INTERNATIONAL STANDARD

ISO 9764

First edition
1989-08-01

Electric resistance and induction welded steel tubes for pressure purposes — Ultrasonic testing of the weld seam for the detection of longitudinal imperfections

Tubes en acier soudés par résistance électrique ou induction pour service sous pression — Contrôle par ultrasons du cordon de soudure pour la détection des imperfections longitudinales

Reference number
ISO 9764 : 1989 (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 approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 9764 was prepared by Technical Committee ISO/TC 17, *Steel.*

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Printed in Switzerland

!ntroduction

This International Standard concerns ultrasonic testing of the weld seam of electric resistance and induction weld steel tubes for pressure purposes, for the detection of longitudinal imperfections.

Two different acceptance levels are considered in table 1. The choice between these acceptance levels will depend on the intended application.

This page intentionally left blank

Electric resistance and induction welded steel tubes for pressure purposes — Ultrasonic testing of the weld seam for the detection of longitudinal imperfections

1 Scope

This International Standard specifies requirements for the ultrasonic testing of the weld seam of electric resistance and induction welded steel tubes for the detection of predominantly radial longitudinal imperfections, according to two different acceptance levels (see table 1).

2 General requirements

2.1 The ultrasonic inspection covered by this International Standard is usually carried out on tubes after completion of all the production process operations.

This inspection shall be carried out by suitably trained operators and be supervised by competent personnel nominated by the manufacturer. In the case of third-party inspection, this shall be agreed between the purchaser and manufacturer.

2.2 The tubes to be tested shall be sufficiently straight to ensure the validity of the test. The surfaces shall be sufficiently free from such foreign matter as would interfere with the validity of the test.

3 Method of test

3.1 The weld of the tube shall be tested using an ultrasonic shear wave technique for the detection of predominantly radial longitudinal imperfections.

3.2 During testing, the tubes and/or the transducer assembly shall be maintained in proper alignment with the weld so that the specified test sensitivity is maintained over the whole of the weld seam area over the tube length.

NOTE — It is recognized that there is a short length at both tube ends which it may not be possible to test.

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

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

3.5 Equipment for automatic testing shall be capable of differentiating between acceptable and suspect tube by means of an automatic trigger/alarm level combined with marking and/or sorting systems.

4 Reference standards

4.1 The reference standards defined in this International Standard are designed for establishing the sensitivity of non-destructive testing equipment. The dimensions of these standards should not be construed as the minimum size of imperfection detectable by such equipment.

4.2 The ultrasonic equipment shall be calibrated using a longitudinal reference notch on the outside and inside surfaces, or on the outside surface only, of a tubular test piece. The internal notch shall not be used when the tube internal diameter is less than 15 mm, unless otherwise agreed between purchaser and manufacturer.

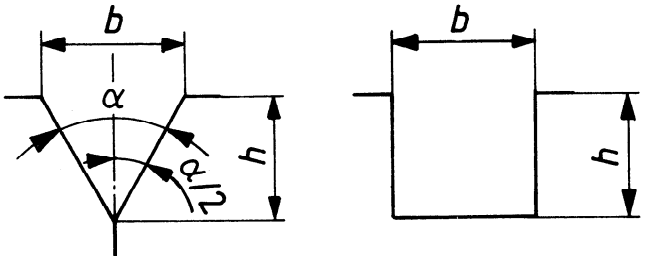
Alternatively, a reference hole drilled radially through the full thickness of the test piece may be used for equipment calibration, by agreement between purchaser and manufacturer. In this case, the diameter of the drill required to produce the reference hole for a specific acceptance level shall also be agreed and the manufacturer shall demonstrate to the satisfaction of the purchaser that the test sensitivity achieved using the reference hole is essentially equivalent to that obtained when using the specified reference notch or notches.

4.3 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 (velocity, attenuation coefficient, etc.).

4.4 The external and internal notches, or the reference hole, shall be sufficiently separated from the extremities of the test piece and from each other when both are used, so that clearly distinguishable signal indications are obtained.

