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मानक

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Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 1239-1 (2004): Steel Tubes, Tubulars and Other Wrought Steel Fittings, Part 1: Steel Tubes [MTD 19: Steel Tubes, Pipes and Fittings]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
इस्पात की नलियाँ, नलिकाकार सामग्रियाँ
तथा इस्पात की अन्य फिटिंगें — विशिष्टि

भाग 1 इस्पात की नलियाँ
(छठा पुनरीक्षण)

Indian Standard
STEEL TUBES, TUBULARS AND OTHER WROUGHT
STEEL FITTINGS — SPECIFICATION

PART 1 STEEL TUBES

(*Sixth Revision*)

First Reprint MAY 2007
(Including Amendment 1)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (Part 1) (Sixth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Steel Tubes, Pipes and Fittings Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1958 and subsequently revised in 1964, 1968, 1973, 1979 and 1990 respectively. In this revision, the following main modifications have been made:

- All the amendments on the fifth revision have been incorporated.
- Chemical composition for seamless tubes (ladle analysis) has been incorporated and for manufacturing of welded tubes, IS 10748 'Hot-rolled steel strip for welded tubes and pipes' or IS 513 'Cold-rolled low carbon steel sheets and strips' have been included.
- Permissible variation in case of product analysis of seamless tubes for all specified elements have been incorporated.
- Provision for supply of tubes with bevel end has been incorporated.

In this country, the regulations governing the use of tubes for conveying steam are laid down in the Indian Boiler Regulations published by the Central Boilers Board.

While formulating this standard, due consideration has been given to the trade practices followed in the country in this field. Due consideration has also been given to international coordination among the standards prevailing in different countries. Assistance has been derived from the following publications:

ISO 68 : 1981	Carbon steel tubes suitable for screwing in accordance with ISO International Organization for Standardization
BS 1387 : 1985	Screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 : 1985 Pipe threads for tubes and fitting where pressure-tight joints are made on the threads

This standard contains clauses 6.4, 7.1, 7.1.1, 11.2, 16.2 and 17.3 which call for an agreement between the manufacturer and the purchaser.

The other part of this standard is IS 1239 (Part 2) : 1992 'Specification for mild steel tubes, tubulars and other wrought steel fittings, Part 2 Mild steel socket, tubulars and other wrought steel pipe fittings (fourth revision)'.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 NOVEMBER 2005
TO
IS 1239 (PART 1) : 2004 STEEL TUBES, TUBULARS
AND OTHER WROUGHT STEEL FITTINGS —
SPECIFICATION

PART 1 STEEL TUBES

(Sixth Revision)

(Page 1, clause 3.3) — Substitute the following for the existing

‘The ends of the tubes shall be finished clean.’

(Page 2, clause 6.3) — Substitute the following for the existing clause:

‘Steel tubes shall be manufactured through one of the following processes.

- a) Hot-finished seamless (HFS),
- b) Cold-finished seamless (CDS),
- c) Hot-finished welded (HFW), and
- d) Electric resistance welded or high frequency induction welded (ERW or HFIW)

NOTE — Tubes made by manual welding are not covered by this specification ’

(Page 3, clause 9.1, Note) — Substitute ‘10 tonnes lot’ for ‘15 tonnes lot’

(Page 5, clause 13.1.1, lines 2 and 3) — Substitute the following for the existing

‘Hydrostatic test shall be carried out at a pressure of 5 MPa and the same maintained for atleast 3 seconds and shall not show any leakage in the pipe.’

(Page 6, clause 17.4) — Substitute the following for the existing clause

‘Tubes having random length 4 to 7 metres shall have two 75 mm bands one near each end. Tubes having exact length and approximate length as prescribed in clauses 11.2 and 11.3 shall have one 75 mm band.’

(MTD 19)

**AMENDMENT NO. 2 NOVEMBER 2007
TO
IS 1239 (PART 1) : 2004 STEEL TUBES, TUBULARS
AND OTHER WROUGHT STEEL FITTINGS —
SPECIFICATION**

PART 1 STEEL TUBES

(Sixth Revision)

(Page 1, clause 2) — Delete IS 12278 : 1998 along with its title.

