INTERNATIONAL STANDARD

ISO 10893-8

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Non-destructive testing of steel tubes —

Part 8: Automated ultrasonic testing of seamless and welded steel tubes for the detection of laminar imperfections

Essais non destructifs des tubes en acier —

Partie 8: Contrôle automatisé par ultrasons pour la détection des dédoublures des tubes en acier sans soudure et soudés

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10893-8 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 19, *Technical delivery conditions for steel tubes for pressure purposes*.

This first edition cancels and replaces ISO 10124:1994, ISO 11496:1993 and ISO 13663:1995, which have been technically revised.

ISO 10893 consists of the following parts, under the general title *Non-destructive testing of steel tubes*:

- *Part 1: Automated electromagnetic testing of seamless and welded (except submerged arc-welded) steel tubes for the verification of leaktightness*
- *Part 2: Automated eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections*
- *Part 3: Automated full peripheral flux leakage testing of seamless and welded (except submerged arc-welded) ferromagnetic steel tubes for the detection of longitudinal and/or transverse imperfections*
- *Part 4: Liquid penetrant inspection of seamless and welded steel tubes for the detection of surface imperfections*
- *Part 5: Magnetic particle inspection of seamless and welded ferromagnetic steel tubes for the detection of surface imperfections*
- *Part 6: Radiographic testing of the weld seam of welded steel tubes for the detection of imperfections*
- *Part 7: Digital radiographic testing of the weld seam of welded steel tubes for the detection of imperfections*
- *Part 8: Automated ultrasonic testing of seamless and welded steel tubes for the detection of laminar imperfections*
- *Part 9: Automated ultrasonic testing for the detection of laminar imperfections in strip/plate used for the manufacture of welded steel tubes*
- *Part 10: Automated full peripheral ultrasonic testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of longitudinal and/or transverse imperfections*

— *Part 11: Automated ultrasonic testing of the weld seam of welded steel tubes for the detection of longitudinal and/or transverse imperfections*

— *Part 12: Automated full peripheral ultrasonic thickness testing of seamless and welded (except submerged arc-welded) steel tubes*

Non-destructive testing of steel tubes —

Part 8:
Automated ultrasonic testing of seamless and welded steel tubes for the detection of laminar imperfections

1 Scope

This part of ISO 10893 specifies requirements for automated ultrasonic testing for the detection of laminar imperfections

a) in the pipe body (full peripheral testing) of seamless and welded, except submerged arc-welded (SAW), steel tubes, or

b) in the area adjacent to the weld seam of welded steel tubes, and optionally

c) at the ends (full peripheral testing) of seamless and welded tubes.

This part of ISO 10893 can also be applicable to the testing of circular hollow sections.

NOTE For welded tubes, see ISO 10893-9 for an alternative test method for the detection of laminar imperfections in steel strip/plate prior to tube forming.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5577, *Non-destructive testing — Ultrasonic inspection — Vocabulary*

ISO 9712, *Non-destructive testing — Qualification and certification of personnel*

ISO 10893-6, *Non-destructive testing of steel tubes — Part 6: Radiographic testing of the weld seam of welded steel tubes for the detection of imperfections*

ISO 10893-7, *Non-destructive testing of steel tubes — Part 7: Digital radiographic testing of the weld seam of welded steel tubes for the detection of imperfections*

ISO 11484, *Steel products — Employer's qualification system for non-destructive testing (NDT) personnel*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5577 and ISO 11484 and the following apply.

3.1
reference standard
standard for the calibration of non-destructive testing equipment (e.g. drill holes, notches, recesses)

3.2
reference tube
tube or length of tube containing the reference standard(s)

3.3
reference sample
sample (e.g. segment of tube, plate or strip) containing the reference standard(s)

NOTE Only the term “reference tube” is used in this part of ISO 10893, also covering the term “reference sample”.

3.4
laminar imperfection
imperfection located in the wall thickness and generally parallel to the pipe surfaces

NOTE Its extension can be calculated by measuring its outlined area on the external surface.

3.5
tube
hollow long product open at both ends, of any cross-sectional shape

3.6
seamless tube
tube made by piercing a solid product to obtain a tube hollow, which is further processed, either hot or cold, into its final dimensions

3.7
welded tube
tube made by forming a hollow profile from a flat product and welding adjacent edges together, and which after welding can be further processed, either hot or cold, into its final dimensions

3.8
manufacturer
organization that manufactures products in accordance with the relevant standard(s) and declares the compliance of the delivered products with all applicable provisions of the relevant standard(s)

3.9
agreement
contractual arrangement between the manufacturer and purchaser at the time of enquiry and order

4 General requirements

4.1 Unless otherwise specified by the product standard or agreed on by the purchaser and manufacturer, an ultrasonic testing shall be carried out on tubes after completion of all the primary production process operations (rolling, heat treating, cold and hot working, sizing and primary straightening, etc.).

4.2 The tubes under test shall be sufficiently straight to ensure the validity of the test. The surfaces shall be sufficiently free of foreign matter which can interfere with the validity of the test.

4.3 This test shall be carried out by suitable trained operators qualified in accordance with ISO 9712, ISO 11484 or equivalent and supervised by competent personnel nominated by the manufacturer. In the case of third-party inspection, this shall be agreed on by the purchaser and manufacturer.

The operating authorization issued by the employer shall be according to a written procedure. Non-destructive testing (NDT) operations shall be authorized by a level 3 NDT individual approved by the employer.

NOTE The definition of levels 1, 2 and 3 can be found in appropriate International Standards, e.g. ISO 9712 and ISO 11484.

5 Test method

5.1 General

5.1.1 As specified in the product standard, the test shall be executed using an ultrasonic pulse echo technique for the detection of laminar imperfections in accordance with 5.2 or 5.3 and/or 5.4. The ultrasound shall be transmitted in the direction normal to the tube surface.

5.1.2 For testing in accordance with 5.2 or 5.3, the relative speed of movement during testing shall not vary by more than ±10 %. For determining the extent of the laminated suspect area, adjacent suspect areas separated by less than the smaller of the two minor axes of the laminations shall be considered as one lamination. There may be a short length at both tube ends which cannot be tested in the case of testing in accordance with 5.2 or 5.3.

Any untested ends shall be dealt with in accordance with the requirements of the appropriate product standards (see also 5.4).

5.1.3 The ultrasonic test frequency that shall be applied shall be in the range of 2 MHz to 10 MHz.

5.1.4 The suggested maximum width of each transducer, or each active aperture when using phased array transducers, should be 25 mm measured in any direction. However, manufacturers may use larger transducers providing their capability for detecting the adopted reference standard; on request, this capability shall be demonstrated.

5.1.5 The equipment shall be capable of classifying tubes as either acceptable or suspect by means of an automated trigger/alarm level combined with a marking and/or sorting system.

5.1.6 Where manual ultrasonic testing is required, this shall be carried out in accordance with Annex A.

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

5.2 Full peripheral testing of seamless and welded (except SAW) tubes

During testing, the tubes and the transducer assembly shall be moved relative to each other such that the tube surface is scanned in order to detect laminar imperfections with a size equal to or greater than the relevant minimum lamination size, B_{min}, with a circumferential dimension, C_{min}, calculated as given in Table 1.