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**Non-destructive testing — Ultrasonic
testing — Specification for step wedge
calibration block**

*Essais non destructifs — Essais par ultrasons — Spécifications
relatives aux blocs d'étalonnage à gradins*



Reference number
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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html

This document was prepared by Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 3, *Ultrasonic testing*.

This second edition cancels and replaces the first edition (ISO 16946:2015), of which it constitutes a minor revision with the following changes:

- a) the normative references have been updated;
- b) [Figure 1](#) has been updated in respect of the tolerances for length and width.

Introduction

A step wedge calibration block is not meant to check an ultrasonic instrument. A step wedge calibration block 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.

Calibration block No. 1 is specified in ISO 2400.

Calibration block No. 2 is specified in ISO 7963.

Requests for official interpretations of any aspect of this document are to be directed to the Secretariat of ISO/TC 135/SC 3 via your national standards body, a complete listing of which can be found at www.iso.org.

Non-destructive testing — Ultrasonic testing — Specification for step wedge calibration block

1 Scope

This document specifies the dimensions, material, and manufacture of a step wedge steel block for the calibration of ultrasonic instruments.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Dimensions

The dimensions of the block are given in [Figure 1](#).

The tolerances are $\pm 0,1$ mm for the length and the width of the block and $-0,02$ mm for the step thickness.

All external surfaces shall be machined to an Ra value not greater than $0,8 \mu\text{m}$.

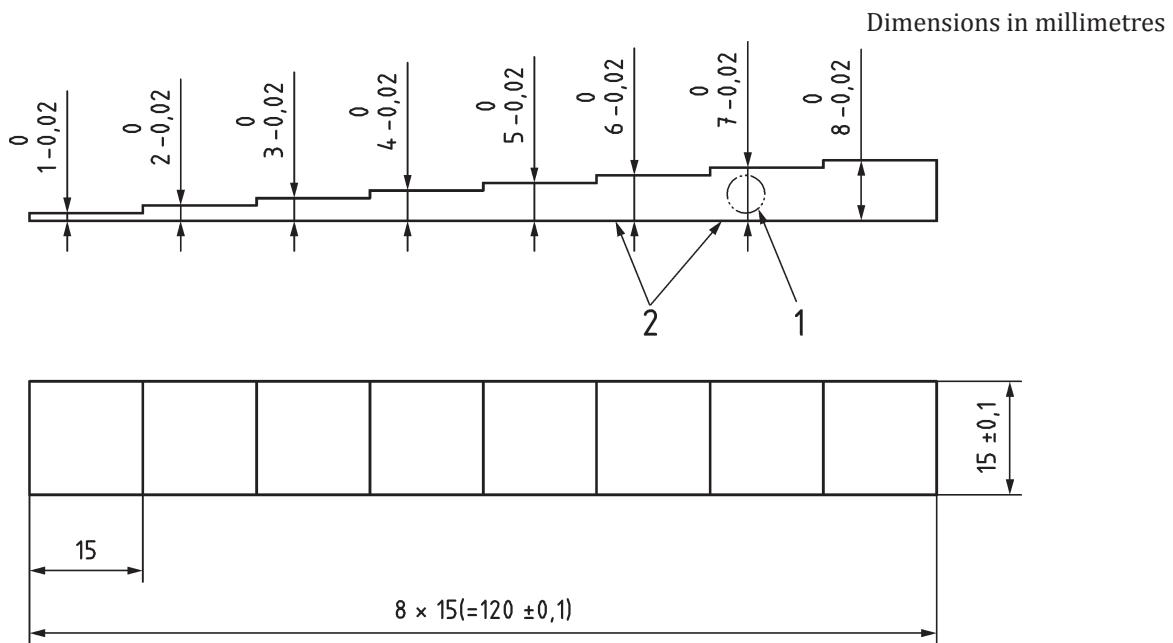


Figure 1 — Step wedge calibration block

5 Alternative dimensions

In the event of a different size of calibration block being required which is not described in this document, the principles embodied in the design and manufacture of a calibration block to the requirements of this document shall be applied to such a block.

The tolerances are $\pm 0,1$ mm for the length and the width of the block and $-0,02$ mm for the step thickness up to 12,5 mm and $-0,1$ mm for larger thickness.

6 Material

The calibration block shall be made from steel of grade S355J0 in accordance with EN 10025-2 or from an equivalent steel grade.

7 Preparation

Blocks shall be rough-machined to a plan parallel plate which is at least 3 mm larger at all sides than the dimensions of the finalized step block.

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

- a) maintain at 920 °C for 30 min;
- b) rapid cooling (quenching) in water;
- c) tempering by heating to 650 °C for at least 3 h;
- d) cooling in still air.

After heat treatment, at least 2 mm shall be removed from all surfaces.

Prior to final machining, the block shall undergo ultrasonic testing to prove that the block is free from internal discontinuities.

For this purpose, an ultrasonic test shall be performed with a longitudinal wave normal-beam 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 from at least two long surfaces to cover the complete volume. The following two acceptance criteria apply:

- 1) with the probe scanning as shown in [Figure 2](#), the noise level produced by the grain structure shall always be at least 50 dB lower than the amplitude of the fourth back wall echo;
- 2) no echo arising from any discontinuity in the material shall have an amplitude greater than the grain scatter noise level.

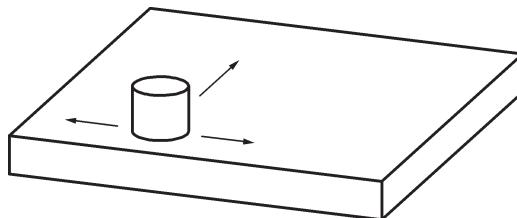


Figure 2 — Scan pattern

The velocity of longitudinal waves shall be verified as being $5\ 920\ \text{m/s} \pm 30\ \text{m/s}$.

8 Marking

The block shall be permanently marked with

- a) the manufacturer's trademark,
- b) the number of this document, i.e. ISO 16946, and
- c) a unique serial number.

9 Declaration of conformity

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

- a) that the block complies with this document, and
- b) the mean value of the measured longitudinal wave velocities, v_l .

Bibliography

- [1] ISO 2400, *Non-destructive testing — Ultrasonic testing — Specification for calibration block No. 1*
- [2] ISO 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*
- [3] ISO 7963, *Non-destructive testing — Ultrasonic testing — Specification for calibration block No. 2*
- [4] ISO 16809, *Non-destructive testing — Ultrasonic thickness measurement*

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