(Page 5, clause 14.1, line 4) — Delete 'IS 12278'.

(Page 8, clause B-3.2) — Substitute the following for the existing matter:

'The calibration of the equipment shall be checked at the beginning of the shift and before size change.'

AMENDMENT NO. 3 MAY 2008
TO
IS 1239 (PART 1) : 2004 STEEL TUBES, TUBULARS
AND OTHER WROUGHT STEEL FITTINGS — SPECIFICATION

(Sixth Revision)

(Page 2, clause 6.1.1, first sentence) — Substitute the following for the existing:

‘Chemical composition of steel to be used for seamless steel tubes, shall comply with Table 1 in Ladle sample analysis.’

(Page 3, clause 8.1.1) — Add the following Note at the end:

‘NOTE — Mass of plain end tubes is also applicable for threaded tube without socket.’

(Page 6, clause 17.3) — Delete the ‘Note’.

(Page 6, clause 17.4) — Add the following Note at the end:

‘NOTE — Additional colour bands, as given in 17.2 to 17.4 may also be applied.’

AMENDMENT NO. 4 JUNE 2010
TO
IS 1239 (PART 1) : 2004 STEEL TUBES, TUBULARS AND
OTHER WROUGHT STEEL FITTINGS —
SPECIFICATION

PART 1 STEEL TUBES

(Sixth Revision)

(Page 5, clause 10.1.1) — Substitute the following for the existing clause:

‘Each screwed tube shall be supplied with one socket conforming to IS 1239 (Part 2).’

(MTD 19)

Reprography Unit, BIS, New Delhi, India

*Indian Standard***STEEL TUBES, TUBULARS AND OTHER WROUGHT
STEEL FITTINGS — SPECIFICATION****PART 1 STEEL TUBES***(Sixth Revision)***1 SCOPE**

1.1 This standard (Part 1) covers the requirements for welded and seamless plain end or screwed and socketed steel tubes intended for use for water, non-hazardous gas, air and steam. This standard is applicable to tubes of size 6 mm nominal bore to 150 mm nominal bore.

1.2 Medium and heavy tubes only are recommended for carrying steam services. The maximum permissible pressure and temperatures for different sizes of tubes are given in Annex A for guidance only.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No</i>	<i>Title</i>
228	Method for chemical analysis of steels
513 : 1994	Cold-rolled low carbon steel sheets and strips (<i>fourth revision</i>)
554 : 1999	Pipe threads where pressure-tight joints are made on the threads — Dimensions, tolerances and designation (<i>fourth revision</i>)
1239 (Part 2) : 1992	Mild steel tubes, tubulars and other wrought steel fittings : Part 2 Mild steel socket, tubulars and other wrought steel pipe fittings (<i>fourth revision</i>)
1387 : 1993	General requirements for the supply of metallurgical materials (<i>second revision</i>)
1608 : 1995	Mechanical testing of metals — Tensile testing (<i>second revision</i>)
2328 : 1983	Method for flattening test on metallic tubes (<i>first revision</i>)

*IS No**Title*

2329 : 1985	Method for bend test on metallic tubes (in full section) (<i>first revision</i>)
4711 : 1974	Methods for sampling of steel pipes, tubes and fittings (<i>first revision</i>)
4736 : 1986	Hot dip zinc coatings on mild steel tubes (<i>first revision</i>)
4740 : 1979	Code of practice for packaging of steel tubes (<i>first revision</i>)
8999 : 1979	Gauging practice for pipe threads where pressure tight joints are required on the threads
10748 : 1995	Hot rolled steel strip for welded tubes and pipes (<i>first revision</i>)
12278 : 1988	Method for ring tensile test on metallic tubes

3 TERMINOLOGY**3.1 Black Tube**

Tube as manufactured without any subsequent surface treatment.

3.2 Nominal Bore

A size reference denoting the approximate bore of the tube. For each size of tube, the outside diameter is fixed by the corresponding screw thread dimensions of IS 554 and therefore, the actual bore of each size of tube will vary according to the thickness.

3.3 Plain End

The ends are cleanly finished by normal deburring process.

