

Non-destructive testing of pipes and tubes —

Part 1: Methods of automatic ultrasonic testing for the detection of imperfections in wrought steel tubes

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The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

Associated Offices Technical Committee	British Welded Steel Tube Manufacturers' Association
Association of Consulting Engineers	Chartered Institution of Building Services
Association of Hydraulic Equipment Manufacturers	Confederation of British Industry
British Electrical and Allied Manufacturers' Association (BEAMA)	Department of Trade (Marine Division)
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This British Standard, having been prepared under the direction of the Iron and Steel Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 May 1983

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Foreword

This revision of this British Standard has been prepared under the direction of the Iron and Steel Standards Committee. It supersedes BS 3889-1A:1965 which is withdrawn.

During the period 1965 to 1966 five Parts of BS 3889 were published; this is the first Part to be revised and revision of Part 2A (eddy current testing) is in course of preparation. Part 3A (penetrant testing) and Part 4A (magnetic particle flaw detection) have been withdrawn. Part 3A was obsolescent and Part 4A has been superseded by BS 6072:1981. In the original edition the Parts were designated A or B according to whether they dealt with ferrous or non-ferrous metals; in this revision this designation has been dropped in accordance with current BSI style.

The BS 3889 series establishes several methods of non-destructive testing, allowing manufacturers and purchasers to select those appropriate to their needs. It should not, however, be inferred that one method is inherently superior to another. Methods of non-destructive testing, being complementary to each other, should always be considered in relation to inspection and testing as a whole.

This Part of BS 3889 takes account of extensive advances in the understanding and application of automatic ultrasonic methods of non-destructive testing. The automatic testing methods that this standard describes are now widely accepted and used. The need for adequate training of personnel engaged in non-destructive testing has been recognized by industry. No specific formal qualifications have been laid down in this standard but it is emphasized that the operation of all equipment should be supervised by competent, trained personnel.

Application of automatic ultrasonic test methods enables tubes to be classified into categories of acceptance appropriate to the application for which the finished product is required. It is, therefore, necessary to relate the signals received from imperfections to reference standards that have been established as indicating the required level of acceptance. Details of these reference standards are normally included in the British Standard relevant to the particular tube product.

Reference standards, given in Appendix A, are recommended for use when none is specified in the product standard.

This British Standard is being progressively replaced by BS EN 10246, *Non-destructive testing of steel tubes*, Parts of which deal with ultrasonic testing. When the relevant Parts of BS EN 10246 have been published, BS 3889-1 will be withdrawn.

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, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of this British Standard describes four automatic ultrasonic testing methods for the detection of longitudinal, transverse and laminar imperfections in wrought steel tubes using shearwave and compression wave ultrasonic techniques. It is applicable to both seamless and welded tubes with outside diameters greater than 12.5 mm and a thickness of not less than 1.5 mm.

This standard describes the types of reference standard to be used for the calibration of ultrasonic equipment.

For methods A and B, Appendix A gives recommended dimensions and tolerances for reference standards for use where none are described in the appropriate product standard.

NOTE 1 It is intended that this standard be used in conjunction with the appropriate product standard for steel tubes.

NOTE 2 In this standard no difference in meaning is intended between “pipe” and “tube”; idiomatic use sometimes prefers the one and sometimes the other.

NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of this British Standard, the definitions given in BS 3683-4, together with the following, apply.

2.1

pulse repetition frequency

the number of impulses per second that the equipment imparts to each ultrasonic transducer

2.2

trigger/alarm level

the level at which the equipment is required to differentiate between acceptable and suspect tubes

2.3

trigger/alarm condition

the condition where the equipment has indicated that a particular tube is suspect

2.4

transducer

a device that produces ultrasonic vibrations in the tube to be tested

NOTE Transducers use different methods of generating and receiving ultrasound (see 2.5 to 2.7).

2.5

piezoelectric transducer

a transducer in which the application of an electric field across the active element of the transducer produces mechanical deformation of the active element thereby generating ultrasonic vibrations and vice-versa

2.6

magnetostrictive transducer

a transducer in which the application of a magnetic field on the active element of the transducer produces mechanical deformation of the active element thereby generating ultrasonic vibrations and vice-versa

2.7

electromagnetic acoustic transducer

a transducer in which eddy currents are produced at the surface of the tube to be tested, adjacent to the transducer in the presence of a static magnetic field, and their interaction produces mechanical deformation of the interrogated surface thereby generating ultrasonic vibrations and vice-versa

2.8

reference standard

an artificially produced imperfection of predetermined dimensions, usually a notch or a hole, used for the sole purpose of establishing the test sensitivity of the ultrasonic equipment

2.9

test piece

a conveniently sized sample of steel of similar acoustic properties to the tube to be tested in which the reference standards are located (see 7.2)

3 Condition of tubes

The tubes to be tested shall be sufficiently straight in length to ensure the validity of the test. All surfaces shall be sufficiently free from such scale, dirt, grease, paint and other foreign matter that would interfere with the validity of the test. The methods used for cleaning and preparing the surfaces for ultrasonic testing shall not be detrimental to the material or surface finish.

4 Test procedure

4.1 Methods. Automatic ultrasonic testing of wrought steel tubes shall be carried out by any one or a combination of more than one of the following four methods.

Method A. Full peripheral shearwave testing of seamless and welded tubes. This method is intended for the detection of imperfections of a generally radial nature that are orientated predominantly longitudinally or transversely to the major axis of the tube.

Method B. Shearwave testing of the weld of longitudinally and spirally welded tubes. This method is intended for the detection of imperfections of a generally radial nature that are orientated predominantly longitudinally or transversely to the weld.