INTERNATIONAL STANDARD

ISO 7963

Second edition
2006-09-15

Non-destructive testing — Ultrasonic testing — Specification for calibration block No. 2

Essais non destructifs — Contrôle par ultrasons — Spécifications relatives au bloc d'étalonnage n° 2

Reference number
ISO 7963:2006(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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.

ISO 7963 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 5, *Testing and inspection of welds*.

This second edition cancels and replaces the first edition (ISO 7963:1985), which has been technically revised.

Introduction

Calibration block No. 2 differs in size and shape from that described in ISO 2400.

Calibration block No. 2 is very much smaller and lighter, and its geometry is much simpler.

Calibration block No. 2 does not offer as much scope as the larger block; in particular it is not meant to check an ultrasonic flaw detector completely.

However, calibration block No. 2 makes it possible, during practical testing, to check simply, from time to time, the setting of the time base and the sensitivity of the ultrasonic equipment. Moreover, it is suited to checking the beam angle and the probe index of miniature angle-beam probes.

NOTE Calibration block No. 1 is currently specified in EN 12223.

Requests for official interpretations of any aspect of this International Standard should be directed to the Secretariat of ISO/TC 44/SC 5 via your national standards body, a complete listing which can be found at www.iso.org.

Non-destructive testing — Ultrasonic testing — Specification for calibration block No. 2

1 Scope

This International Standard specifies the dimensions, material, manufacture and methods of use for calibration block No. 2 for calibrating and checking ultrasonic testing equipment.

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 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

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

EN 10025-1, *Hot rolled products of structural steels — Part 1: General technical delivery conditions*

3 Terms and definitions

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

4 Dimensions

The dimensions of the block are given in Figure 1.

The tolerances are $\pm$ 0,1 mm, except on the length of the engraved scale where it is $\pm$ 0,5 mm.

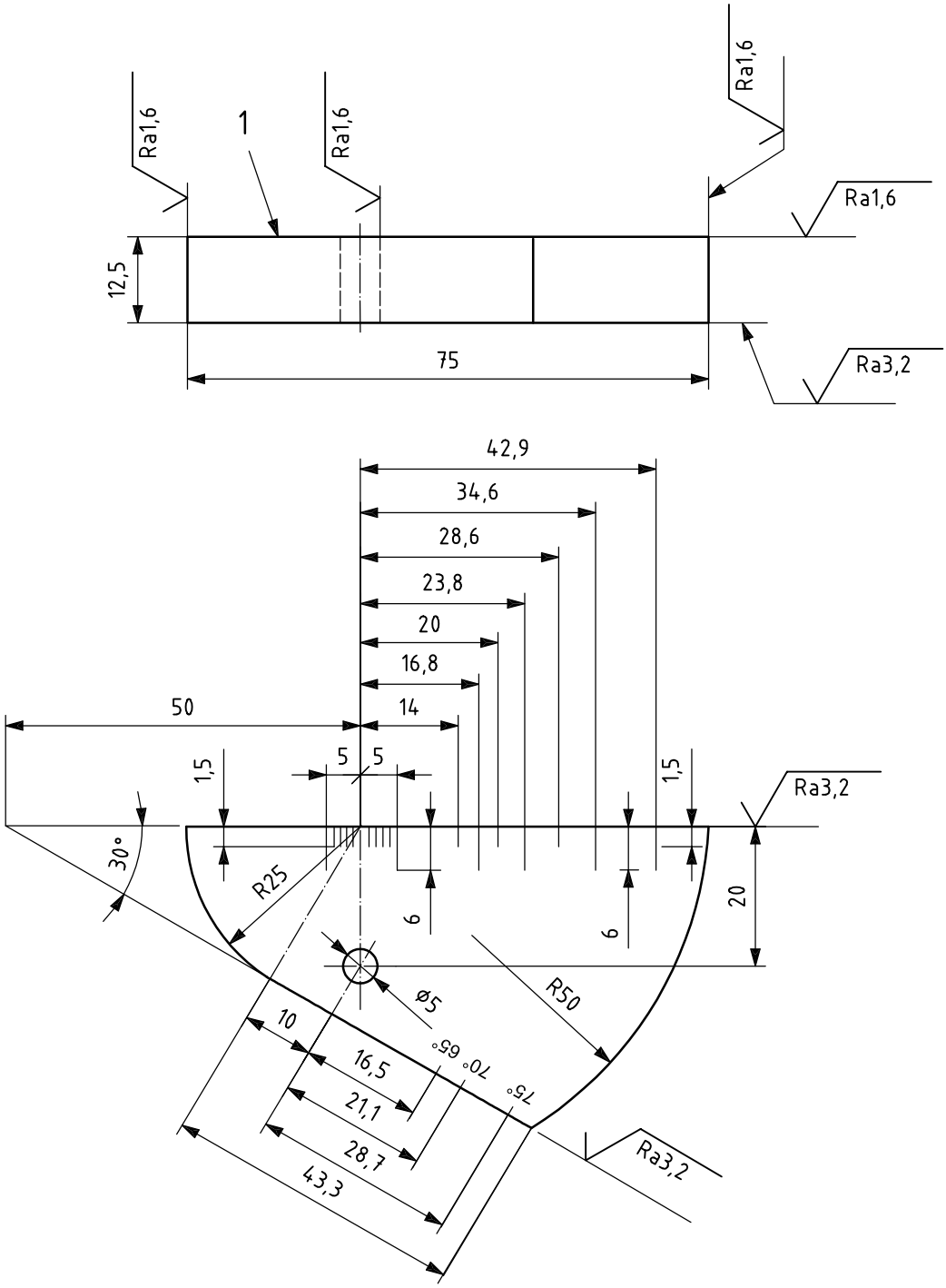
Average surface roughness values, Ra, are defined in accordance with ISO 4287.