3.4 Bevel End

The finished tube end shall be with a specified angle and root face as given in Fig 1

3.5 Tube, Pipe

A long, hollow, open-ended object of circular or other cross-section. The term tube is synonymous with the term pipe.

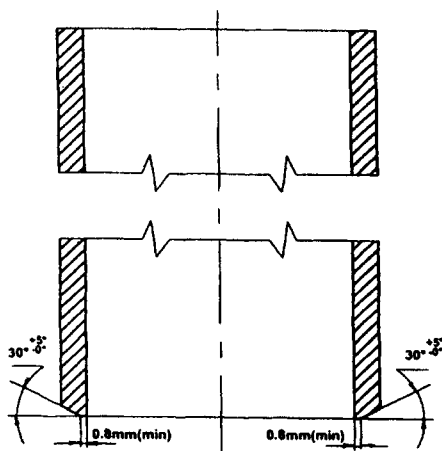


FIG. 1 TUBE END WITH 30° BEVELLING

3.6 Socket

The screwed coupling utilized in joining the tubes together.

NOTE — The term socket is synonymous with the term coupler.

3.7 Length

3.7.1 Random Length

Normal manufacturing lengths, which may vary over a wide range; alternatively, a length range may be agreed to between the purchaser and the manufacturer.

3.7.2 Exact Length of Screwed and Socketed Tube

The length of the tube exclusive of the socket.

3.7.3 Length of Screwed and Socketed Tube

The length of the tube inclusive of the socket on one end with handling tight.

NOTE — Handling tight means that the socket is so tight fitted that it should not fall down during handling or transit.

4 DESIGNATION

Steel tubes covered by this standard shall be designated by their nominal bore and shall be further classified as light, medium and heavy depending on the wall thickness; and screwed and socketed or plain-end/bevel-end to denote end condition, and black or galvanized to denote surface condition.

5 SUPPLY OF MATERIALS

General requirements relating to the supply of steel tubes shall conform to IS 1387.

6 MANUFACTURE

6.1 Seamless steel tube shall be made from tested quality steel manufactured by any approved process and shall be fully killed.

6.1.1 Chemical composition of the steel shall comply with Table 1 in Ladle Sample analysis.

Table 1 Chemical Composition (Ladle Analysis)
Percent, Max

Carbon (1)	Manganese (2)	Sulphur (3)	Phosphorus (4)
0.20	1.30	0.040	0.040

6.2 The welded tubes shall be manufactured from hot-rolled steel strip for welded tubes and pipes conforming to IS 10748 or Cold-rolled low carbon steel sheets and strips conforming to IS 513.

6.3 Steel tubes shall be manufactured by one of the following processes:

- Hot-finished seamless (HFS);
- Electric resistance welded (ERW);
- High frequency induction welded (HFIW);
- Hot-finished welded (HFW); and
- Cold-finished seamless (CDS).

NOTE — Tubes made by manual welding are not covered by this specification.

6.4 Light, medium and heavy tubes shall be either welded or seamless as agreed to between the purchaser and the manufacturer.

6.5 For welded tubes, the height of the internal weld fin shall not be greater than 60 percent of the specified wall thickness.

6.6 All electric welded tubes used for steam services shall be normalized. Only medium and heavy class of tube shall normally be used for steam services.

NOTE — HFS and HFW tubes need not be normalized.

7 CHEMICAL COMPOSITION

7.1 The analysis of steel shall be carried out either by the method specified in IS 228 and its relevant parts or any other established instrumental/chemical methods. In case of dispute the procedure given in IS 228 and its relevant parts shall be the referee method. However, where method is not given in IS 228 and its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

7.1.1 Product Analysis

If so agreed between the purchaser and the

manufacturer, the product analysis may be carried out. Maximum permissible variations in the case of product analysis over the maximum limits specified in Table 1 shall be as given in Table 2.

Table 2 Permissible Variation for Product Analysis

(Clause 7.1.1)

Sl No.	Content	Variation Over Specified Limit Percent, Max
(1)	(2)	(3)
i)	Carbon	0.02
ii)	Manganese	0.04
iii)	Sulphur	0.005
iv)	Phosphorus	0.005
NOTE — In case of welded tubes, product analysis shall not be applicable to rimming steel.		

