BRITISH STANDARD

BS EN
10275:1999

Metallic materials — Tube ring hydraulic pressure test

The European Standard EN 10275:1999 has the status of a British Standard

ICS 77.040.10

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 7 and a back cover.

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Metallic materials — Tube ring hydraulic pressure test

Matériaux métalliques — Essai d'expansion hydraulique sur anneau tubulaire

Metallische Werkstoffe — Hydraulischer Ringaufweitversuch

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Comité Européen de Normalisation
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Ref. No. EN 10275:1999 E

Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 29, Steel tubes and fittings for steel tubes, the Secretariat of which is held by UNI.

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1 Scope

This European Standard specifies the ring hydraulic pressure test for metallic tubes. It is generally applied to tubes with an outside diameter generally greater than 120 mm and outside diameter to thickness ratio not less than 20.

The objective of this test is to ascertain the value of the hoop stress required to produce a specified total circumferential (hoop) strain.

2 Symbols

Symbols and corresponding designations are given in Table 1.

Table 1 — Symbols and designations

Symbol	Unit	Designation
T	mm	Measured tube test ring thickness
D	mm	Measured outside diameter of the tube test ring
L	mm	Length of tube test ring
p	N/mm^2	Hydrostatic pressure to produce the specified total strain
x		Specified total strain
R_{tx}	N/mm^2	Hoop strength at the specified total strain

3 Principle

The test involves the unrestrained expansion of the test ring between two platens, under internal hydraulic pressure; the outer circumference of the tube is the effective test piece gauge length.

The test is carried out on a test piece (see Figure 1) removed from a welded or seamless tube of thickness up to a limit dependent upon the capacity of the machine and the strength of the tube. Where the hydraulic pressure required to produce the specified circumferential strain exceeds the capacity of the test machine modified tests may be carried out as described in annex A.

The test is specified when a measure of the hoop strength is required which is not influenced by cold forming and residual stress introduced when flattening a standard tensile test piece. The standard tensile test is necessary, however, when tensile strength and elongation measurements are required.

4 Apparatus

4.1 The testing machine shall be capable of allowing the test ring to expand freely without imposing any end restraint. This shall be achieved by leaving a small gap between the test piece and the top platen. Pressure loss during testing shall be prevented by the use of a flexible seal.

NOTE A typical testing machine is shown schematically in Figure 2.

4.2 To reduce friction between the test piece, platens and inner die to a minimum, the platens shall be parallel and have a fine turned or ground finish. Prior to each test, friction at the contact surfaces shall be further minimized either by the use of a lubricant e.g. graphited grease or by the use of PTFE (polytetrafluorethylene) sheet. The platens shall be inspected regularly and any ridges that develop shall be removed.

4.3 Stress shall be applied to the test ring by means of a pressurized fluid. Provision shall be made to remove any air in the system through a bleed line.

5 Test ring

5.1 Shape and position

5.1.1 Prior to separation from the main body of the tube the test ring shall be marked with a unique identification.

5.1.2 The test ring may be prepared from an oversize flame cut sample. Final preparation shall be by a cold machining process to ensure removal of any heat affected zones. The machined edges shall have a fine turned or ground finish and be free from burrs.

5.1.3 The dimensions and tolerances for the test piece are given in Figure 1. The machined edges shall be parallel and normal to the axis of the tube to within 0,15 mm measured across the diameter.

5.2 Determination of dimensions

5.2.1 The outside diameter of the test ring shall be calculated from measurement of the tube circumference, e.g. using a flexible steel tape. The maximum tolerance on the accuracy of this measurement shall be $\pm$1 mm.

5.2.2 The wall thickness shall be determined by calculating the mean of eight measurements taken at approximately 45° intervals around the test piece, excluding the weld region of welded tubes (see Figure 3). The measuring device shall be capable of measuring thickness with an accuracy of better than 0,025 mm.

