

# Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)

The European Standard EN 10160:1999 has the status of a  
British Standard

ICS 77.140.50

---

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

**BSI**  
Documents

**AVA**

Document Sharing Hub

# National foreword

This British Standard is the English language version of EN 10160:1999. It supersedes BS 5996:1993, which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee ISE/73, Steels for pressure purposes, to Subcommittee ISE/73/2, Steel plates and bars for pressure purposes, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

## Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

## Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 14, an inside back cover and a back cover.

The BSI copyright notice displayed throughout this document indicates when the document was last issued.

This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 November 1999

© BSI 11-1999

## Amendments issued since publication

| Amd. No. | Date | Comments |
|----------|------|----------|
|          |      |          |
|          |      |          |
|          |      |          |
|          |      |          |
|          |      |          |

ISBN 0 580 32370 6

English version

## Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)

Contrôle ultrasonore des produits plats en acier d'épaisseur égale ou supérieure à 6 mm (méthode par réflexion)

Ultraschallprüfung von Flacherzeugnissen aus Stahl mit einer Dicke größer oder gleich 6 mm (Reflexionsverfahren)

This European Standard was approved by CEN on 3 March 1999.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents

|                                                                                           |    |
|-------------------------------------------------------------------------------------------|----|
| Foreword.....                                                                             | 2  |
| 1 <b>Scope</b> .....                                                                      | 3  |
| 2 <b>Normative references</b> .....                                                       | 3  |
| 3 <b>Terms and definitions</b> .....                                                      | 3  |
| 4 <b>Principle</b> .....                                                                  | 4  |
| 5 <b>Personnel</b> .....                                                                  | 4  |
| 6 <b>Apparatus</b> .....                                                                  | 4  |
| 7 <b>Coupling conditions - Surface condition of the flat product</b> .....                | 6  |
| 8 <b>Scanning plan</b> .....                                                              | 6  |
| 9 <b>Procedure</b> .....                                                                  | 8  |
| 10 <b>Acceptance criteria</b> .....                                                       | 9  |
| 11 <b>Test report</b> .....                                                               | 10 |
| Annex A (informative) <b>List of equivalent terms in several European languages</b> ..... | 14 |

Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 2 "Steel physico-chemical and non-destructive testing", the Secretariat of which is held by AFNOR.

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 January 2000, and conflicting national standards shall be withdrawn at the latest by January 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## 1 Scope

This European Standard describes a method for the ultrasonic testing of uncoated flat steel product for internal discontinuities. It is applicable to flat product in nominal thickness range of 6 mm to 200 mm of non-alloyed or alloyed steel, excluding austenitic or austenoferritic steels. However, this standard may be applied to the latter types of steels provided that the difference between the amplitude of the noise signal and that of the echo detection threshold is sufficient for the limit fixed.

This standard also defines four quality classes for the flat product body (classes S<sub>0</sub>, S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub>) and 5 classes (E<sub>0</sub>, E<sub>1</sub>, E<sub>2</sub>, E<sub>3</sub>, E<sub>4</sub>) for the edges in accordance with the criteria specified in clause 9.

Other methods of testing (e.g. by transmission) or other test equipment may be used at the manufacturer's discretion provided that they give identical results to those obtained under the conditions of this standard. In the event of a dispute, only the method defined in this standard shall prevail.

Testing of flat product of thickness less than 6 mm may be the subject of special agreements between the parties concerned.

The inspection is normally carried out in the place of production or on the premises of the supplier. If specified on the order, the inspection may take place in the presence of the purchaser or his representative<sup>1)</sup>.

A list of equivalent terms in several European languages is given in annex A.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 473, *Qualification and certification of NDT personnel - General principles*

prEN 1330-4, *Non destructive testing - Terminology - Part 4 : Terms used in ultrasoning testing*

## 3 Terms and definitions

For the purposes of this European Standard, the definitions given in prEN 1330-4 and the following definitions apply:

### 3.1

#### **internal discontinuity**

any imperfection lying within the thickness of the flat product, e.g. planar or laminar imperfection, single-plane or multi-plane inclusion bands or clusters

NOTE It is referred in the text as discontinuity.

### 3.2

#### **defect**

unacceptable internal discontinuity, i.e. exceeding the specified maximum size or population density limits

---

<sup>1)</sup> In this case, all steps should be taken to ensure that the production process is not disturbed.

### 3.3

#### **population density**

the number of individual internal discontinuities of a size greater than a specified minimum size and less than a specified maximum size per specified area of body or length of edge zone

### 3.4

#### **manual and assisted manual testing**

testing by an operator applying an ultrasonic probe, or probes, to the flat product surface, manually executing the appropriate scanning pattern on the flat product surface and visually assessing ultrasonic signal indications on the electronic equipment screen either by direct viewing or by built-in signal amplitude alarm devices

### 3.5

#### **automatic and semi-automatic testing**

testing using a mechanized means of applying the ultrasonic probe or probes to, and executing the appropriate scanning pattern on the flat product surface, together with ultrasonic signal indication evaluation by electronic means. Such testing can be either fully automatic with no operator involvement, or semi-automatic when the operator performs basic equipment operation functions

## 4 Principle

The method used is based on the reflection of ultrasonic waves (generally longitudinal), the mean direction of which is perpendicular to the surface of the product. The examination consists of:

a) locating any discontinuity by comparing the amplitude of the discontinuity echo with the amplitude of the echo of a flat-bottomed hole of a given diameter and located at the same depth as the discontinuity.

NOTE Only those discontinuities giving an echo at least equivalent in amplitude to that of the echo obtained with the reference flat-bottomed hole are taken into consideration;

b) then determining its area, the contour of the discontinuity being defined by the positions of the centre of the probe corresponding to an echo amplitude of half the maximum amplitude of the discontinuity under consideration (6 dB method).

The examination is carried out during the first ultrasonic scan for all the flat product thicknesses and from one side only.

## 5 Personnel

Testing is carried out by qualified personnel under the responsibility of a level 3 individual certified in accordance with EN 473.

## 6 Apparatus

### 6.1 Description

The detection apparatus shall be equipped with an oscilloscope screen allowing the path of the ultrasonic waves in the flat product to be followed. The oscillograms shall be clearly visible, the peaks corresponding to the successive echoes being sharp and very clear; the apparatus shall be suitably calibrated and shall be equipped with an amplifier marked in decibels.

Both ultrasonic testing apparatus with display monitor and amplifier control graduated in dB, or apparatus without display monitor can be used. Apparatus without display monitor shall be able to carry out automatic amplitude testing and evaluation and their unit of measurement shall be calibrated in dB.

It shall be possible to regulate amplification, power and time base.