8 DIMENSIONS

8.1 The dimensions and nominal mass of tubes shall be in accordance with Tables, 3, 4 and 5 subject to the tolerances permitted in 9.

8.1.1 Thickness and mass mentioned in Tables 3, 4 and 5 are applicable to both black and galvanized tubes.

9 TOLERANCES ON THICKNESS AND MASS

9.1 The following manufacturing tolerances shall be

permitted on the tubes and sockets.

a) Thickness:

1) Welded tubes:

Light tubes	+ not limited – 8 percent
Medium and heavy tubes	+ not limited – 10 percent

2) Seamless tubes

+ not limited – 12.5 percent

b) Mass:

1) Single tube (light series)

+ 10 percent – 8 percent

2) Single tube (medium and heavy series)

± 10 percent

3) For quantities per load of 10 tonnes, Min (light series)

+ 7.5 percent – 5 percent

4) For quantities per load of 10 tonnes, Min (medium and heavy series)

± 7.5 percent

NOTE — For the purpose of minimum weight of 15 tonnes lot, the weight may be done in convenient lots at the option of the manufacturer

Table 3 Dimensions and Nominal Mass of Steel Tubes — Light

(Clauses 8.1 and 10.1.1.1)

Nominal Bore	Outside Diameter		Thickness	Mass of tube	
	Maximum	Minimum		Plain End	Screwed and Socketed
mm	mm	mm	mm	kg/m	kg/m
(1)	(2)	(3)	(4)	(5)	(6)
6	10.1	9.7	1.8	0.360	0.363
8	13.6	13.2	1.8	0.515	0.519
10	17.1	16.7	1.8	0.670	0.676
15	21.4	21.0	2.0	0.947	0.956
20	26.9	26.4	2.3	1.38	1.39
25	33.8	33.2	2.6	1.98	2.00
32	42.5	41.9	2.6	2.54	2.57
40	48.4	47.8	2.9	3.23	3.27
50	60.2	59.6	2.9	4.08	4.15
65	76.0	75.2	3.2	5.71	5.83
80	88.7	87.9	3.2	6.72	6.89
100	113.9	113.0	3.6	9.75	10.0

Table 4 Dimensions and Nominal Mass of Steel Tubes — Medium

(Clause 8 1)

Nominal Bore	Outside Diameter		Thickness	Mass of Tube	
	Maximum	Minimum		Plain End	Screwed and Socketed
mm	mm	mm	mm	kg/m	kg/m
(1)	(2)	(3)	(4)	(5)	(6)
6	10.6	9.8	2.0	0.404	0.407
8	14.0	13.2	2.3	0.641	0.645
10	17.5	16.7	2.3	0.839	0.845
15	21.8	21.0	2.6	1.21	1.22
20	27.3	26.5	2.6	1.56	1.57
25	34.2	33.3	3.2	2.41	2.43
32	42.9	42.0	3.2	3.10	3.13
40	48.8	47.9	3.2	3.56	3.60
50	60.8	59.7	3.6	5.03	5.10
65	76.6	75.3	3.6	6.42	6.54
80	89.5	88.0	4.0	8.36	8.53
100	115.0	113.1	4.5	12.2	12.5
125	140.8	138.5	4.8	15.9	16.4
150	166.5	163.9	4.8	18.9	19.5

Table 5 Dimensions and Nominal Mass of Steel Tubes — Heavy

(Clause 8 1)

Nominal Bore	Outside Diameter		Thickness	Mass of Tube	
	Maximum	Minimum		Plain End	Screwed and Socketed
mm	mm	mm	mm	kg/m	kg/m
(1)	(2)	(3)	(4)	(5)	(6)
6	10.5	9.8	2.6	0.487	0.490
8	14.0	13.2	2.9	0.765	0.769
10	17.5	16.7	2.9	1.02	1.03
15	21.8	21.0	3.2	1.44	1.45
20	27.3	26.5	3.2	1.87	1.88
25	34.2	33.3	4.0	2.93	2.95
32	42.9	42.0	4.0	3.79	3.82
40	48.8	47.9	4.0	4.37	4.41
50	60.8	59.7	4.5	6.19	6.26
65	76.6	75.3	4.5	7.93	8.05
80	89.5	88.0	4.8	9.90	10.1
100	115.0	113.1	5.4	14.5	14.8
125	140.8	138.5	5.4	17.9	18.4
150	166.5	163.9	5.4	21.3	21.9

10 JOINTS

10.1 All screwed tubes shall be supplied with pipe threads conforming to IS 554. Gauging in accordance with IS 8999 shall be considered as an adequate test for conformity of threads of IS 554.

