

INTERNATIONAL STANDARD

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Seamless and welded steel tubes for pressure purposes — Magnetic particle inspection of the tube ends for the detection of laminar imperfections

*Tubes en acier sans soudure et soudés pour service sous pression —
Contrôle par magnétoscopie des extrémités des tubes pour la détection
des dédoubleures de laminage*



Reference number
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Foreword

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Seamless and welded steel tubes for pressure purposes — Magnetic particle inspection of the tube ends for the detection of laminar imperfections

1 Scope

1.1 This International Standard specifies requirements for magnetic particle inspection of the end/bevel face at the ends of seamless and welded steel tubes for pressure purposes, for the detection of laminar imperfections.

It is intended that this International Standard be used to detect, on the end/bevel face at the ends of plain-end and bevelled-end tubes, laminar imperfections which may interfere with subsequent fabrication and inspection operations (e.g. welding, ultrasonic inspection of the butt welds, etc.). This International Standard may be used as an alternative to, or in addition to, ISO 11496.

1.2 This International Standard may also be used for the detection of imperfections, other than laminar imperfections, on the end/bevel face. In this case, magnetization shall be applied in the direction essentially perpendicular to the orientation of the particular imperfections to be detected.

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 9934-1:—¹⁾, *Non-destructive testing — Magnetic particle testing — Part 1: General principles*.

ISO 11484:1994, *Steel tubes for pressure purposes — Qualification and certification of non-destructive testing (NDT) personnel*.

ISO 11496:1993, *Seamless and welded steel tubes for pressure purposes — Ultrasonic testing of tube ends for the detection of laminar imperfections*.

3 General requirements

3.1 The magnetic particle inspection covered by this International Standard shall be carried out on tubes after completion of final end-machining operations.

This inspection 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 surface of the end/bevel face at both tube ends to be tested shall be sufficiently free from oil, grease and other foreign matter which could interfere with the correct interpretation of indications obtained from the magnetic particle inspection of the tube ends.

4 Method of test

4.1 The end/bevel face at both ends of each tube shall be inspected using the magnetic particle method, for the detection of laminar imperfections, with a.c. or d.c. magnetization and black or fluorescent ink, as appropriate to the magnetic particle

1) To be published.

technique adopted. The use of dry magnetic powder is permitted only by prior agreement between the purchaser and manufacturer.

4.2 During the production testing of the end/bevel face at both ends of each tube, magnetization shall, at the discretion of the manufacturer, be applied either parallel to the major axis of the tube or radially through the tube thickness. Black ink shall be applied simultaneously to the end/bevel face, to reveal the presence of laminar imperfections, using an illumination of not less than 350 lx.

In cases where there is insufficient sensitivity due, for example, either to poor contrast between the black ink and the surface of the end/bevel face to be inspected, or as a result of the magnetization technique adopted, the end/bevel face shall, prior to inspection, be coated with a white background paint to aid contrast. Alternatively, fluorescent ink shall be used and the inspection carried out in a darkened area using a UV-A radiation source, with a background white light level not exceeding 20 lx and a black light intensity of at least 8 W/m².

4.3 When using magnetization parallel to the major axis of the tube, this shall be achieved using a rigid concentric coil surrounding or inside the tube, positioned close to the tube end. The coil shall be energized using an alternating or a half- or full-wave rectified or direct current source. In this case, it shall be demonstrated by a measuring device that the induced currents in the tube wall produce a magnetic flux perpendicular to the surface.

Alternatively, the current flow method may be used by passing current around the tube circumference using clamps on the tube end that are 180° apart. After inspection, the test shall be repeated after rotating the clamps by 90° with respect to their initial position. In this case, but only by agreement between the purchaser and manufacturer, it is permissible to conduct the test using residual magnetization and fluorescent ink.

4.4 When using magnetization applied radially through the thickness of the tube at the ends, this shall be achieved using an a.c. or d.c. yoke, with the pole pieces applied radially between the inner and outer surface of the tube across the tube thickness at the ends. By agreement between the purchaser and manufacturer, the use of a permanent magnet of sufficient power is permitted.

Other methods of applying radial magnetization may be adopted, provided that the manufacturer can demonstrate their equivalence to the method described above.

4.5 It is emphasized that it is outwith the scope of this International Standard to specify the levels of magnetization and current which are required to reveal the presence of unacceptable laminar imperfections.

NOTE 1 This is due to the wide variety of magnetic particle techniques available and permitted for this purpose.

However, in all cases the magnetization requirements together with the use of magnetic inks and powders given in ISO 9934-1 shall apply.

4.6 During the production testing of the end/bevel face, the level of magnetization shall be checked at regular intervals, not exceeding 4 h, for example using a magnetic field-strength meter where appropriate. Alternatively, a test piece containing either an artificial simulation of, or a naturally occurring laminar imperfection on, the end/bevel face may be used, where the manufacturer shall demonstrate the presence of a consistent indication of the imperfection.

5 Acceptance

5.1 Any tube producing either no indication at all or an individual indication of laminar imperfections, on the end/bevel face at both ends of the tube, less than 6 mm in circumference, shall be deemed to have passed the test.

5.2 Any tube producing an individual indication of a laminar imperfection on the end/bevel face at either end of the tube, equal to or greater than 6 mm in circumference, shall be designated suspect.

5.3 For suspect tube, the manufacturer may either reject the tube or machine the end/bevel face(s). In the latter case, the manufacturer shall ensure that, as a result of remachining the tube end(s), the detected laminar imperfection(s) has (have) been removed, and shall subject the remachined end/bevel face to a repeat test as specified above, using the same magnetic particle technique etc. as in the original test.

NOTE 2 To facilitate the determination of how far the detected laminar imperfection(s) on the end/face bevel extend along the length of the tube from the tube end, the manufacturer may carry out an ultrasonic test over the tube-end zone, in accordance with ISO 11496.

6 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 the test report;
- c) statement of conformity;
- d) material designation by grade and size;
- e) type and details of inspection technique adopted, including the magnetic material used during inspection.

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