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

*Contrôle non destructif des assemblages soudés — Contrôle par  
ultrasons — Caractérisation des indications dans les assemblages  
soudés*

Preview

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## Foreword

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ISO 23279 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 5, *Testing and inspection of welds*.

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Preview  
ISO 23279

## Introduction

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

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

The classification process involves comparing each parameter to all the others in order to arrive at an accurate conclusion.

The flowchart in Annex A gives the classification of internal weld indications suitable for general applications.



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

## 1 Scope

This International Standard defines a procedure for classifying internal indications as planar or non-planar.

This procedure is only suitable for indications located at least 5 mm below the unground surface of the joint.

Annex A defines the procedure in the form of a flowchart. Figure 1 illustrates the location of indications.

## 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 1712, *Non-destructive examination of welds — Ultrasonic examination of welded joints — Acceptance levels*

## 3 Criteria

### 3.1 General

The classification is carried out by the successive application of several discriminatory criteria, i.e.

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

The classification is carried out in accordance with EN 1712.

The flowchart procedure is stopped as soon as one of the above criteria is fulfilled.

The probes used for the classification are, as a general rule, the same as those specified for the detection.

The flowchart procedure standardizes a quality control system of classification. Several levels 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.

Proposed dB levels for the different stages in the flowchart procedure are given in Table 1.

**Table 1 — Proposed dB levels for the different stages in the flowchart procedure**

Reflectivity level	S1	S2	S3	S4
Decibel	DAC – 10 dB	DAC + 6 dB	DAC – 6 dB	9 dB <sup>a</sup> /15 dB <sup>b</sup>
<sup>a</sup> Shear waves. <sup>b</sup> Between reflections obtained with a shear and a longitudinal wave.				

The flowchart procedure calls for five stages, each having a precise aim:

- 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 “hybrid” indications resulting from the association of an inclusion and a 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**

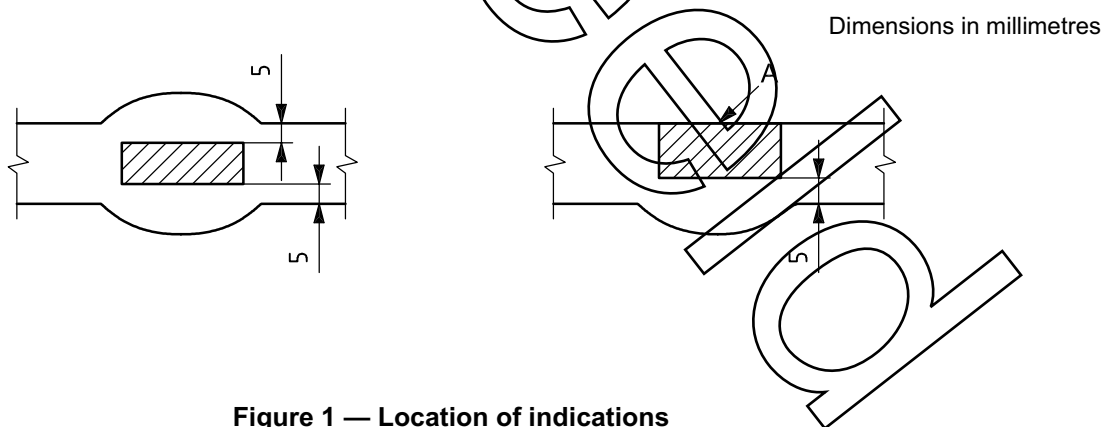
The reference echoes shall be obtained on 3 mm side drilled holes.

By convention,

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

**3.3 Location of indications**

Figure 1 illustrates the location of indications.



**Figure 1 — Location of indications**

**3.4 Echo height criteria (Stages 1 and 2)**

**3.4.1 Low amplitudes (Stage 1)**

It is accepted that an indication with a lower echo amplitude than level S1 (DAC – 10 dB) is not significant. For special applications, this S1 value should be lowered if agreed between the contracting parties.



### 3.4.2 High amplitudes (Stage 2)

It is assumed that an echo height that is at least equal to the level S2 (DAC + 6 dB) comes from a planar indication.

### 3.5 Directional reflectivity criteria (Stage 3)

This stage of the flowchart procedure shall be applicable either to all indications or, if agreed between the contracting parties, only to those indications exceeding a specified length. For the range of thicknesses  $8 \text{ mm} \leq t \leq 15 \text{ mm}$ , this length is  $t$ , and for thicknesses over 15 mm, this length is  $t/2$  or 20 mm, whichever is the larger. For indications not exceeding the specified length, proceed to Stage 4.

For the criteria below, the angle of incidence of examination which gives the highest echo amplitude relative to a DAC curve,  $H_{\text{dmax}}$ , is taken as reference. The minimum echo amplitude relative to a DAC curve,  $H_{\text{dmin}}$ , obtained from the other angles of incidence, is compared with  $H_{\text{dmax}}$ .

To satisfy the directional reflectivity, the two conditions below shall be fulfilled simultaneously.

- a) The reflectivity of the indication, for at least one of the angles of incidence, is higher than or equal to S3 (DAC – 6 dB).
- b) There is a high directional reflectivity, i.e.
  - 1) an imbalance of, at least, 9 dB between two angles of incidence of examination, if the examination is carried out with shear waves:
 
$$|H_{\text{dmax}} - H_{\text{dmin}}| \geq 9 \text{ dB, or}$$
  - 2) an imbalance of, at least, 15 dB between two angles of incidence of examination, where one of them is carried out with shear waves, the other with longitudinal waves:
 
$$|H_{\text{dmax}} - H_{\text{dmin}}| \geq 15 \text{ dB.}$$

The incidence of examination results from the association of a refraction angle and examination conditions (half skip, full skip). Some examples are given in Annex B.

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

The attenuation of the weld could be taken into account.

The following conditions apply.

- Normally, the wave length of the different angles of incidence of examination shall be almost the same (e.g. 4 MHz for longitudinal waves and 2 MHz for shear waves).
- In all cases, the differences between the compared angles of incidence are equal to or greater than  $10^\circ$  (the nominal refraction angles are taken into account).
- The comparison of reflectivities shall be made at the position on the indication which exhibits the highest reflectivity.
- Such comparisons make sense only if it is certain that the compared echoes come from the same reflectors.
- It shall be certain before the application of these criteria that:
  - there is no segregation in the base metal;

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