10.1.1 Unless specified otherwise, tubes shall be supplied screwed with taper threads and fitted with one socket having parallel thread. The socket shall conform to all requirements (except 6.4) of IS 1239 (Part 2).

10.1.1.1 In case of light tubes the application of taper pipe threads may be modified by permitting the outside diameter of the tubes to be within the limits shown in col 2 and 3 of Table 3. Where the tube approaches the lower limit of outside diameter, some incomplete threads (perfect at root and imperfect at the crest) may be expected from and beyond the gauge plane. Such incomplete threads, shall not be regarded as justification for rejection of the tubes. Also the minimum length of threads in light tubes shall be 80 percent of that specified in IS 554.

10.2 The plain end pipes shall be supplied with square cut. However, bevel end may also be supplied on mutual agreement between the purchaser and the manufacturer (see Fig. 1).

11 LENGTHS

Following tolerances shall be applied on lengths of tubes.

11.1 Random Length

4 to 7 m, unless otherwise specified Includes one socket for screwed and socketed tubes.

11.1.1 For orders of over 150 m of any one size of tube, it shall be permissible to supply short random lengths from 2 to 4 m provided that the number of such length does not exceed 5 percent of the total number of lengths for sizes below 65 mm nominal bore and above, 7.5 percent of such short random length shall be permitted. In addition, it shall be permissible for two lengths to be joined together to make a random length, provided that the number of such joint lengths does not exceed 5 percent of the total number of lengths for sizes below 65 mm nominal bore and 7.5 percent of the total number of lengths for sizes 65 mm and above.

11.2 Exact Length

Unless otherwise agreed to between the manufacturer and the purchaser, where exact lengths are specified, either for screwed and socketed tubes or for plain-end tubes each tube shall be within $\begin{smallmatrix} +6 \\ -0 \end{smallmatrix}$ mm of the specified length.

11.3 Approximate Length

When approximate lengths are required, either for screwed and socketed tubes or for plain end tubes, each tube shall be within ± 150 mm of the specified length.

12 GALVANIZING

12.1 Where tubes are required to be galvanized, the zinc coating on the tubes shall be in accordance with IS 4736.

12.2 Tubes, which are to be screwed, shall be galvanized before screwing.

13 LEAK PROOF TEST

13.1 Each tube shall be tested for leak tightness as an in-process test at manufacturer's works either by hydrostatic test or alternatively by eddy current test, in accordance with Annex B.

13.1.1 Hydrostatic test shall be carried out at a pressure of 5 MPa and the same maintained for at least 3 and shall not show any leakage in the pipe

NOTE --- The choice of test is at the discretion of the manufacturer.

14 TEST ON TUBES

Following tests shall be conducted by the manufacturer on tubes.

14.1 The tensile strength shall be at least 320 MPa (320 N/mm²). The test shall be carried out on full section or strip cut from the selected tubes in accordance with IS 1608 and IS 12278.

NOTES

1 For welded tubes, the strip tensile test specimen shall not contain the weld

2 For galvanized tubes, zinc coating may be removed by stripping prior to tensile test

14.1.1 The elongation percent on a gauge length of $5.65\sqrt{S_0}$, where S_0 is the original cross-sectional area of the test specimen, shall be as follows

Nominal Bore	Elongation Percent, Min
a) For steam services for all sizes	20
b) For other services:	
1) Up to and including 25 mm	12
2) Over 25 mm up to and including 150 mm	20

14.2 Bend Test on Tubes Up to and Including 50 mm Nominal Bore

When tested in accordance with IS 2329 the tubes

shall be capable of withstanding the bend test without showing any signs of fracture or failure. Welded tubes shall be bent with the weld at 90° to the plane of bending. The tubes shall not be filled for this test.

