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Specification for

Calibration blocks for use in ultrasonic flaw detection

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British Non-ferrous Metals Federation	United Kingdom Atomic Energy Authority
Institute of Physics	Welding Institute

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Foreword

This British Standard, which is a revision of the 1966 edition of BS 2704, has been prepared under the direction of the Mechanical Engineering Standards Committee. The purpose of the standard is essentially to provide a range of suitable blocks by which, used singly or in combination, the overall characteristics of ultrasonic flaw detection equipment can be calibrated and verified.

As compared with the previous edition, it has been decided to exclude the original type A1 calibration block, as this is no longer used for checking ultrasonic flaw detection equipment employing shear wave probes, and also the block previously designated A3, developed in Switzerland, which has not come into general use in the United Kingdom.

The internationally established A2 block has been retained and a miniature block, based on that developed by the International Institute of Welding, has been introduced together with a further three blocks, the uses of which are featured in BS 4331-3.

Whereas the former edition of this standard also gave recommendations for the use of calibration blocks in ultrasonic flaw detection, it has been decided to confine this edition to a specification for the blocks only as their application for calibrating various characteristics of flaw detection equipment is covered in detail in the appropriate Parts of BS 4331.

It should be noted that the blocks described in this standard do not apply to apparatus intended for medical or biological use in which particular considerations arise.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

1.1 This British Standard describes the dimensions, materials and manufacture of steel blocks for calibrating ultrasonic flaw detection equipment used in manual testing.

1.2 The blocks described may be selected, as appropriate, for the checking of flaw detection equipment under either laboratory conditions or on site conditions (see BS 4331-1 and BS 4331-3).

1.3 Recommendations concerning the manufacture of calibration blocks for special purposes are given in Appendix A.

2 References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3 Dimensions and tolerances

3.1 Dimensions. The dimensions of calibration blocks shall conform to those given in Figure 1 to Figure 7 inclusive. (If block A2 is modified in either of the ways described in clause 7, its dimensions shall conform to those given in Figure 2 or Figure 3 respectively.) For rectangular blocks, the longer opposing faces shall be parallel within ± 0.10 mm and the adjacent faces shall be perpendicular to within $\pm 5'$ of arc.

3.2 Tolerances. Wherever practicable, the limits on dimensions shall be held to ± 0.10 mm.

3.3 Reference marks (A2 block). The shorter of the two longer edges of the A2 block shall be provided with engraved reference marks denoting the positions of the probe index for the 35°, 40°, 45°, 50°, 55° and 60° positions relative to the polymethylmethacrylate insert.

The longer edge shall be engraved to mark the probe index positions for the 60°, 70° and 80° positions relative to the insert, and the index for range setting when using the 100 mm radius.

NOTE In addition to the above, intermediate reference marks are recommended and may be provided by agreement between the purchaser and the manufacturer.

4 Materials

4.1 Steel. Blocks shall be manufactured from low- or medium-carbon ferritic steel (killed), normalized to produce a fine-grained structure and homogeneous throughout. Steels complying with the requirements up to and including 060A37 Section 2 of BS 970-1:1972 are generally suitable.

4.2 General. In addition to freedom from internal flaws, the material selected shall be free from undesirable metallurgical features such as coarse grain or pronounced rolling or casting structure.

5 Machining, heat treatment and surface texture

Blocks shall be rough-machined before heat treatment, which shall consist of normalizing only. Processes for surface hardening shall not be employed. Final preparation shall be by light grinding, but burnishing of the surfaces is not permitted. The surface of the faces and edges shall generally be machined to an R_a value not greater than $0.8 \mu\text{m}$ (see BS 1134).

6 Test for attenuation

This shall be carried out on the blank after heat treatment, using compressional waves. There will be unavoidable fluctuations of signal height, even with a good surface finish, of the order of 1 dB. Blanks may be accepted for finish machining provided the local variations of attenuation do not exceed $\pm (1 \text{ dB} + 0.02 \text{ dB/mm of block dimension})$ when tested with compressional waves in the frequency range 4 MHz to 6 MHz inclusive.

7 Modifications to blocks A2 and A4

7.1 Block A2. Whilst the basic dimensions of block A2 conform with ISO 2400, the following modifications, if required, may be made to the block. These modifications enable the scale calibration, including the transmission point of shear wave probes, to be carried out in one operation.

7.1.1 Slots at zero point. Two slots at zero point may be provided, see Figure 2, which will give calibrating signals at intervals of 100 mm range.

NOTE The A2 block with this modification is the subject of the German standard DIN 54-120¹⁾.

7.1.2 Alternative reflector. An alternative reflector, in the form of a circular arc and accessible from the longer sides of the block, may be provided, see Figure 3. This will give calibrating signals at intervals of 100 mm and 225 mm range.

NOTE The A2 block with this modification is the subject of the Netherlands standard NEN 2510²⁾.

7.2 Block A4. The thickness of block A4 may be either 12.5 mm or 20 mm and the target hole may have a diameter of either 1.5 mm or 5 mm. Blocks having a thickness of 20 mm and a target hole of 1.5 mm diameter are generally preferred.

¹⁾ DIN 54-120 Non-destructive testing; calibration block 1 and its use for the adjustment and control of ultrasonic echo equipment.

²⁾ NEN 2510 Calibration block 1 for the ultrasonic testing of materials.