INTERNATIONAL STANDARD

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Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Ultrasonic testing for verification of hydraulic leak-tightness

Tubes en acier sans soudure et soudés (sauf à l'arc immergé) pour service sous pression — Contrôle par ultrasons pour la vérification de l'étanchéité

Reference number
ISO 10332:1994(E)

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 10332 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 welded (except submerged arc-welded) steel tubes for pressure purposes — Ultrasonic testing for verification of hydraulic leak-tightness

1 Scope

1.1 This International Standard specifies requirements for ultrasonic testing of seamless and welded tubes for pressure purposes, with the exception of submerged arc-welded (SAW) tubes, for verification of hydraulic leak-tightness.

1.2 It is applicable to the inspection of tubes with an outside diameter greater than or equal to 168,3 mm, and with an outside diameter-to-thickness ratio greater than or equal to 5. By agreement between the purchaser and manufacturer, it can also be applied to smaller tube diameters.

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 235:1980, *Parallel shank jobber and stub series drills and Morse taper shank drills.*

ISO 286-1:1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits.*

ISO 9302:1989, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Electromagnetic testing for verification of hydraulic leak-tightness.*

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.

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.

For electric resistance and induction welded tubes, the inside and outside weld beads must be trimmed.

4 Method of test

4.1 The tubes shall be tested for verification of hydraulic leak-tightness using an ultrasonic technique.

4.2 During testing, the tubes shall be scanned in two opposing circumferential directions of beam travel, unless otherwise agreed between the purchaser and the manufacturer.

NOTE 1 It is recognized that there is a short length at both tube ends which may not be able to be tested.

1) To be published.

4.3 During testing, the tubes and/or the transducer assembly shall be moved relative to each other so that the whole of the tube surface is scanned.

In the case of welded tubes (excluding welded stretch-reduced), by agreement between the purchaser and manufacturer, verification of hydraulic leak-tightness of only the weld zone is permitted. In this case, the transducer assembly shall be correctly aligned with the weld seam so that the whole length of the weld seam is scanned.

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

4.5 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 automatic marking and/or sorting systems.

NOTE 2 This ultrasonic test method utilizes one or more ultrasonic transducers to describe a helical path over the tube surface. For this reason, it detects longitudinal imperfections having a minimum length dependent on the width of the transducer and the inspection helical pitch. It is recognized that transverse imperfections are not normally detectable.

5 Reference standards

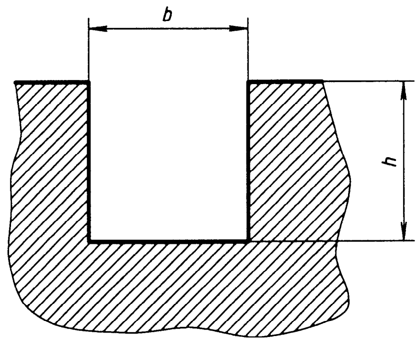
5.1 The reference standards defined in this International Standard are convenient standards for calibration of non-destructive testing equipment. The dimensions of these standards should not be construed as the minimum sizes of imperfections detectable by such equipment.

5.2 Unless otherwise agreed at the time of enquiry and order, the ultrasonic equipment shall be calibrated using a longitudinal reference notch on the outside surface or a reference hole drilled radially through the full thickness of a tubular test piece.

5.3 The test piece shall have the same nominal diameter, thickness, surface finish and heat treated condition as the tube to be tested, and shall have similar acoustic properties (e.g. velocity, attenuation coefficient, etc.).

5.4 The external notch or the reference hole shall be sufficiently separated from the extremities of the test piece, so that a clearly distinguishable signal indication is obtained.

5.5 The reference notch shall be of the "N" type (see figure 1) and shall lie parallel to the major axis of the tube. The sides shall be nominally parallel and the bottom shall be nominally square to the sides.



Key

b Width

h Depth

Figure 1 — "N"-type notch

5.6 The reference notch shall be formed by machining, spark erosion or other methods.

NOTE 3 It is recognized that the bottom or the bottom corners of the notch may be rounded.

6 Dimensions of reference notch or hole

6.1 Dimensions of reference notch

6.1.1 Width, ***b*** (see figure 1)

1,5 mm max.

6.1.2 Depth, ***h*** (see figure 1)

12,5 % of the specified thickness with the following limitations:

— Minimum depth: 0,5 mm

— Maximum depth: 1,5 mm

6.1.3 Tolerance on depth

± 15 % of reference notch depth or ± 0,05 mm, whichever is the larger.

6.1.4 Length

The reference notch shall be of a convenient length selected by the manufacturer for calibration and checking purposes.

6.1.5 Verification

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

6.2 Diameter of reference hole

6.2.1 The diameter of the drill required to produce the reference hole shall be 3,2 mm with a tolerance according to ISO 235 (jobber series) and ISO 286-1 (h8).

When the tube diameter is less than 168,3 mm, and where agreement between the purchaser and manufacturer is required (see clause 1), the diameter of the drill shall be agreed upon but it shall not exceed 3,2 mm.

6.2.2 The diameter of the reference hole shall be checked and shall not exceed the specified drill diameter by more than 0,2 mm.

7 Equipment calibration and checking

7.1 The equipment shall be adjusted to consistently produce, to the satisfaction of the purchaser when represented, a clearly identifiable signal from the reference standard. This signal shall be used to set the trigger/alarm level of the equipment.

7.2 During calibration, the relative speed of movement between the test piece and the transducer assembly shall be the same as that to be used during the production test, except that semi-dynamic calibration may be used when dynamic calibration is impractical. In this case, any necessary adjustment to sensitivity shall be made to allow for differences in signal magnitude between semi-dynamic and dynamic calibration.

7.3 The calibration of the equipment shall be checked at regular intervals during the production testing of tubes of the same diameter, thickness and grade, by passing the test piece through the testing equipment.

The frequency of checking the calibration shall be at least every 4 h, but also whenever there is an equipment operator team changeover and at the start and end of the production run.

NOTE 4 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.

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

7.5 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 tubes tested since the previous check shall be retested after the equipment has been recalibrated.

Retesting shall not be necessary even after a drop in test sensitivity of more than 3 dB since the previous calibration, provided that suitable recordings from individually identifiable tubes are available which permit accurate classification into suspect and acceptable categories.

8 Acceptance

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

8.2 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 as specified above.

8.3 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.

Tube giving signals equal to or greater than the trigger/alarm level shall be designated suspect.

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

a) The suspect area shall be explored by dressing using an acceptable method. After verifying that the remaining thickness is within the tolerance, the tube shall be retested as previously specified. If no signals are obtained equal to or greater than the trigger/alarm level, the tube shall be deemed to have passed this test.

   The suspect area may be retested in accordance with ISO 9302 or, by agreement between the purchaser and manufacturer, using other non-destructive techniques and test methods to agreed acceptance levels.

b) Each suspect tube shall be subjected to a hydraulic leak-tightness test in accordance with the relevant product standard, unless otherwise agreed between the purchaser and manufacturer.

c) 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.

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

9 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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ICS 23.040.10; 77.040.20; 77.140.30

Descriptors: pipes (tubes), metal tubes, steel tubes, seamless tubes, welded tubes, pressure pipes, tests, non-destructive tests, ultrasonic tests, fluid-tightness tests, verification.

Price based on 4 pages