14.2.1 Ungalvanized tubes shall be capable of being bent cold without cracking through 180° round a former having a radius at the bottom of groove in the plane of bending, equal to at least six times the outside diameter of the tube.

14.2.2 Galvanized tubes shall be capable of being bent cold, without cracking of the steel, through 90° round a former having a radius at the bottom of the groove equal to at least eight times the outside diameter of the tubes.

14.3 Flattening Test on Tubes Above 50 mm Nominal Bore

Rings not less than 40 mm in length cut from the ends of the selected tubes shall be flattened cold between parallel plates with the weld, if any at 90° (point of maximum bending) in accordance with IS 2328. No opening shall occur by fracture in the weld area until the distance between the plates is less than 75 percent of the original outside diameter of the tube and no cracks or breaks in the metal elsewhere than in the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

NOTE — Slight premature cracking at the edges would not be deemed to affect compliance with this standard.

14.3.1 The test rings may have the inner and outer edges rounded.

14.4 Re-test

Should any one of the test pieces first selected fail to pass any of the tests specified above, two further samples shall be selected for testing in respect of each failure. Should the test pieces from both these additional samples pass, the material shall be deemed to comply with the requirements of that particular test. Should the test pieces from either of these additional samples fail, the material represented by the test samples shall be deemed as not complying with the standard.

15 WORKMANSHIP

All pipes shall be cleanly finished and reasonably free from injurious defects. The ends shall be free from sharp edges and burrs of the pipe. The tubes shall be reasonably straight.

16 SAMPLING FOR TUBES

16.1 Lot for the purpose of drawing samples all tubes bearing same designation and manufactured under a single process shall be grouped together to constitute

a lot. Each lot shall be sampled separately and assessed for conformity to this specification.

16.2 Sampling and Criterion for Conformity

Unless otherwise agreed to between the manufacturer and the purchaser the procedure for sampling of tubes for various tests and criteria for conformity, IS 4711 shall be followed.

17 MARKING

17.1 Each tube shall be marked with manufacturer's name or trade-mark, IS No. that is, IS 1239 (Part 1) and class of tubes, that is, L, M, and H, for light, medium and heavy class.

17.2 The different classes of tubes shall be distinguished by colour bands, which shall be applied as follows before the tubes leave the manufacturer's works:

- a) Light tubes — Yellow
- b) Medium tubes — Blue
- c) Heavy tubes — Red

NOTE — For export purpose the colour band on the light tubes may be painted yellow or brown.

17.3 Unless otherwise agreed to between the manufacturer and the purchaser a white colour band shall be applied at each end of the tubes for steam services.

NOTE — Additional colour bands, as given in 17.2 to 17.4 may also be applied.

17.4 Tubes having length more than 7 shall have two 75 mm bands, one near each end. All other lengths shall have one 75 mm band.

17.5 BIS Certification Marking

The tubes may also be marked with the Standard Mark, details for which may be obtained from the Bureau of Indian Standards.

17.5.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

18 PROTECTION AND PACKING

Black tubes not otherwise protected shall be varnished or suitably painted externally throughout the length unless ordered unvarnished or unpainted. Where tubes are bundled for transport, all qualities of tubes shall be packed in accordance with IS 4740.

ANNEX A

(Clause 1.2)

MAXIMUM PERMISSIBLE PRESSURE AND TEMPERATURE FOR TUBES FOR CONVEYING STEAM

A-1 The maximum permissible pressure and temperature for tubes with screwed and socketed joints shall be as given in Table 6.

A-2 For tubes fitted with appropriate flanges or suitably butt welded together, the maximum permissible pressure shall be 2.06 MPa and the maximum permissible temperature 260°C.

Table 6 Maximum Permissible Pressure and Temperature for Tubes with Steel Couplings or Screwed and Socketed Joints

(Clause A-1)

Nominal Bore mm (1)	Maximum Permissible Pressure MPa (2)	Maximum Permissible Temperature °C (3)
Up to and including 25 mm	1.20	260
Over 25 mm up to and including 40 mm	1.03	260
Over 40 mm up to and including 80 mm	0.86	260
Over 80 mm up to and including 100 mm	0.69	260
	0.83	177
Over 100 mm up to and including 125 mm	0.69	171
Over 125 mm up to and including 150 mm	0.50	160

NOTE — 1 MPa = 1 N/mm² = 0.102 0 kg/mm².

