

# Non-destructive testing of steel tubes —

## Part 17: Ultrasonic testing of tube ends of seamless and welded steel tubes for the detection of laminar imperfections



[www.dlsspipeline.com](http://www.dlsspipeline.com)

[info@dlsspipe.com](mailto:info@dlsspipe.com)

The European Standard EN 10246-17:2000 has the status of a  
British Standard

ICS 23.040.10; 77.040.20

## National foreword

This British Standard is the official English language version of EN 10246-17:2000.

This British Standard contains elements of BS 3889-1, *Non-destructive testing of pipes and tubes — Part 1: Methods of ultrasonic testing for the detection of imperfections in wrought steel tubes*. A complete list of the parts of EN 10246 is given in annex A of this standard. When all relevant parts have been published BS 3889-1:1983 will be withdrawn.

The UK participation in its preparation was entrusted by Technical Committee ISE/73, Steel for pressure purposes, to Subcommittee ISE/73/1, Steel tubes 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 8, an inside back cover and a back cover.

The BSI copyright notice displayed in 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 June 2000

© BSI 06-2000

### Amendments issued since publication

Amd. No.	Date	Comments

ICS 23.040.10; 77.040.20

English version

## Non-destructive testing of steel tubes – Part 17: Ultrasonic testing of tube ends of seamless and welded steel tubes for the detection of laminar imperfections

Essais non destructifs sur des tubes en acier – Partie 17:  
Contrôle par ultrasons des extrémités de tubes pour la  
détection des dédoubleures des tubes en acier sans soudure  
et soudés

Zerstörungsfreie Prüfung von Stahlrohren – Teil 17:  
Ultraschallprüfung der Rohrenden nahtloser und  
geschweißter Stahlrohre zum Nachweis von Dopplungen

This European Standard was approved by CEN on 25 December 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.



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

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

## CONTENTS

	Page
FOREWORD.....	3
1 SCOPE.....	4
2 GENERAL REQUIREMENTS.....	4
3 METHOD OF TEST.....	4
4 REFERENCE STANDARDS.....	5
5 EQUIPMENT CALIBRATION AND CHECKING.....	6
6 ACCEPTANCE.....	7
7 TEST REPORTING.....	7
ANNEX A (informative) Table A.1: Parts of EN 10246 - Non-destructive testing of steel tubes.....	8

## FOREWORD

This European Standard has been prepared by Technical Committee ECISS/TC 29, Steel tubes and fittings for steel tubes, the Secretariat of which is held by UNI.

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 August 2000, and conflicting national standards shall be withdrawn at the latest by August 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 part of EN 10246 specifies requirements for the full peripheral ultrasonic testing of the ends of seamless and welded tubes for the detection of laminar imperfections. The standard specifies acceptance levels and calibration procedures.

This part of EN 10246 is applicable to the inspection of welded tubes with an outside diameter greater than 30 mm. No lower limit of wall thickness is specified but see note in 3.1.

European Standard EN 10246, Non-destructive testing of steel tubes, comprises the parts shown in Annex A.

## 2 GENERAL REQUIREMENTS

**2.1** The ultrasonic inspection covered by this part of EN 10246 is usually carried out on tubes after completion of all the primary production process operations.

**2.2** The surfaces of the tube ends to be tested shall be free from foreign matter so as to ensure the validity of the test.

## 3 METHOD OF TEST

**3.1** The tube end zone at both tube ends shall be tested using an ultrasonic pulse echo technique for the detection of laminar imperfections. The ultrasound shall be transmitted in the direction normal to the tube surface.

NOTE: For wall thicknesses less than 5 mm, where difficulties may occur in detecting and sizing laminar imperfections using this method of test, an alternative method of test may be agreed between the manufacturer and the purchaser.

**3.2** During testing, the tubes and the transducer assembly shall be moved relative to each other so that the circumference of the tube ends is scanned from the outside surface, or the inside surface where appropriate, over a length of approximately 25 mm or  $2T$  ( $T$  = specified tube thickness in mm) whichever is the greater with a maximum of 50 mm, from the point where the outside surface meets the face or bevel.

In the case of submerged arc welded tubes, when the weld reinforcement precludes a test for laminar imperfections close to and over the reinforcement, a zone 25 mm on either side of the weld reinforcement shall not be inspected unless by agreement between the purchaser and the manufacturer the reinforcement is removed to permit a full peripheral test to be carried out.

**3.3** The maximum width of each individual transducer, measured parallel to the major axis of the tube, shall be 25 mm.

