signals at intervals of 100 mm.

8.3 Circular reflector

If this modification is chosen, a circular arc reflector accessible from the longer sides of the block shall be machined, see Figure 3. For angle beam probes, this provides calibrating signals at beam path lengths of 25 mm, 225 mm, 350 mm, etc.

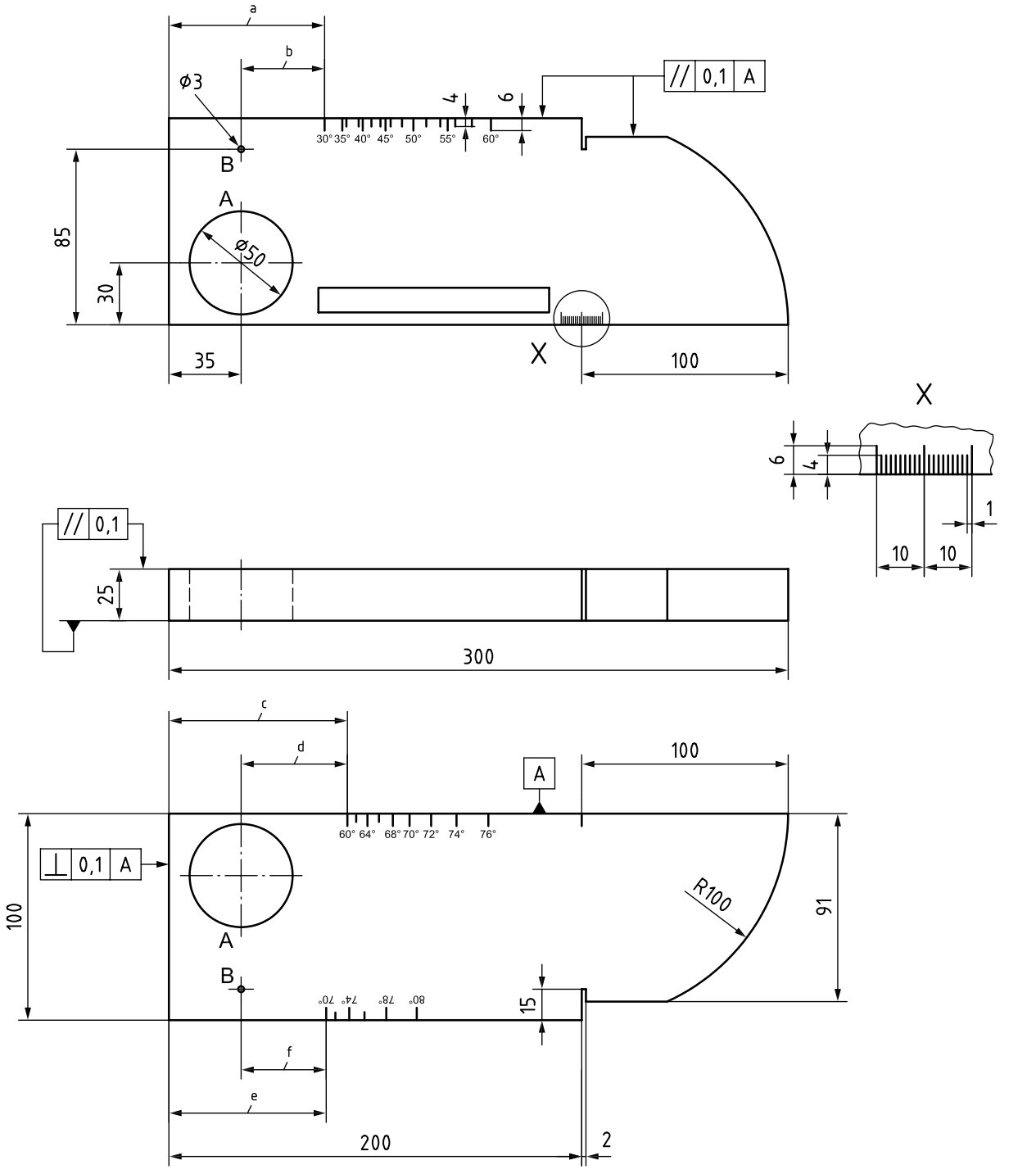
8.4 Block thickness

Thicker blocks are permitted.

9 Existing blocks

Existing blocks fulfil the requirements of this International Standard provided that they meet the requirements on velocities (see Clause 5) and dimensions (see 4.2) with the exception that the small side-drilled hole may have a diameter of 1,5 mm.

Dimensions in millimetres



Tolerances, unless otherwise stated	±0,10 mm	Height of characters for angle indents	5 mm
Angle identification and index mark lengths	±0,4 mm	Surface finish, all over	$Ra \leq 0{,}8$ µm

Figure 1 — Block dimensions with tolerances

Table 1 — Indent distance

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

Dimensions in millimetres

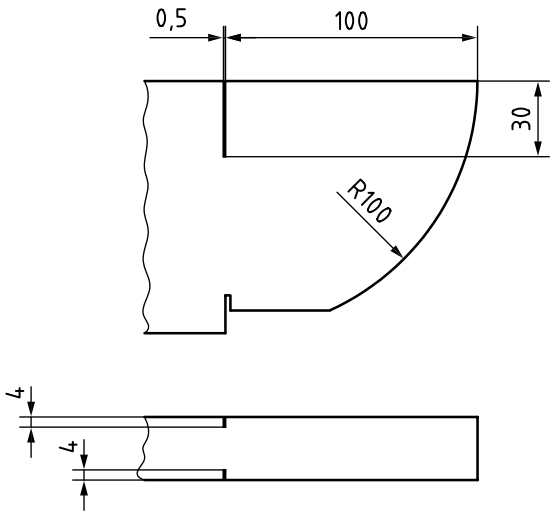


Figure 2 — Two zero-point slots

Dimensions in millimetres

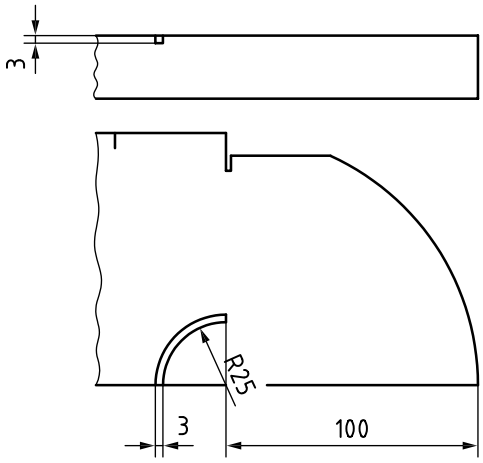


Figure 3 — Circular reflector

Annex A
(normative)

Determination of velocities

A.1 General

This method first measures the physical dimensions of the block to an uncertainty 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 instrument 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 (path over time)[1)]. 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 at one position through the 100 mm thickness. The measurements shall be carried out within the temperature range 17 °C to 23 °C.

A.2 Longitudinal waves

Use a probe with a nominal centre frequency of at least 5 MHz, broadband pulse and a transducer size of 10 mm to 15 mm in diameter. Measure the time difference between the first and second backwall echo.

A.3 Transverse waves

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

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

1) 1 mm/µs ≡ 1 000 m/s

ICS 25.160.40

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