5.2.3 All tube diameter and thickness measurements of the test ring shall be fully documented.

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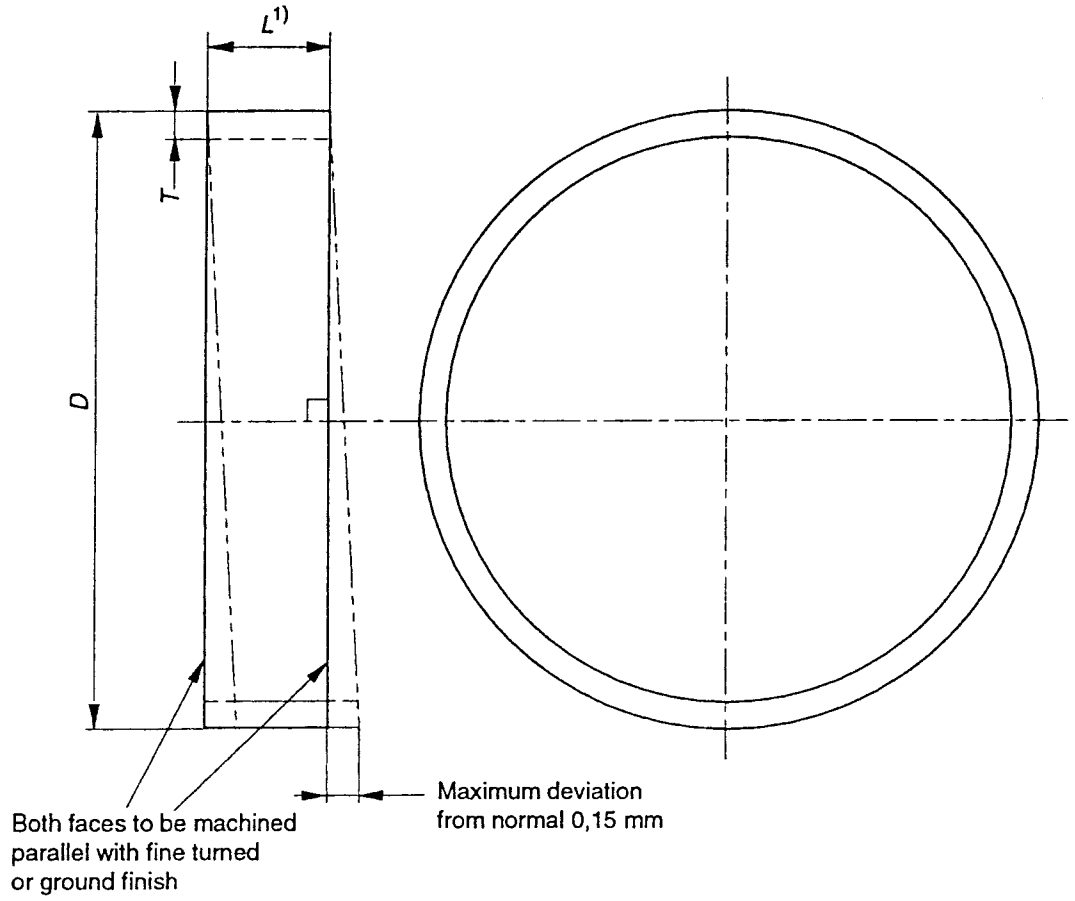

1) Tolerance on L ±0,25 mm.

L is commonly taken as 76 mm.

NOTE Remove all sharp edges and protect machined surfaces.

Figure 1 — Test ring dimensions and tolerances

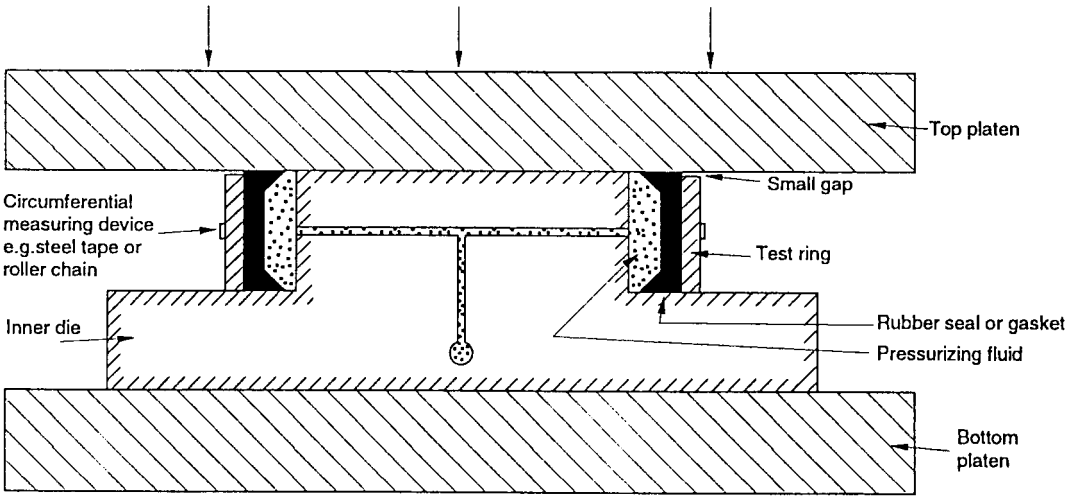

Figure 2 — Schematic diagram of testing machine (with insalled test ring)

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6 Test procedure

6.1 The test procedure consists of applying pressure and measuring circumferential extension.

6.2 Circumferential extension of the test ring shall be measured during pressurization as follows. The equipment for measuring the change of circumference, e.g. steel tape or roller chain extensometer shall be wrapped around the test ring perimeter at the mid-point and crossing at the weld.