**3.4** The equipment for automatic/semi-automatic testing, when used, shall be capable of differentiating between acceptable and suspect tube by means of an automatic trigger/alarm level.

## 4 REFERENCE STANDARDS

### 4.1 General

**4.1.1** The reference standards defined in this part of EN 10246 are the convenient standards for calibration of non-destructive testing equipment. The dimensions of these standards should not be construed as the minimum size of imperfections detectable by such equipment.

**4.1.2** The ultrasonic equipment shall be calibrated either electronically using a tubular test piece (see 5.1.a)) or with a reference standard comprising flat bottomed circular, square or rectangular recess (see figure 1) machined into the tubular test piece (see 5.1.b)).

The flat bottomed circular recess shall be used as the primary means of establishing the test sensitivity. When using one of the other types of reference standard, the test sensitivity shall be adjusted such that it is equivalent to that obtained when using the flat bottomed circular recess.

**4.1.3** The test piece shall be of the same nominal diameter, thickness and surface finish as the tube to be tested and shall have similar acoustic properties (e.g. velocity, attenuation coefficient).

### 4.2 Dimensions of reference standards

**4.2.1** The dimensions of the rectangular recess reference standards (see figure 1) shall be as follows:

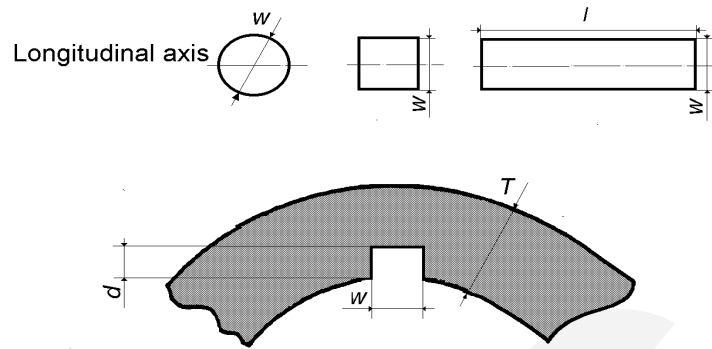
- a) width,  $w$  : 6 mm  $\begin{matrix} +10\% \\ 0 \end{matrix}$  ;
- b) length,  $l$  : 6 mm min;
- c) depth,  $d$  :  $T/4 < d < T/2$ , with a maximum of 10 mm.

**4.2.2** The dimensions of the circular and square recess reference standards (see figure 1) shall be as follows:

- a) width or diameter,  $w$  : 6 mm  $\begin{matrix} +10\% \\ 0 \end{matrix}$  ;
- b) depth,  $d$  :  $T/4 < d < T/2$ , with a maximum of 10 mm.

### 4.3 Verification of reference standards

The reference standard dimensions and shape shall be verified by a suitable technique.



$l$  = length of rectangular recess     $w$  = width or diameter of recess  
 $d$  = depth of recess     $T$  = specified wall thickness

**Figure 1 - Reference recess forms (reference standards)**

## 5 EQUIPMENT CALIBRATION AND CHECKING

**5.1** The equipment shall be calibrated statically either without reference standard in accordance with 5.1.a) or using a reference standard in accordance with 5.1.b).

a) Calibration without reference standard:

With the transducer assembly positioned on the test piece, the full amplitude of the first back wall echo minus 6 dB shall be used to set the trigger/alarm level of the equipment.

The test sensitivity may be established with DAC<sup>1)</sup> curves as supplied by the transducer manufacturer or DAC curves as prepared by the tube manufacturer using, in both cases, the 6 mm flat bottom hole curve.

At the commencement of the production test run, the manufacturer shall demonstrate that at the set sensitivity, the equipment will detect under static conditions the reference standard as given in 4.1.2 and figure 1. If this is not the case, the necessary adjustment in sensitivity shall be made prior to the testing of production tubes.

b) Calibration using a reference standard:

Under static conditions, with the transducer or each transducer of a transducer assembly centrally located over the reference standard, the full signal amplitude of the signal obtained from the reference standard shall be used to set the trigger/alarm level of the equipment.

**5.2** During production testing, the relative rotational and/or translational speeds and pulse repetition frequency shall be chosen to provide full surface coverage of the zone at both ends of the tube.

<sup>1)</sup> DAC = Distance amplitude correction

**5.3** The calibration of the equipment shall be checked at regular intervals during the production testing of tubes of the same nominal diameter, thickness and grade.

The frequency of checking the calibration shall be at least every four hours but also whenever there is an equipment operator team changeover and at the start and end of the production run.

