SLOVENSKI STANDARD
SIST EN 4050-2:2014

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Aeronavtika - Metode za preskušanje kovinskih materialov - Ultrazvočno preskušanje palic, plošč, kovnih materialov in izkovkov - 2. del: Izvajanje preskušanja

Aerospace series - Test method for metallic materials - Ultrasonic inspection of bars, plates, forging stock and forgings - Part 2: Performance of test

Luft- und Raumfahrt - Prüfverfahren für metallische Werkstoffe - Ultraschallprüfung von Stangen, Platten, Schmiedevormaterial und Schmiedestücken - Teil 2: Durchführung der Prüfung

Série aérospatiale - Méthode d'essai applicable aux matériaux métalliques - Contrôle par ultrasons de barres, plaques, demi-produit pour forgeage et pièces forgées - Partie 2: Réalisation de l'essai

Ta slovenski standard je istoveten z: EN 4050-2:2012

ICS:

49.025.01	Materiali za letalsko in vesoljsko gradnjo na splošno	Materials for aerospace construction in general
49.035	Sestavni deli za letalsko in vesoljsko gradnjo	Components for aerospace construction

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EUROPEAN STANDARD

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Aerospace series - Test method for metallic materials - Ultrasonic inspection of bars, plates, forging stock and forgings - Part 2: Performance of test

Série aérospatiale - Méthode d'essai applicable aux matériaux métalliques - L'inspection par ultrasons des barres, des assiettes, des stocks de forgeage et de pièces forgées - Partie 2: Réalisation de l'essai

Luft- und Raumfahrt - Prüfverfahren für metallische Werkstoffe - Ultraschallprüfung von Stangen, Platten, Schmiedevormaterial und Schmiedestücken - Teil 2: Durchführung der Prüfung

This European Standard was approved by CEN on 15 July 2011.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 4050-2:2012) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2012, and conflicting national standards shall be withdrawn at the latest by March 2012.

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1 Scope

This European Standard specifies the method of performing ultrasonic testing. The general requirements are given in EN 4050-1.

2 Normative references

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

EN 4050-1, *Aerospace series — Test method for metallic materials — Ultrasonic inspection of bars, plates, forging stock and forgings — Part 1: General requirements*

EN 4050-4, *Aerospace series — Test method for metallic materials — Ultrasonic inspection of bars, plates, forging stock and forgings — Part 4: Acceptance criteria*

3 General

3.1 Implementation

Implementation shall be as required by the relevant technique, inspection schedule or order.

3.2 Test procedures

The equipment to be used, its performance, the scanning plan and the acceptance standard shall be as defined in the relevant test procedure, inspection schedule or order for each item.

3.3 Calibration of the flaw detector time base

The time base shall be calibrated and care shall be taken to ensure that interface and target echoes can be readily identified.

3.4 Scanning speed and pitch

To ensure efficient inspection of the entire volume of the material, the scanning speed and pitch shall be established taking into account the test beam diameter, the acceptance standard and the pulse repetition frequency. Account shall also be taken of whether a manual or automatic system of flaw detection is used.

3.5 Scanning index

The scanning index shall be such that the reference reflector always produces at least two indications on two successive pulses. The two signals shall not be more than 6 dB lower than the maximum indication of the reference reflector measured in the static conditions.

3.6 Wave modes

There are different ultrasonic wave modes, namely:

— longitudinal;

— shear;

- surface;
- lamb waves.

The wave mode shall be as specified in the relevant technique or inspection schedule.

3.7 Sensitivity corrections

Corrections for distance/amplitude effects, attenuation, shape effects and specified acceptance standard shall be made to attain the desired level of sensitivity in the part being examined.

3.8 Flaw size and position recording

The inspection system shall generate and contain sufficient information to enable flaw size and position to be derived with respect to the scanning sequence and reference data from the equipment.

4 Performance characteristics of the inspection system

4.1 Requirements

In order to meet the specific requirements for each test item of the procedural document for each part number and for optimum and reproducible inspection, it is essential that the characteristics and performance data of all the equipment are measured and recorded. This is defined in the three following sections:

- the probe and flaw detector that are used in establishing the working sensitivity and for evaluating flaws;
- periodic control checks carried out on the facility;
- specific operating and control instructions unique to each facility; this latter point is particularly directed to automatic and semi-automatic facilities.

Table 1 lists the requirements for identification and performance measurement of the equipment which is to be used in establishing the working sensitivity, inspecting and evaluating flaws.