The thickness of the block can be greater than 12,5 mm (see A.1).

5 Material

The calibration block shall be made of steel of grade S355JO in accordance with EN 10025-1 or equivalent.

Dimensions in millimetres,
surface roughness in micrometres



Key

1 reflection surface

Figure 1 — Calibration block No. 2 for ultrasonic testing — Dimensions of block and scales

6 Preparation

The calibration block shall be homogeneous and free from defects revealed by ultrasonic testing (see A.2).

In order to obtain a fine grain structure and good homogeneity, before final machining the block shall be heat treated as follows:

a) maintain at 920 °C for 30 min with water-quenching;

b) reheating to 650 °C for at least 2 h with cooling in still air.

After heat treatment, and prior to machining, the block shall undergo further ultrasonic testing from two different directions at right angles to each other and in the direction of rolling.

At least 2 mm shall be removed from all surfaces after heat treatment. All dimensions and surface finishes shall be in accordance with Figure 1.

In order to prevent parasitic effects, the depth of the marks of the engraved scale shall be 0,1 mm ± 0,05 mm. The length of the marks shall be 6 mm and the tolerance on the positioning of the marks shall be ± 0,2 mm.

On completion of machining, a final ultrasonic testing shall be carried out.

The velocity of longitudinal waves shall be verified as being 5 920 m/s ± 30 m/s and the velocity of transverse waves shall be verified as being 3 255 m/s ± 15 m/s.

7 Marking

Reference marks on block No. 2 shall be permanently marked as shown in Figure 1.

Additionally the block shall be permanently marked with

— the manufacturer's trade mark,

— the number of this International Standard, and

— a unique serial number.

8 Method of use

8.1 Setting of the time base

To set the time base, the leading edge (left side) of successive echoes shall be adjusted to coincide with the appropriate scale markings on the screen of the measuring equipment.

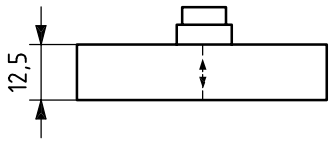
The pulse-travel time depends on the velocity of ultrasonic waves in the material examined.

8.1.1 Calibration of the time base up to 250 mm with a straight beam probe

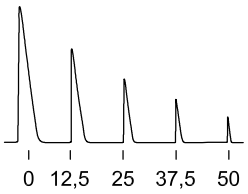
The position of the probe on the reflective side of the calibration block shall be as indicated in Figure 2a). Figure 2b) is a schematic representation of the screen (A-scan) of the instrument for calibration of a range of 50 mm.

NOTE Depending on the probe and the frequency used, difficulties can arise when calibrating distances greater than 10 times the thickness of the block.

