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Non-destructive testing — Ultrasonic testing — Specification for a step wedge standard block

Essais non destructifs — Contrôle par ultrasons — Spécifications relatives au bloc étalon à gradins

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Contents

Page

Foreword

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

This third edition cancels and replaces the second edition (ISO 16946:2017), which has been technically revised.

The main changes are as follows:

— the term “calibration block” is replaced by “standard block”;

— Figure 1 is modified;

— a link to a CAD file of the step wedge standard block is added;

— the structure of Clause 4 is aligned with ISO 2400 and ISO 7963.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

A step wedge standard block makes it possible, during practical testing, to check the setting of the time base and the setting of the sensitivity of the ultrasonic equipment in a simple manner.

A step wedge standard block is not intended to check an ultrasonic instrument but can be used to check some characteristics of the ultrasonic instrument.

Other existing blocks are:

— Calibration block No. 1, specified in ISO 2400.

— Calibration block No. 2, specified in ISO 7963.

— Calibration block for phased array testing, specified in ISO 19675.

NOTE In the next revisions of ISO 2400, ISO 7963 and ISO 19675, the term “calibration block” will be replaced by the term “standard block”.

Non-destructive testing — Ultrasonic testing — Specification for a step wedge standard block

1 Scope

This document specifies the requirements for the dimensions, material, and manufacture of a steel step wedge standard block for the setting of an ultrasonic instrument.

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 2400, *Non-destructive testing — Ultrasonic testing — Specification for calibration block No. 1*

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

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 apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Manufacture

4.1 Steel

The step wedge standard block shall be manufactured from steel grade S355J0, specified in EN 10025-2, or from steel of an equivalent grade.

4.2 Dimensions

a) The dimensions of the step wedge standard block shall be as shown in Figure 1.

NOTE A CAD file of the step wedge standard block can be downloaded from https://standards.iso.org/iso/16946/ed-3/en.

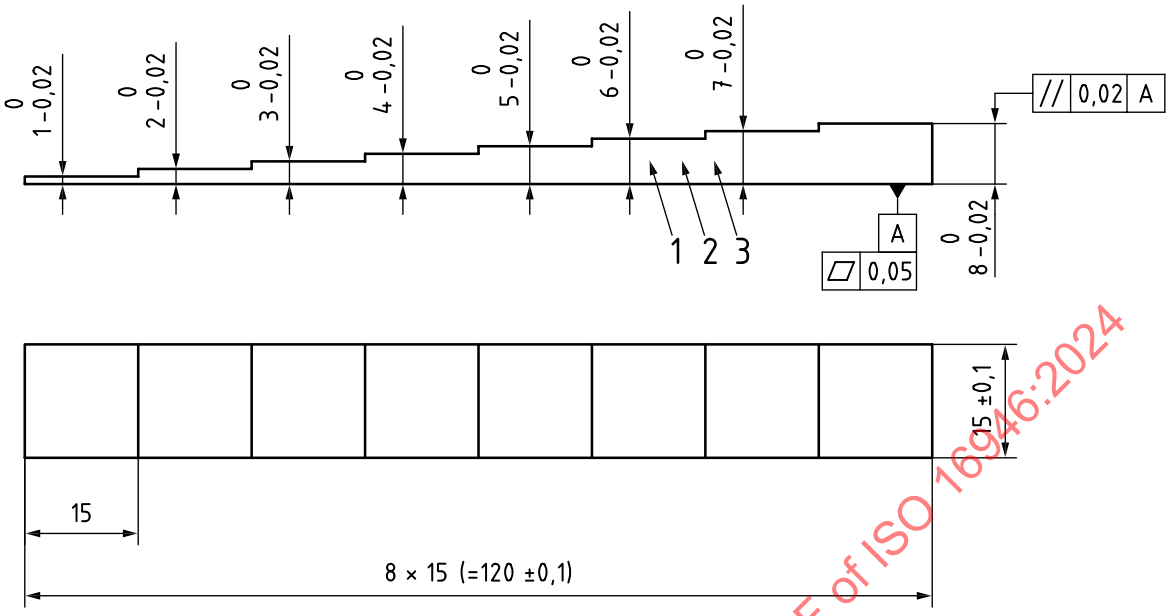
b) The tolerances are ±0,1 mm for the length and the width of the step wedge standard block.

c) The tolerances are −0,02 mm for the step thickness up to 12,5 mm and −0,1 mm for larger step thicknesses.

d) All external surfaces shall be machined to a surface roughness value R_a not greater than 0,8 µm.

e) For step wedge blocks having other dimensions, e.g. steps up to 20 mm, the principles for the design and manufacture given in this document shall be applied.

Dimensions in millimetres



Key

1 manufacturer's name or logo
2 International Standard number (ISO 16946)
3 serial number

Figure 1 — Step wedge standard block

4.3 Machining, heat treatment and surface finish

A proof for homogeneity of the material and the determination of the sound velocities in perpendicular directions is only possible on a rectangular block.

Additionally, to determine the sound velocities with the required precision, a thickness larger than 25 mm is needed.

Therefore, it is recommended to manufacture a large rectangular block as for calibration block No. 1 according to ISO 2400 as a semi-finished block.

a) The block shall be rough machined to a dimension of 320 mm × 120 mm × 30 mm before heat treatment which shall consist of:

   1) austenitizing at 920 °C for 30 min;

   2) rapid cooling (quenching) in water;

   3) tempering by heating to 650 °C for 3 h;

   4) cooling in still air.

b) At least 2 mm shall be removed from all surfaces after heat treatment.

c) Prior to final machining, the semi-finished block shall be proven to be free from internal discontinuities.

   1) For this purpose, an ultrasonic test 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.

2) With the probe positioned on the largest face of the block, the ultrasonic instrument's gain shall be set to achieve a grain scatter noise of 10 % of the screen height.

3) No echo from internal imperfections shall have an amplitude greater than that of the grain scatter noise.

d) Prior to final machining, the velocities of longitudinal waves shall be determined as specified in ISO 2400.

1) The velocities shall be determined within a maximum permissible error of ±0,2 %, i.e. with an uncertainty of ±12 m/s.

2) The determined longitudinal wave velocity, v_l, shall be (5 920 ± 30) m/s.

e) Then cut this large block into smaller parts to continue with the manufacturing of step wedge standard blocks.

f) All external surfaces shall be machined to a surface roughness value, R_a, not greater than 0,8 µm.

4.4 Reference marks

a) Reference marks as shown in Figure 1 shall be permanent.

b) The step wedge standard block shall be marked with:

1) the manufacturer's name or logo,

2) the number of this document (i.e. ISO 16946), and

3) a unique serial number.

5 Statement of conformity

A statement shall be issued by the manufacturer for each step wedge standard block, containing

a) a statement that the step wedge standard block complies with this document (i.e. ISO 16946:2024);

b) the value of the determined longitudinal wave velocity, v_l, in the thickness direction of the steps.