



SLOVENSKI STANDARD
oSIST prEN 1713:2007

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Non-destructive testing of welds - Ultrasonic testing - Characterization of indications in welds

Zerstörungsfreie Prüfung von Schweißverbindungen - Ultraschallprüfung - Charakterisierung von Anzeigen in Schweißnähten

Contrôles non destructifs des assemblages soudés - Contrôle par ultrasons - Caractérisation des indications de soudures

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25.160.40 Varjeni spoji in vari Welded joints

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Will supersede EN 1713:1998

English Version

Non-destructive testing of welds - Ultrasonic testing - Characterization of indications in welds

Contrôles non destructifs des assemblages soudés -
Contrôle par ultrasons - Caractérisation des indications de
soudures

Zerstörungsfreie Prüfung von Schweißverbindungen -
Ultraschallprüfung - Charakterisierung von Anzeigen in
Schweißnähten

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 121.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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Foreword

This document (prEN 1713:2007) has been prepared by Technical Committee CEN/TC 121 "Welding", the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1713:1998.

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Introduction

Classification of indications as planar or non-planar is based on several parameters :

- welding techniques;
- geometrical position of the indication;
- maximum echo amplitude;
- directional reflectivity;
- echostatic pattern (i.e. A-Scan);
- echodynamic pattern.

The process of classification involves examining each of the parameters against all the others in order to arrive at an accurate conclusion.

For guidance, the flowchart in annex A gives the classification of internal weld indications suitable for general applications. This flowchart should be applied in conjunction with the two first parameters listed above and not taken in isolation.

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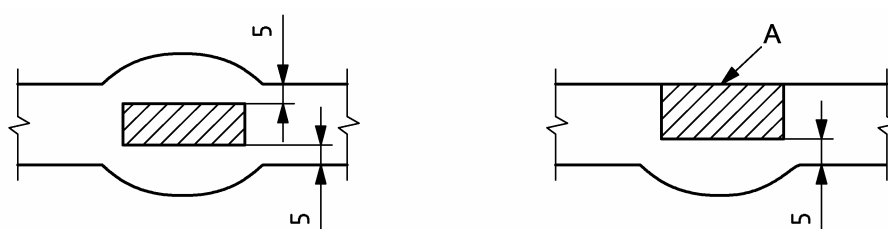
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1 Scope

This standard defines how to characterise embedded indications by classifying them as planar or non-planar.

This procedure is also suitable for indications that are surface breaking after removal of the weld reinforcement (see figure 1).

Dimensions in millimeters



Key

A ground weld

Figure 1 — Location of indications in a weld

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.

EN 1714, *Non destructive testing of weld – Ultrasonic testing of welds*

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3 Criteria

3.1 General

The classification is carried out by the successive application of several discriminatory criteria to:

- echo amplitude ;
- directional reflectivity ;
- echostatic pattern (A-SCAN) ;
- echodynamic pattern.

It is recommended that the same probes be used for detection of indications and for classification. The flowchart procedure standardises a system of classification. Several thresholds are defined in decibels (dB) by a comparison with the distance amplitude curve (DAC) or by a comparison between the maximum echo heights from the discontinuity when tested at different angles of incidence.

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Proposed thresholds for the different stages in the flowchart procedure are given in Table A.1.

The flowchart procedure calls for five stages :

- Stage 1: to avoid the classification of indications with very low echo amplitudes ;
- Stage 2: to classify all indications with high echo amplitude as planar ;
- Stage 3: primarily to classify lack of fusion ;
- Stage 4: primarily to classify inclusions ;
- Stage 5: primarily to classify cracks.

NOTE The indications resulting from a combination of an inclusion and lack of fusion are classified as planar by the flowchart procedure. An example of this type of flaw is given in Figure A.3.

3.2 Conventions used

The reference echoes shall be obtained on 3 mm diameter side drilled holes.

By convention:

- a negative threshold value means that the indication has a lower echo amplitude than the reference ;
- a positive threshold value means that the indication has a higher echo amplitude than the reference.