Dimensions in millimetres



a) Position of probe on the calibration block



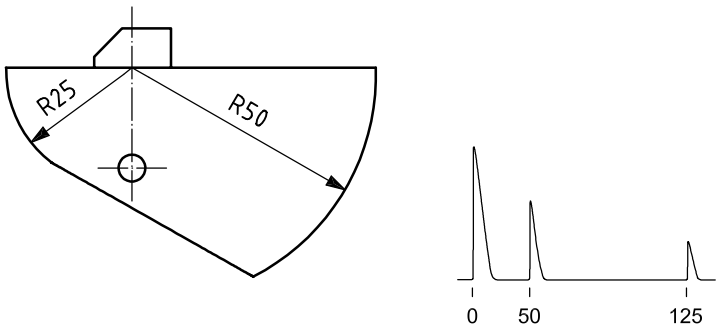
b) Schematic representation of the A-scan for calibration of a range of 50 mm

Figure 2 — Calibration of time base up to 250mm with a straight-beam probe

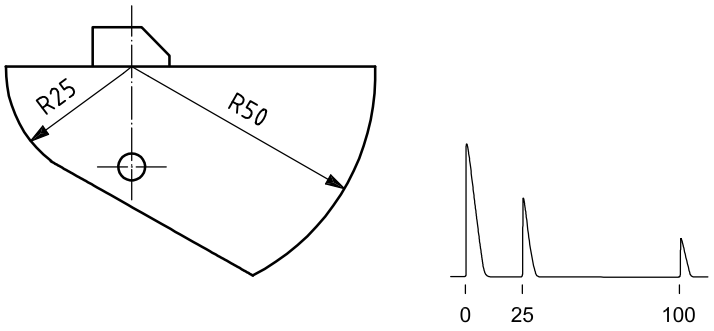
8.1.2 Calibration of the time base for 100 mm or 125 mm with a miniature angle-beam probe

The position of the miniature shear-wave probe on the calibration block shall be as shown in Figure 3a) for a distance of 125 mm and in Figure 3b) for a distance of 100 mm. The screen of the instrument for the calibration of these two ranges is shown schematically in Figures 3a) and 3b).

Dimensions in millimetres



a) For a range of 125 mm



b) For a range of 100 mm

Figure 3 — Position of miniature shear-wave probe on the calibration block

8.2 Sensitivity setting and probe checking

8.2.1 General

A large number of factors can influence the sensitivity setting (see A.3).

8.2.2 Longitudinal-wave probes — Sensitivity setting

The probe shall be placed in position “a” as indicated in Figure 4.

The A-scan representing the successive echoes shall be used as a reference for setting sensitivity.

The reflection from the 5 mm diameter hole, position “b” in Figure 4 may also be used, the probe being placed so that the corresponding echo amplitude is at its maximum.

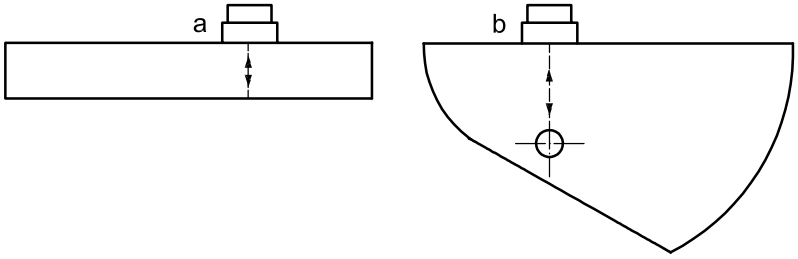


Figure 4 — Straight-beam probes — Sensitivity setting

8.2.3 Miniature shear-wave probes

8.2.3.1 Sensitivity setting

The maximum echo from the 5 mm diameter hole shall be used as a reference for setting sensitivity (see Figure 5, position “a”).

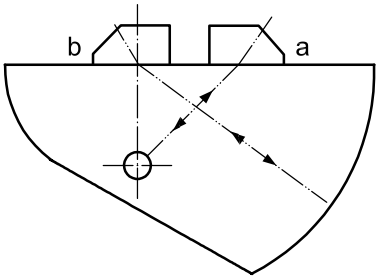


Figure 5 — Miniature angle-beam probes — Sensitivity setting

Alternatively, it is possible to make use of the reflections from the cylindrical surfaces of radii 50 mm and 25 mm, respectively.

