INTERNATIONAL STANDARD

ISO 10893-2

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Non-destructive testing of steel tubes —

Part 2: Automated eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections

Essais non destructifs des tubes en acier —
Partie 2: Contrôle automatisé par courants de Foucault pour la détection des imperfections des tubes en acier sans soudure et soudés (sauf à l'arc immergé sous flux en poudre)

Reference number
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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 10893-2 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 9304:1989, which has 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 hydraulic 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 2:
Automated eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections

1 Scope

This part of ISO 10893 specifies requirements for automated eddy current testing of seamless and welded tubes with the exception of submerged arc-welded (SAW) tubes, for the detection of imperfections according to the different acceptance levels as shown in Tables 1 and 2. It is applicable to the inspection of tubes with an outside diameter greater than or equal to 4 mm.

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

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

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 11484 and the following apply.

3.1
reference standard
standard for the calibration of non-destructive testing equipment (e.g. drill holes, notches and 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
tube
hollow long product open at both ends, of any cross-sectional shape

3.5
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

3.6
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

3.7
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)

3.8
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, this eddy current inspection shall be carried out on tubes after completion of all the production process operations, such as rolling, heat treating, cold forming and hot working, sizing and primary straightening.

4.2 The tubes being tested 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 inspection shall be carried out by 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 between the purchaser and manufacturer.

The operating authorization issued by the employer shall be according to a written procedure. 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 Test techniques

5.1.1 The tubes shall be tested by the eddy current method for the detection of imperfections using in “absolute mode” and/or in “differential mode” one of the following alternative automated or semi-automated techniques:

a) concentric coil technique — full peripheral (see Figure 1);

b) fixed or rotating probe/pancake coil technique — full peripheral (see Figure 2);

c) segment coil technique — weld seam only (see Figure 3) or full body (see Figure 4).

For all techniques, the chosen relative speed of movement during the testing shall not vary by more than ±10 %.

It is recognized that there may be a short length at both tube ends which cannot be tested. Any untested ends shall be dealt with in accordance with the requirements of the appropriate product standards.

NOTE See Annex A for guidelines on the limitations of the eddy current test method.

5.1.2 When testing tubes using the concentric coil technique, the maximum tube outside diameter that shall be tested shall be restricted to 180 mm (250 mm for E4H).

Square and rectangular tubes, used for structural purposes, with a maximum dimension across the diagonal of 180 mm may also be tested using this technique with adequately shaped coils.

5.1.3 When testing tubes using the rotating or fixed probe/pancake coil technique, the tube and the probe/pancake coil shall be moved relative to each other or the movement shall be simulated by electronic commutation through the individual probes composing the pancake, such that the whole of the tube surface is scanned. There is no restriction on the maximum tube outside diameter using this technique.

NOTE It is emphasized that only external surface breaking imperfections can be detected using this technique.

5.1.4 When testing the weld of welded tubes using the segment coil technique, there is no restriction on the maximum tube outside diameter. The test coil shall be maintained in proper alignment with the weld, such as that the whole of the weld is scanned.

5.1.5 When testing the full body of tubes using the segment coils technique, the maximum tube outside diameter that shall be tested shall be limited to:

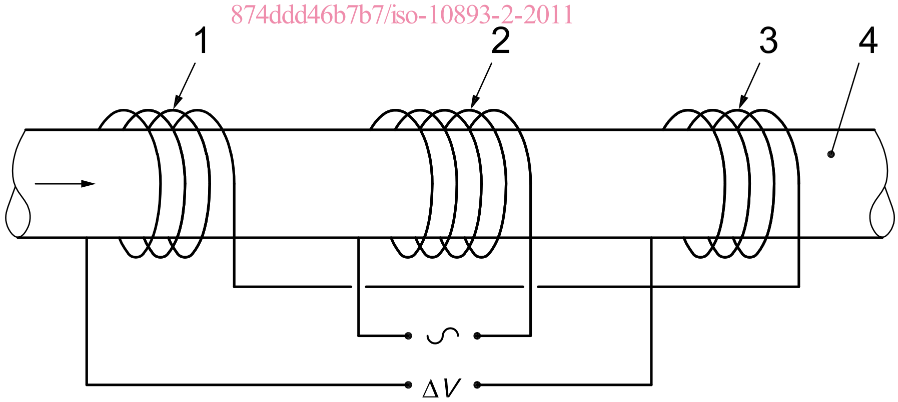
— ∅ 219,1 mm for 2 × 180° coils,

— ∅ 508,0 mm for 4 × 100° coils.

NOTE It is emphasized that the test sensitivity is at a maximum at the tube surface adjacent to the test coil and decreases with increasing thickness (see Annex A).

5.2 Test equipment

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



Key

1 secondary coil 1

2 primary coil

3 secondary coil 2

4 tube

~ alternate energizing current

ΔV signal output

NOTE The above diagram is a simplified form of a multi-coil arrangement which can contain, for example split primary coils, twin differential coils and calibrator coil.

Figure 1 — Simplified diagram of the concentric coil technique