NOTE An example of the use of a steel tape is shown in Figure 4.

When a steel tape is used friction shall be minimized by coating both the tape and test ring circumference with a suitable lubricant. Change in circumference shall be measured by a suitable mechanical or electrical device having an accuracy of $\pm$0,25 mm.

6.3 The equipment for measuring the increase in circumference shall be wrapped around the test ring before application of the internal pressure.

6.4 The tolerance for the measurement of internal pressure shall be within $\pm$1 %. Accuracy of the pressure measurement device shall be verified, e.g. by comparison with dead weight test equipment, at the commencement of a sequence of testing and then once every 200 tests, and not less than once per year during the testing period.

6.5 The rate of strain shall not exceed 0,2 % per minute.

6.6 The pressure and circumferential extension output signals shall be recorded, for example on a X–Y plotter, and related to the test piece identity.

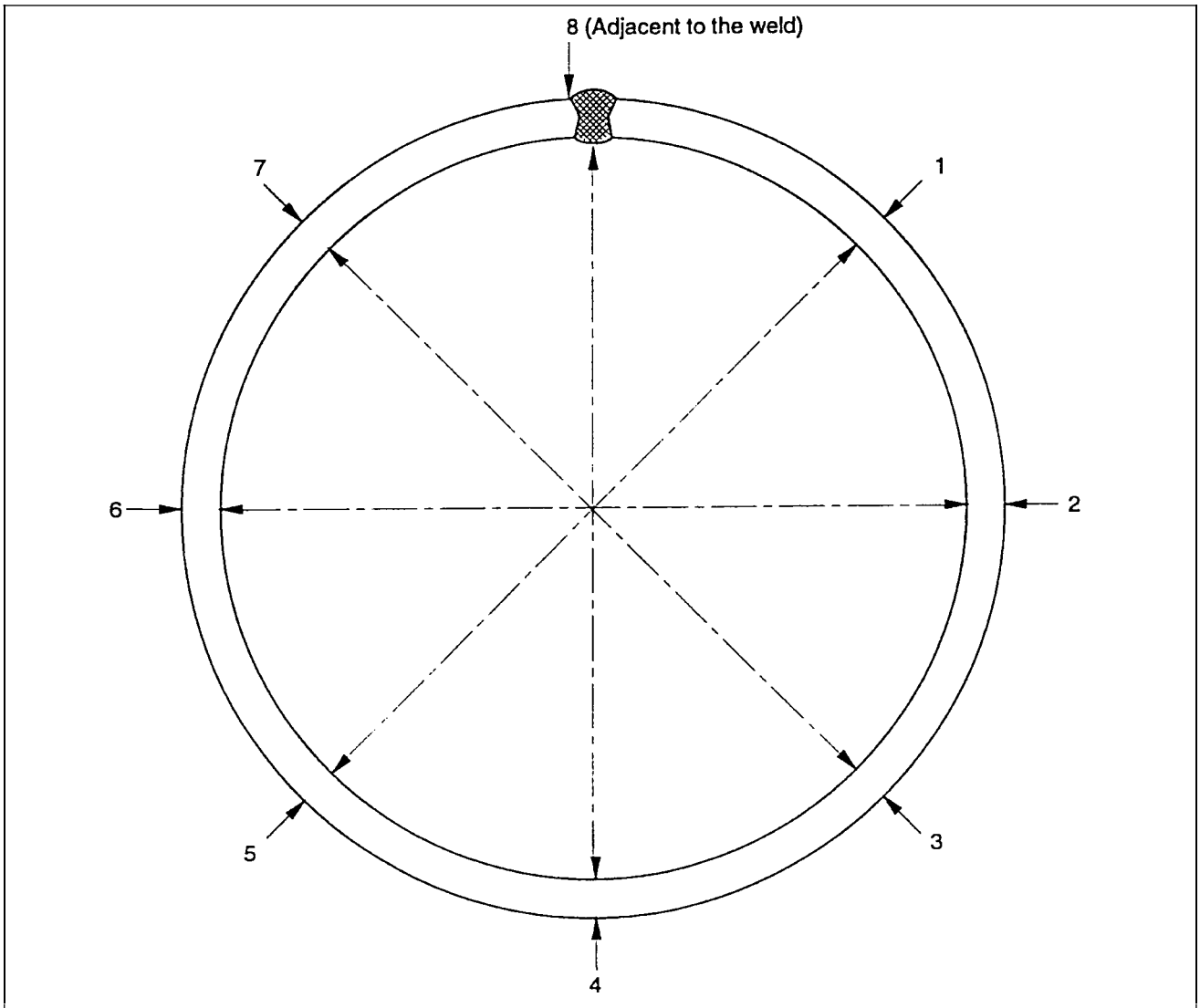

Figure 3 — Wall thickness measurement positions

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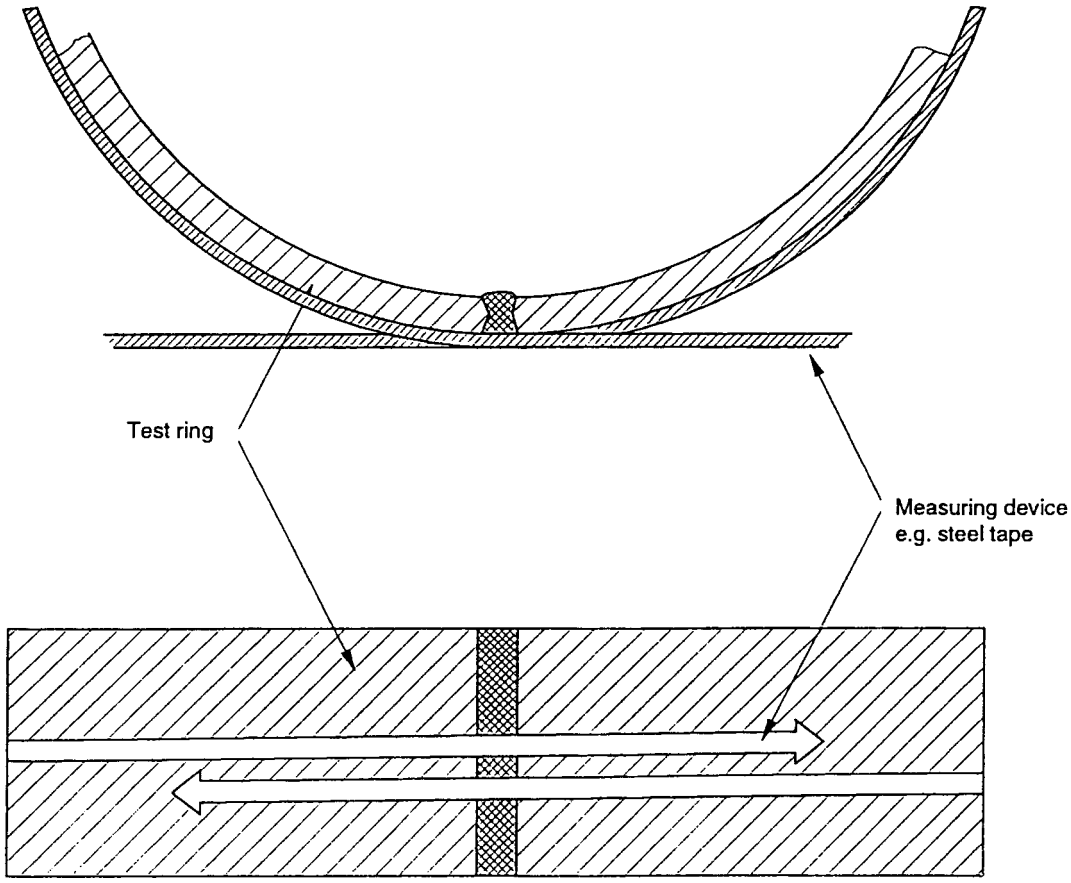

NOTE The separation between the two parallel portions of the measuring device shall be between 1,5 mm and 3,0 mm.

Figure 4 — Measuring device position for extension measurement

7 Hoop strength evaluation

7.1 A typical test pressure–circumferential extension record is shown in Figure 5.

7.2 The pressure p corresponding to the specified total strain shall be determined from the test record.

7.3 For tubes where $D/T \geq 20$ the hoop strength at the specified total strain shall be calculated from the formula:

$$R_{tx} = \frac{pD}{2T}$$

NOTE 1 For tubes with $D/T < 20$ the hoop strength calculated from this formula becomes increasingly inaccurate and quantitative results should be used with caution. Factors such as strain hardening could have a significant effect on the validity of the calculated strength.