**5.4** The equipment shall be recalibrated if any of the test parameters which were used during initial calibration are changed.

**5.5** If on checking during production testing the calibration requirements are not satisfied, even after increasing the test sensitivity by 3 dB to allow for system drift, then all the tubes tested since the previous check shall be retested after the equipment has been recalibrated.

## **6 ACCEPTANCE**

**6.1** Any tube producing signals lower than the trigger/alarm level shall be deemed to have passed this test.

**6.2** Any tube producing signals equal to or greater than the trigger/alarm level shall be designated suspect or, at the manufacturer's option, may be retested.

**6.3** If on retesting no signal is obtained equal to or greater than the trigger/alarm level, the tube shall be deemed to have passed this test.

Tubes giving signals equal to or greater than the trigger/alarm level shall be designated suspect when the peripheral length of imperfection exceeds 6 mm. To detect this peripheral length the half-amplitude method shall be applied, if applicable.

NOTE: If applicable, the evaluation may be based on DAC curves.

**6.4** For a suspect tube, the manufacturer may either reject the tube or crop off the suspect area. In the latter case, the manufacturer shall ensure that all the suspect area has been removed and shall submit the end zone of the remaining length to a repeat test as specified above.

## **7 TEST REPORTING**

When specified, the manufacturer shall submit to the purchaser a test report that includes at least the following information:

- a) reference to this part of EN 10246;
- b) date of test report;
- c) acceptance level;
- d) statement of conformity;
- e) product designation by grade and size;
- f) type and details of inspection technique;
- g) description of the reference standard;
- h) equipment calibration method used.

## ANNEX A (informative)

**Table A.1: Parts of EN 10246 - Non-destructive testing of steel tubes**

Purpose of test	Title of part	Part No.	ISO ref.
<b>Leak Tightness</b>	Automatic electromagnetic testing of seamless and welded (except submerged arc-welded) ferromagnetic steel tubes for verification of hydraulic leak-tightness.	1	9302
	Automatic eddy current testing of seamless and welded (except submerged arc-welded) austenitic and austenitic-ferritic steel tubes for verification of hydraulic leak-tightness.	2	-
<b>Longitudinal and/or Transverse Imperfections</b>	Automatic eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections.	3	9304
	Automatic full peripheral magnetic transducer/flux leakage testing of seamless ferromagnetic steel tubes for the detection of transverse imperfections.	4	9598
	Automatic full peripheral magnetic transducer/flux leakage testing of seamless and welded (except submerged arc-welded) ferromagnetic steel tubes for the detection of longitudinal imperfections.	5	9402
	Automatic full peripheral ultrasonic testing of seamless steel tubes for the detection of transverse imperfections.	6	9305
	Automatic full peripheral ultrasonic testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of longitudinal imperfections.	7	9303
	Automatic ultrasonic testing of the weld seam of electric welded steel tubes for the detection of longitudinal imperfections.	8	9764
	Automatic ultrasonic testing of the weld seam of submerged arc-welded steel tubes for the detection of longitudinal and/or transverse imperfections.	9	9765
	Radiographic testing of the weld seam of automatic fusion arc welded steel tubes for the detection of imperfections.	10	12096
<b>Surface Imperfections</b>	Liquid penetrant testing of seamless and welded steel tubes for the detection of surface imperfections.	11	12095
	Magnetic particle inspection of seamless and welded ferromagnetic steel tubes for the detection of surface imperfections.	12	13665
<b>Thickness</b>	Automatic full peripheral ultrasonic thickness testing of seamless and welded (except submerged arc-welded) steel tubes.	13	10543
<b>Laminar Imperfections</b>	Automatic ultrasonic testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of laminar imperfections.	14	10124
	Automatic ultrasonic testing of strip/plate used in the manufacture of welded steel tubes for the detection of laminar imperfections.	15	12094
	Automatic ultrasonic testing of the areas adjacent to the weld seam of welded steel tubes for the detection of laminar imperfections.	16	13663
	Ultrasonic testing of the tube ends of seamless and welded steel tubes for the detection of laminar imperfections.	17	11496
	Magnetic particle inspection of the tube ends of seamless and welded ferromagnetic steel tubes for the detection of laminar imperfections.	18	13664

---

---

## **BSI — British Standards Institution**

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

### **Revisions**

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

### **Buying standards**

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

### **Information on standards**

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

### **Copyright**

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

If permission is granted, the terms may include royalty payments or a licensing agreement. Details and advice can be obtained from the Copyright Manager. Tel: 020 8996 7070.