3.3 Echo amplitude criteria (Stages 1 and 2)

3.3.1 Low amplitudes (Stage 1)

It is accepted that an indication with a lower echo amplitude than threshold T1 (DAC - 10 dB) is not significant.

For special applications this value T1 may be lowered (i.e. DAC - 12 dB) if defined by specification.

3.3.2 High amplitudes (Stage 2)

It is assumed that an echo amplitude that is at least equal to the threshold T2 (DAC + 6 dB) comes from a planar indication.

3.4 Directional reflectivity criteria

3.4.1 Applicability

Stage 3 of the flowchart procedure shall be applicable either to all indications or, if specified, only to those indications exceeding the following lengths:

- t for the range of thicknesses $8 \text{ mm} \leq t < 15 \text{ mm}$
- $t/2$ or 20 mm whichever is the larger for thicknesses over 15 mm

For indications not exceeding the specified length proceed to stage 4.

3.4.2 Stage 3

Application conditions:

- a) comparison of directional reflectivities shall only be made if it is certain that the echoes compared come from the same reflector;
- b) the comparison shall be made at the position which exhibits the highest reflectivity along the indication
- c) when a straight beam probe and an angle beam probe are used, their wave lengths shall be similar (e.g.: 4 MHz for longitudinal waves and 2 MHz for shear waves) ;
- d) when two or more probe angles are used, the differences between the nominal refraction angles shall be equal to or greater than 10°;
- e) If the comparison is made between a beam crossing the weld and a beam not crossing the weld, the attenuation of the weld shall be taken into account.

NOTE The following items can affect the results:

- density of segregations in the base material;
- non parallelism of the faces if full skip is used ;
- anisotropic material.

For the criteria below, the highest echo amplitude (H_{dmax}) relative to the DAC curve obtained from the indication is taken as a reference. The minimum echo amplitude (H_{dmin}), relative to a DAC curve, obtained from the other directions, is compared with H_{dmax} .

To satisfy the directional reflectivity, the following conditions shall be fulfilled simultaneously:

- 1) The reflectivity of the indication, for at least one of the directions is higher than, or equal to, T3 (DAC - 6 dB).
- 2) There is a high directional reflectivity, namely either:
 - a) A difference of at least 9 dB between two directional reflectivities, if the examination is carried out with shear waves.

$$|H_{dmax} - H_{dmin}| \geq 9 \text{ dB, or}$$

- b) A difference of at least 15 dB between two directional reflectivities, where one of them is carried out with shear waves, the other with longitudinal waves.

$$|H_{dmax} - H_{dmin}| \geq 15 \text{ dB.}$$

The directional reflectivities result from the association of a refraction angle and examination conditions (half skip, full skip). See Figure B.1.

An example of the application of these criteria is given in Figure A.2.

3.5 Echostatic pattern criteria (Stage 4)

At this stage, the echostatic pattern (i.e. A-Scan) of the indication is compared with that obtained from the reference reflector (3 mm diameter side drilled hole).

If the echostatic pattern is single and smooth the indication is classified as non-planar.

If the echostatic pattern is not single and not smooth the next stage of the procedure is followed.

3.6 Transverse Echodynamic pattern criteria (stage 5)

The transverse echodynamic pattern of an indication is the envelope of the resulting echoes when the ultrasonic probe is moved perpendicular to the indication. The analysis takes into account not only the envelope, but also the behaviour of the echoes inside it.

The patterns can be classified into four types as given in Annex C.

Classification depends on the patterns observed:

- pattern 1: single non-planar;
- pattern 2: excluded by previous stage
- pattern 3: planar, if observed for the two highest reflectivity directions. If only observed for one reflectivity direction, use complementary examination (see 3.7)
- pattern 4: cluster of non-planar.

3.7 Complementary examination

In case of any doubt the following examinations should be carried out:

- use of additional reflectivity directions or probes;
- analysis of echodynamic pattern when the probe is moved parallel to the indication (see Figures C.1 c), C.2 c), C.3 c), C.4 c), C.5 c)).
- results from other NDT (i.e. radiography).

The above list is not restrictive.

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