NOTE 2 The specified total strain is calculated from the circumferential extension divided by the original test ring circumference.

8 Test report

The test report shall contain at least the following information:

a) reference to this European Standard i.e. EN 10275;

b) identification of test ring, e.g. cast No./tube No. /identification No.;

c) material specification, if known;

d) diameter and wall thickness of the tube;

e) length of the tube test ring;

f) calculated hoop strength at specified total strain;

g) reference to an alternative test method used, when appropriate (see annex A).

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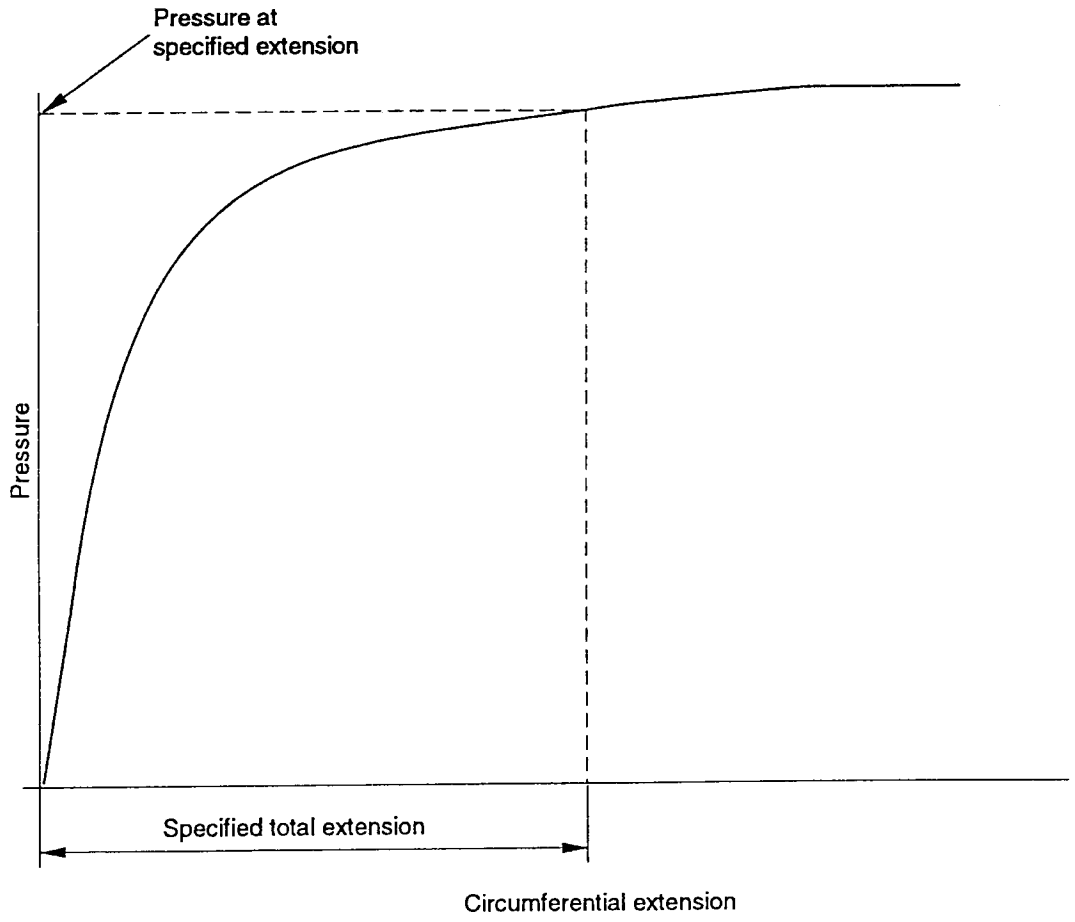

Figure 5 — Typical pressure/extension test record

Annex A (informative)
Proof and reduced section testing

A.1 Proof testing

This method may be used where the stress necessary to produce the specified circumferential extension has not been achieved but where the stress in the test ring exceeds the specified minimum hoop strength requirement. In this case the percentage circumferential expansion achieved shall be quoted in the report.

A.2 Reduced section testing

This method enables the stress corresponding to the specified circumferential extension to be achieved by a reduction in the test ring thickness. This reduction can be effected by machining the inside and/or outside diameter. To ensure that the full thickness is represented two or possibly three tests should be carried out after machining i) inside, ii) outside and iii) both diameters. Details of all test piece locations and dimensions relative to the full thickness ring section will be included in the report.

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