As there may be differences between equipment performances, when used on manual or automatic modes, the corresponding calibration shall be carried out. The methods of deriving these basic data are detailed in the following paragraphs.

4.2 Ultrasonic test set

The ultrasonic test set used shall operate in the pulse-echo mode and, if required, shall also be capable of operating in the through-transmission mode. Gain calibrated in steps of 1 dB max. shall be used (steps of 2 dB may be agreed).

When required a means of reducing the back-wall echo shall be provided, but the possibility of flaw detection shall remain unimpaired.

Equipment featuring distance amplitude correction shall be used.

Equipment shall be calibrated.

5 Measurement of material characteristics

5.1 Attenuation

The attenuation in the part under test shall be measured for application to working sensitivity and flaw evaluation. The attenuation factor shall preferably be measured by comparison with a reference test block, the acoustic impedance and geometry of which are similar to that of the product to be inspected and the attenuation of which has been previously evaluated using the same probe/flaw detector combination.

This measurement shall be made using the same operating conditions and probe/flaw detector combination, limited to sections with parallel faces, diametrically opposing faces, and for grain flow correction.

Sections of material with non parallel faces can be assessed for material attenuation based on figures obtained from a nearby parallel sided section.

5.2 Structure noise (grass)

Structure noise (grass) limits the ability to detect flaws. Grass may therefore need to be measured in order to determine to what level a part can be inspected.

The flaws to be detected shall rise 6 dB or more above the structure noise.

The measurement of structure noise shall be carried out at the same equipment settings and by that method used for inspection.

6 Flaw recognition level

The flaw echo amplitude as seen on the flaw detector screen during inspection may have been diminished by the effects of attenuation, depth, flaw tilt, scanning pitch and pulse repetition frequency.

To ensure that rejectable flaws are not ignored because of their diminished response, it is necessary to establish a monitor threshold level above which all indications shall be evaluated.

This shall be carried out in accordance with the relevant technique, or inspection schedule.

When using the manual contact technique an additional gain of + 6 dB may be added to correct this diminution.

7 Setting-up procedure

7.1 Choice of probe

The choice of probe for inspection will depend upon a number of factors governed largely by the component to be inspected and the acceptance standard to be applied.

7.2 Choice of inspection frequency

The inspection frequency chosen shall be such as to ensure that a signal-to-noise ratio of 6 dB or greater shall be attained in accordance with the flaw detection capability.

7.3 Choice of water gap (immersion technique)

Inspection water gap shall be defined and maintained according to the relevant technique test procedure taking into account the need to optimise either near surface resolution or sensitivity, or to obtain the best compromise of the two.

Where of significant magnitude, water attenuation effects shall be taken into account, as agreed between manufacturer and purchaser.

The distance (L) between transducer and part is related to the thickness (t) of the given part, velocity of sound in water (v_w) and velocity of sound in the material of the part (v_{part}) and is given in $L/t \geq v_w/v_{part}$.

7.4 Type of coupling (contact technique)

The coupling conditions for the material under test and the standard test block shall be the same.

For inspection by the contact method clean tap water, oil, glycerine or cellulose gum may be used as the couplant. The acoustic impedance, viscosity and surface wetting of the couplant shall maintain good ultrasonic energy transmission into the test material and low attenuation of the sound beam.

When used, the type and thickness of the protecting membranes of the probes shall allow adequate sensitivity.

7.5 Basic reference sensitivity

7.5.1 General

The basic reference sensitivity is used to establish the working sensitivity by the addition of the material standard, of those characteristics attributable to the part, that is: transmissivity at interface and attenuation.

This specification contains two methods of establishing the basic reference sensitivity, working sensitivity and the evaluation of flaws. These represent the methods currently in use. It shall be recognised that these methods are not necessarily mutually interchangeable or comparable.

7.5.2 Distance gain size (DGS) method

The method as described applies to plane unfocused and narrow frequency band probes only.

7.5.2.1 Reference sensitivity

The DGS method is implemented using the general diagram (Figure 1). Sensitivity is determined from the back echo. In the event where it is not possible to obtain a back echo on the part, the use of a block to obtain a back echo is permitted, if the material of the block has similar characteristics to those of the product to be inspected.

7.5.2.2 Working sensitivity

The working sensitivity is achieved by adding the loss due to material attenuation to the reference sensitivity. Where the acceptance standard differs from the 1,2 mm flat bottom hole standard, a corresponding adjustment in gain is required.

7.5.2.3 Flaw evaluation

Flaw evaluation is carried out using the DGS diagram as illustrated in Figure 2.

The flaw shall be positioned between 1,5 N and 3 N distance.