

INTERNATIONAL
STANDARD

ISO
10543

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**Seamless and hot-stretch-reduced welded
steel tubes for pressure purposes — Full
peripheral ultrasonic thickness testing**

iTeh STANDARD PREVIEW

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*Tubes en acier sans soudure et soudés issus d'un laminoir
étireur-réducteur pour service sous pression — Contrôle de l'épaisseur
par ultrasons sur toute la circonférence*

ISO 10543:1993

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INTERNATIONAL

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10543 was prepared by Technical Committee ISO/TC 17, *Steel*, Sub-Committee SC 19, *Technical delivery conditions for steel tubes for pressure purposes*.

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Seamless and hot-stretch-reduced welded steel tubes for pressure purposes — Full peripheral ultrasonic thickness testing

1 Scope

1.1 This International Standard specifies requirements for full peripheral ultrasonic thickness testing of seamless and hot-stretch-reduced welded steel tubes.

NOTES

1 This International Standard may also be applied to "as welded" (except submerged arc-welded) steel tubes by agreement between the purchaser and manufacturer.

2 Full peripheral testing, in this context, does not necessarily mean that 100 % of the tube surface will be scanned.

Unless otherwise specified in the product standard or by agreement between the purchaser and manufacturer, the surface of the tube shall be scanned in accordance with 4.2.

This inspection may be carried out simultaneously with an inspection for full peripheral ultrasonic testing for the detection of laminar imperfections (see ISO 10124), using the same ultrasonic transducers for both inspection requirements.

Under these circumstances, the percentage of the tube surface to be scanned shall be determined by the minimum lamination size to be detected, as required by ISO 10124.

1.2 This International Standard is applicable to the thickness measurement of tubes with an outside diameter greater than or equal to 25,4 mm and with a minimum wall thickness of 2,6 mm.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions

of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 10124:—¹⁾, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Ultrasonic testing for the detection of laminar imperfections.*

ISO 11484:—¹⁾, *Steel tubes for pressure purposes — Qualification and certification of non-destructive testing (NDT) personnel.*

3 General requirements

3.1 The ultrasonic inspection covered by this International Standard is usually carried out on tubes after completion of all the primary production process operations which affect the tube thickness.

These activities shall be carried out by personnel certificated in accordance with ISO 11484, as nominated by the manufacturer.

In the case of third-party inspection, this shall be agreed between the purchaser and manufacturer.

3.2 The tubes to be tested shall be sufficiently straight to ensure the validity of the test. The surfaces shall be sufficiently free from foreign matter which would interfere with the validity of the test.

1) To be published.

4 Method of test

4.1 The tubes shall be tested using the ultrasonic single or multiple pulse echo technique, with ultrasound transmitted in the direction normal to the tube surface, to determine that the tube thickness meets the specified requirements.

4.2 During testing, the tubes and/or the transducer assembly shall be moved relative to each other so that (with the exception described, in note 2 to 1.1) the tube surface is scanned over equispaced non-coincident spiral paths, not exceeding 150 mm pitch, along the entire length of the tube.

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

4.4 The equipment for automatic testing shall be capable of differentiating between acceptable and suspect tubes by means of an automatic trigger/alarm level combined with a marking and/or sorting system.

5 Reference standards

5.1 The ultrasonic equipment shall be calibrated using a test piece which shall have acoustic properties (e.g. velocity) similar to those of the tube to be tested. The test piece shall be either tubular or partly tubular and of the same nominal diameter as the tube to be tested, or a machined block of steel.

5.2 The test piece shall, at the manufacturer's option, be either

- a) of a known predetermined thickness; or
- b) have a machined section at the specified lower, or lower and upper, thickness limit.

The thickness of the test piece used for calibrating the ultrasonic equipment shall be known within $\pm 0,05$ mm or $\pm 0,2$ % whichever is the greater.

6 Equipment calibration and checking

6.1 The equipment shall be calibrated statically using the selected test piece, such that it indicates the thickness of the test piece with an accuracy better than $\pm 0,10$ mm or ± 2 %, whichever is the larger, and such that a trigger/alarm condition is produced whenever the specified thickness limit(s) is (are) exceeded.

6.2 During the production testing of tubes, the relative rotational and translational speeds shall be chosen so that the tube surface is scanned on an inspection pitch not exceeding 150 mm, in accordance with 4.2.

6.3 The calibration of the equipment shall be checked at regular intervals during the production testing of tubes of the same diameter, wall thickness and grade, using the selected test piece. The frequency of checking the calibration shall be at least every 4 h or once every ten production tubes tested, whichever is the longer time period, but also whenever there is an equipment operator team changeover and at the start and end of the production run.

NOTE 3 In cases where a production testing run is continuous from one shift period to the next, the 4 h maximum period may be extended by agreement between the purchaser and manufacturer.

6.4 The equipment shall be recalibrated following any system adjustments or whenever the specified nominal tube diameter, wall thickness or grade of steel is changed.

6.5 If on checking during production testing the calibration requirements are not satisfied, even after taking into account an additional accuracy tolerance given in 6.5.1, to allow for system drift, then all tubes tested since the previous check shall be retested after the equipment has been recalibrated.

Retesting shall not be necessary even after a change in thickness calibration exceeding that given in 6.5.1 since the previous calibration, provided that suitable recordings from individually identifiable tubes are available which permit accurate classification into suspect and acceptable categories.

6.5.1 To allow for system drift, an additional thickness accuracy tolerance of ± 1 % or $\pm 0,05$ mm, whichever is the larger, in excess of that indicated in 6.1 shall be taken into account when checking the equipment calibration during production testing.

7 Acceptance

7.1 Any tube not producing a trigger/alarm condition shall be deemed to have passed this test.

7.2 Any tube producing a trigger/alarm condition shall be designated suspect, or at the manufacturer's option, may be retested as specified above.

7.3 If upon retesting no trigger/alarm condition is obtained, the tube shall be deemed to have passed this test. Tubes producing a trigger/alarm condition shall be designated suspect.

7.4 For suspect tubes, one or more of the following actions may be taken, subject to the requirements of the product standard:

- a) If the manufacturer can prove to the satisfaction of the purchaser that the trigger/alarm condition arises from a combination of minor imperfections

(e.g. inclusion clusters) which, individually or in combination, are not serious or extensive enough to cause rejection, the tube shall be deemed to have passed this test.

- b) When applicable, the suspect area of tubes exhibiting thickening in excess of the upper tolerance limit may be dressed by an acceptable method. After checking that the remaining wall thickness is within the lower and upper thickness limits, the tube shall be deemed to have passed this test.
- c) Suspect tubes having small local areas exceeding the lower, or lower and upper, thickness limit may only be classified as acceptable by agreement between the purchaser and manufacturer.
- d) The suspect area shall be cropped off. The manufacturer shall ensure, to the satisfaction of the purchaser, that all the suspect area has been removed.

- e) The tube shall be deemed not to have passed this test.

8 Test report

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

- a) reference to this International Standard;
- b) date of test report;
- c) statement of conformity;
- d) material designation by grade and size;
- e) type and details of inspection technique;
- f) description of the reference standard.

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