4.5 The reference notch or notches shall lie parallel to the major axis of the tube.

The reference notch or notches shall be of the "N" type except that the "V" type notch may be used at the discretion of the manufacturer when the specified notch depth is less than or equal to 0,5 mm (see figure 1). In the case of the "N" type notch, the sides shall be nominally parallel and the bottom shall be nominally perpendicular to the sides.



"V" type notch
(only to be used when $h \leq 0,5$ mm)
$\alpha/2 = 30° \pm 2°$
b = width
h = depth

"N" type notch

Figure 1 — Reference notch forms

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

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

5 Dimensions of reference notches

The dimensions of the reference notches shall be as follows:

5.1 Width b (see figure 1)

1,5 mm max.

5.2 Depth h (see figure 1)

As given in table 1.

Table 1

Acceptance level	Notch depth in % of the specified thickness
L3	10
L4	12,5

NOTES

1 The values of notch depth specified in this table are the same, for the corresponding categories, in all International Standards concerning non-destructive testing of steel tubes where reference is made to different acceptance levels. It should, however, be kept in mind that although the reference standards are identical, the various test methods involved can give different test results.

2 Acceptance level L2 (5 % notch depth, with a minimum depth of 0,3 mm) can be used in special circumstances by agreement between the purchaser and manufacturer.

5.2.1 Minimum notch depth

The minimum notch depth shall be 0,3 mm for L3 category tubes and 0,5 mm for L4 category tubes.

5.2.2 Maximum notch depth

The maximum notch depth for all acceptance levels shall be 1,5 mm.

5.2.3 Tolerance on depth (h)

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

5.3 Length

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

5.4 Verification

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

The diameter of the reference hole, when used, shall be verified and shall not exceed the agreed drill diameter by more than 0,2 mm.

6 Equipment calibration and checking

6.1 The equipment shall be adjusted to produce consistently, to the satisfaction of the purchaser, clearly identifiable signals from both the external and internal reference notches, or from the external notch when this alone is used (see 4.2), or from the reference hole.

These signals shall be used to set the trigger/alarm level(s) of the equipment. Where a single trigger/alarm level is used, the transducer(s) shall be adjusted so that the signals from the internal and external reference notches are as nearly equal as possible, and the full signal amplitude of the lesser of the two signals shall be used to set the trigger/alarm level of the equipment. Where separate trigger/alarm levels are used for internal and external reference notches, the full signal amplitude from each notch shall be used to set the relevant trigger/alarm level of the equipment.

When using the reference hole, the manufacturer shall demonstrate to the satisfaction of the purchaser that the test sensitivity achieved at the inner and outer surfaces is essentially equivalent to that achieved when using the specified external and internal reference notches.

6.2 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.

6.3 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 inspection equipment. The frequency of checking the calibration shall be at least every 4 h or once every 10 production tubes tested, whichever represents the longer time period, but the calibration shall also be checked whenever there is an equipment operator change-over and at the start and end of the production run.

NOTE — 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 purchaser and manufacturer.

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

6.5 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, if suitable recordings from individually identifiable tubes are available which permit accurate classification into suspect and acceptable categories.

7 Acceptance

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

7.2 Any tube producing signals originating from within $\pm \delta/2$ of the fusion line, where δ is the specified tube thickness, equal to or greater than the trigger/alarm level shall be designated suspect or, at the manufacturer's option, may be retested as above.

7.3 If, upon retesting, no signal is obtained equal to or greater than the trigger/alarm level, the tube shall be deemed to have passed this test.

Tubes giving signals from the zone defined in 7.2 equal to or greater than the trigger/alarm level shall be designated suspect.

7.4 For a suspect tube, 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 checking that the remaining thickness is within 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 by other non-destructive techniques and test methods, by agreement between purchaser and manufacturer to agreed acceptance levels.

b) 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.

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

8 Test report

When so 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) acceptance level;

d) statement of conformity;

e) material designation by grade and size;

f) type and details of inspection technique;

g) description of the reference standard.

UDC 669.14-462.2 : 620.179.16

Descriptors : pipes (tubes), metal tubes, steel tubes, welded tubes, pressure pipes, specifications, tests, nondestructive tests.

Price based on 3 pages