In this case, there are two possibilities:

a) by using a calibrated gain control, the amplitude of the echo from the cylindrical surface is initially set to 80 % of screen height and subsequently adjusted to the level desired (see Figure 5, position “b”);

b) without the use of a calibrated gain control, the successive echoes from the cylindrical surfaces can be used for the adjustment of sensitivity (see Figure 6).

When checking probes, the acoustic coupling is an important factor, and when comparing probes, the same coupling medium shall be used.

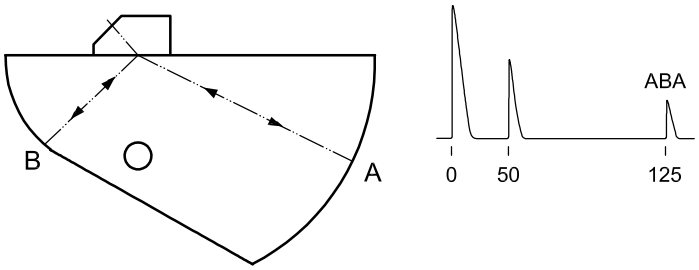


Figure 6 — Miniature angle-beam probes — Sensitivity setting without calibrated gain control

8.2.3.2 Determination of the position of the probe index

The miniature angle-beam probe shall be positioned as shown in Figures 3a) or 3b) and moved parallel to the main faces of the calibration block until the amplitude of the echo from the cylindrical surface has reached its maximum.

The probe index coincides with the centre mark of the millimetre scale of the block.

8.2.3.3 Determination of beam angle

The echo obtained from the 5 mm diameter hole is used to determine the beam angle.

The miniature shear-wave probe shall be moved parallel along the main faces of the calibration block until the amplitude of the echo from the 5 mm diameter hole has reached its maximum.

The beam angle is obtained either by direct reading of the scale engraved on the calibration block, coinciding with the index mark of the probe, or by interpolation if the position found does not coincide with one of the scale lines.

The positions shown in Figure 7 make it possible to check beam angles of 45°, 60° and 70° probes.

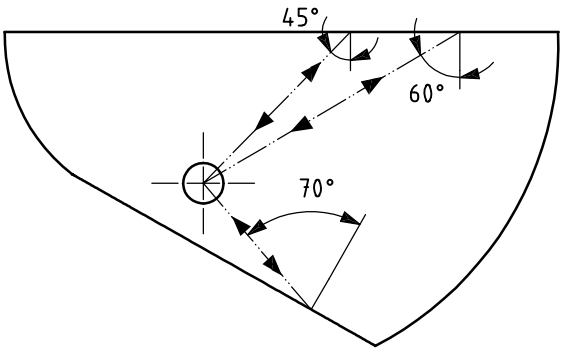


Figure 7 — Miniature angle-beam probes — Determination of beam angle

9 Certificate

For each block, a certificate shall be issued by the manufacturer stating:

a) that the block complies with this International Standard (ISO 7963);

b) the mean value of the measured longitudinal wave velocities, v_l;

c) the mean value of the measured transverse wave velocities, v_t.

Annex A
(normative)

Calibration block characteristics and use

A.1 Thickness of the block for calibration of “non-miniature” probes

A thicker block may be used, for example 20 mm or 25 mm thick, when using non-miniature probes.

A.2 Ultrasonic inspection of material before and after final machining

Two inspections with a longitudinal-wave probe (transducer diameter 10 mm; frequency 6 MHz) are recommended:

a) with the probe positioned as shown in Figure 2a), the amplitude of the fourth back echo shall be greater than the noise level produced by the grain structure when the latter is increased by at least 50 dB;

b) no echo arising from any defect in the homogeneity of the material shall have an amplitude greater than the grain scatter noise level.

A.3 Factors to be taken into consideration for the setting of sensitivity

The following factors, divided into four main groups, should be taken into account when setting the sensitivity:

a) equipment: pulse energy, frequency, pulse shape, amplification, etc.;

b) probe used: type, size, acoustic impedance, transducer damping, polar diagram, etc.;

c) material to be examined: surface condition (in connection with coupling), kind of material (its absorption), etc.;

d) defect analysis: shape, orientation, nature, etc.

Bibliography

[1] ISO 2400, *Welds in steel — Reference block for the calibration of equipment for ultrasonic examination*

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

ICS 25.160.40

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