
Non-destructive testing of steel tubes —

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**

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Essais non destructifs des tubes en acier —

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*Partie 3: Contrôle automatisé par flux de fuite sur toute la circonférence
des tubes en acier ferromagnétique sans soudure et soudés (sauf à
l'arc immergé sous flux en poudre) pour la détection des imperfections
longitudinales et/ou transversales*



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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 10893-3 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 9402:1989 and ISO 9598:1989, 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 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*

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Non-destructive testing of steel tubes —

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

1 Scope

This part of ISO 10893 specifies requirements for automated full peripheral magnetic flux leakage testing of seamless and welded ferromagnetic steel tubes, with the exception of submerged arc-welded (SAW) tubes, for the detection of imperfections.

Unless otherwise specified in the purchase order, this part of ISO 10893 is applicable to the detection of predominantly longitudinal imperfections.

This part of ISO 10893 is applicable to the inspection of tubes with an outside diameter equal to or greater than 10 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

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4 General requirements

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

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

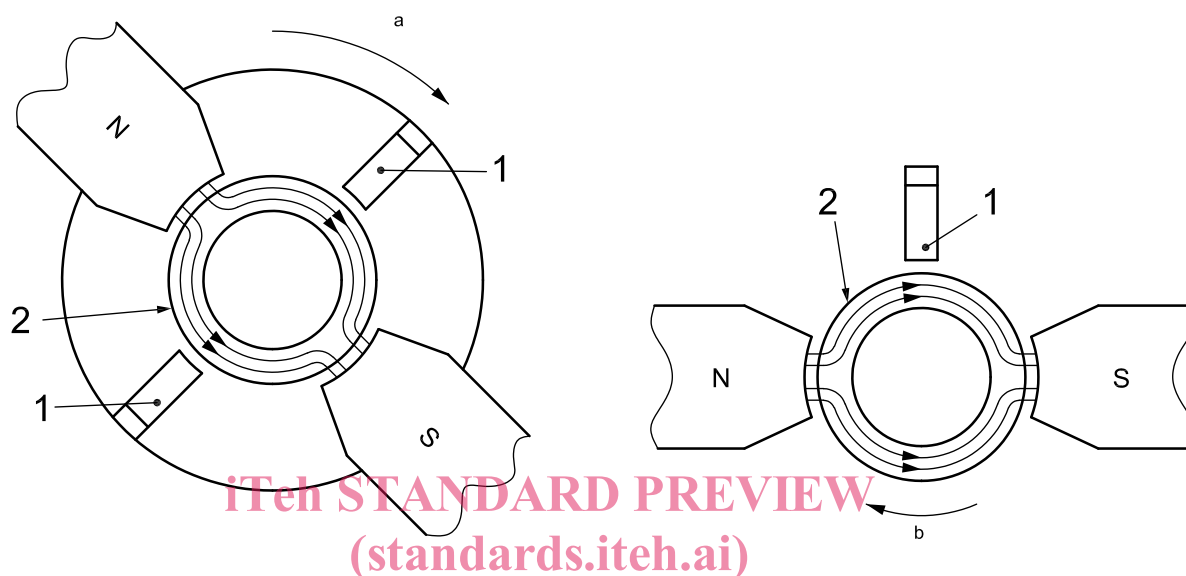
5.1 The tubes shall be tested using the magnetic flux leakage technique for the detection of predominantly longitudinal imperfections (see Figure 1) and/or, by agreement, predominantly transverse imperfections (see Figure 2). No limits on thickness are specified; indications on the limits of the method are reported in Annex A.

It is recognized that there can 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.

5.2 During testing, the tube and the transducer(s) shall be moved relative to each other such that the whole of the tube surface is scanned. The relative speed during testing shall not vary by more than $\pm 10\%$.

5.3 The maximum width of each individual transducer, measured parallel to the major axis of defects being detected, shall be 30 mm.

5.4 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.



a) Rotating magnetic transducer technique — Linear movement of the tube **b) Fixed magnetic transducer technique — Linear and rotary movement of the tube**

Key

1 flux leakage transducers

2 tube

N north pole

S south pole

a Direction of probe rotation.

b Direction of tube rotation.

Figure 1 — Simplified diagram of magnetic flux leakage techniques for the detection of longitudinal imperfections