ANNEX B

(Clause 13.1)

EDDY CURRENT TESTING OF TUBES AS AN ALTERNATIVE TO THE HYDRAULIC LEAK TIGHTNESS TEST**B-1 METHODS OF TEST**

B-1.1 The tubes shall be tested for imperfections using a concentric coil or segment coil or a rotating tube or rotary probe eddy current technique in accordance with this Annex.

B-1.2 The tube shall be sufficiently straight to ensure the validity of the test and the surface shall be free from any foreign matter that would interfere with the interpretation of the test.

B-1.3 Two methods of test are permitted (at the manufacturer's option). The equipment may be located on or off the tube mill.

B-1.3.1 Method A

The tube to be tested is passed through the (a)

concentric test coil (applicable to welded or seamless tubes), or (b) segmental coil covering the weld and $\pm 15^\circ$ arc from weld line (applicable to welded tubes) on either side.

B-1.3.2 Method B

The tube to be tested or the test coil assembly is rotated and translated relative to each other so the test coil describes a helical path over the tube surface. The pitch of the helical scan shall ensure that the whole of the tube surface is effectively covered. This method is applicable to seamless tubes only.

B-2 CALIBRATION OF TEST EQUIPMENT

B-2.1 The equipment shall be calibrated using standard tube containing holes as defined in B-2 for Method A or standard notches as defined

in B-2.3 for Method B. The standard tube for off-line equipment shall have similar electromagnetic properties and same diameter and thickness as the tube to be tested. For online equipment, running tube may be considered as standard tube.

B-2.2 Method A

The standard defect shall be a circular hole drilled radially completely through the tube wall on the welding. The diameters of the drills required to make these holes shall be as follows:

<i>Nominal Bore of the Tubes</i>	<i>Drill Diameter</i>
mm	mm
Up to and including 15	1.2
20, 25-32	1.7
40-50	2.2
65-80	2.7
100-125	3.2
150	3.7

B-2.3 Method B

The standard test piece shall have a longitudinal notch 0.8 mm or less in width machined parallel to the tube axis on the outer surface of the tube. The depth of the notch shall not exceed 12½ percent of the specified thickness of the tube or 0.3 mm whichever is greater. The length of the notch at full depth shall not exceed 50 mm.

B-3 CALIBRATION PROCEDURE

B-3.1 The equipment and test coils shall be adjusted to produce in a consistent manner a clearly identifiable signal from the standard defect(s) on the standard tube and this signal shall be used to set the trigger/alarm level of the equipment. For calibration purposes the relative speed between the standard tube containing standard defect and the test coils shall be the same as that used during the production.

B-3.2 The calibration of the equipment shall be checked at the commencement and at the end of each working period and at intervals not exceeding 2 h.

B-3.3 If on checking during production testing the reference standard defect is not detected even after changing the sensitivity by 2dB to allow for equipment drift, the equipment shall be recalibrated. Following recalibration, all tubes tested since the previous check shall be retested, unless recordings from individually identified tubes are available that permit classification of those tubes into 'suspect' and 'acceptable' categories.

B-4 TEST PROCEDURE

Pass the tube to be inspected through the test unit at the appropriate production speed, maintaining the production speed constant with ± 10 percent under conditions identical to those used in the calibration of the equipment.

NOTE — Identical conditions include all instrument setting, mechanical motion, positioning of the encircling coil(s) in relation to the tube and any other factor that affect the validity of the technique.

B-5 ACCEPTANCE

B-5.1 Any tube producing a signal lower than the signals from the standard shall be deemed to have passed this test.

B-5.2 Since NDT systems are known to be sensitive to some features which do not cause leak, the tube rejected by NDT may be retested hydraulically and whatever tubes pass the hydraulic test shall be accepted.

B-5.3 The tubes rejected in B-5.1 may also be retested off-line NDT equipment. Those which do not produce reject level signals shall be accepted. Others may be accepted after cropping off the portion producing reject level signals.

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