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मानक

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Mazdoor Kisan Shakti Sangathan

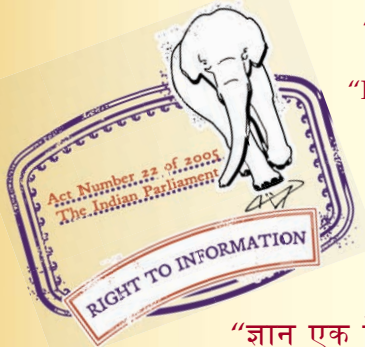
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“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 1161 (1998): Steel Tubes for Structural Purposes [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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इस्पात नलिकाएँ संरचनात्मक उपयोगों के लिये — विशिष्टि  
( चौथा पुनरीक्षण )

*Indian Standard*  
STEEL TUBES FOR STRUCTURAL PURPOSES —  
SPECIFICATION  
( *Fourth Revision* )

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First Reprint NOVEMBER 1998

ICS 77.140.75 ; 91.220

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

## FOREWORD

This Indian Standard ( Fourth 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 its first, second and third revisions were issued in 1963, 1968 and 1979 respectively. While reviewing the standard, the Committee has felt it necessary to revise this Indian Standard with the following modifications:

- a) Thickness and mass is aligned with IS 1239 (Part 1) : 1990.
- b) All amendments have been incorporated.

In the formulation of 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 co-ordination among the standards prevailing in different countries. Assistance has been derived from the following publications:

ISO/R 336 : 1976 Plain end steel tubes, welded or seamless; general table of dimensions and masses per unit length. International Organization for Standardization.

BS 6323 : 1982 Steel tubes for mechanical and general engineering purposes. British Standards Institution.

This standard contains clauses 8.1 and 12.1 which call for agreement between the purchaser and the manufacturer.

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.



Table 1 Sizes and Properties of Steel Tubes for Structural Purposes

(Clauses 3.1, 6.1, 6.1.1 and 6.1.2)

Nominal Bore	Outside Diameter	Class	Thickness	Weight	Area of Cross Section	Internal Volume	Surface		Moment of Inertia	Modulus of Section	Radius of Gyration	Square of Radius of Gyration
							External	Internal				
mm (1)	mm (2)	(3)	mm (4)	kg/m (5)	cm <sup>2</sup> (6)	cm <sup>3</sup> /m (7)	cm <sup>3</sup> /m (8)	cm <sup>3</sup> /m (9)	cm <sup>4</sup> (10)	cm <sup>3</sup> (11)	cm (12)	cm <sup>2</sup> (13)
15	21.3	Light Medium Heavy	2.0 2.6 3.2	0.947 1.21 1.44	1.21 1.53 1.82	235 203 174	669	543 506 468	0.57 0.69 0.75	0.54 0.64 0.70	0.69 0.66 0.55	0.47 0.44 0.42
20	26.9	Light Medium Heavy	2.3 2.6 3.2	1.38 1.56 1.87	1.78 1.98 2.38	390 370 330	845	700 681 644	1.36 1.48 1.70	1.01 1.10 1.26	0.87 0.86 0.84	0.76 0.74 0.71
25	33.7	Light Medium Heavy	2.6 3.2 4.0	1.98 2.41 2.93	2.54 3.06 3.73	638 585 518	1 059	895 857 807	3.09 3.61 4.19	1.83 2.14 2.48	1.10 1.08 1.05	1.21 1.17 1.11
32	42.4	Light Medium Heavy	2.6 3.2 4.0	2.54 3.10 3.79	3.25 3.94 4.82	1 086 1 017 929	1 332	1 168 1 130 1 080	6.47 7.62 8.99	3.05 3.59 4.24	1.41 1.39 1.36	1.98 1.93 1.86
40	48.3	Light Medium Heavy	2.9 3.2 4.0	3.23 3.56 4.37	4.13 4.53 5.56	1 418 1 378 1 275	1 517	1 335 1 316 1 265	10.70 11.59 13.77	4.43 4.80 5.70	1.61 1.59 1.57	2.59 2.54 2.47
50	60.3	Light Medium Heavy	2.9 3.6 4.5	4.08 5.03 6.19	5.23 6.41 7.88	2 332 2 213 2 066		1 711 1 667 1 611	21.59 25.88 30.90	7.16 8.58 10.2	2.03 2.00 1.98	4.13 4.02 3.92
65	76.1	Light Medium Heavy	3.2 3.6 4.5	5.71 6.42 7.93	7.32 8.20 10.1	3 814 3 727 3 534	2 391	2 189 2 163 2 107	48.79 54.02 65.12	12.82 14.20 17.1	2.58 2.57 2.54	6.66 6.60 6.43
80	88.9	Light Medium Heavy	3.2 4.0 4.8	6.72 8.36 9.90	8.61 10.7 12.7	5 343 5 138 4 936	2 793	2 591 2 540 2 490	79.23 96.36 112.52	17.82 21.68 25.31	3.03 3.00 2.98	9.19 9.00 8.88
90	101.6	Light Medium Heavy	3.6 4.0 4.8	8.70 9.63 11.5	11.1 12.3 14.6	6 995 6 877 6 644	3 192	2 964 2 939 2 889	133.27 146.32 171.44	26.23 28.80 33.75	3.47 3.45 3.43	12.03 11.91 11.76

100	114.3	Light Medium Heavy	3.6 4.5 5.4	9.75 12.2 14.5	12.5 15.5 18.5	9 004 8 704 8 409	3 591	3 363 3 306 3 250	192.03 234.3 274.5	33.60 41.0 48.0	3.92 3.89 3.85	15.36 15.10 14.86
110	127.0	Light Medium Heavy	4.5 4.8 5.4	13.6 14.5 16.2	17.3 18.4 20.6	10 930 10 819 10 599	3 990	3 705 3 686 3 649	325.3 344.58 382.0	51.2 54.27 60.2	4.33 4.32 4.30	18.78 18.69 18.52
125	139.7	Light Medium Heavy	4.5 4.8 5.4	15.0 15.9 17.9	19.1 20.3 22.8	13 410 13 287 13 043	4 389	4 104 4 085 4 047	437.2 463.44 514.5	62.6 66.35 73.7	4.78 4.77 4.75	22.87 22.76 22.58
135	152.4	Light Medium Heavy	4.5 4.8 5.4	16.4 17.5 19.6	20.9 22.2 25.0	16 142 16 008 15 740	4 788	4 503 4 484 4 446	572.2 606.92 674.5	75.1 79.65 88.5	5.23 5.22 5.20	27.37 27.25 27.05
150	165.1	Light Medium Heavy	4.5 4.8 5.4	17.8 18.9 21.3	22.7 24.2 27.1	19 128 18 981 18 690	5 187	4 902 4 883 4 845	732.6 777.32 864.7	88.7 94.16 105.0	5.68 5.67 5.65	32.27 32.14 31.92
150	168.3	Light Medium Heavy 1 Heavy 2	4.5 4.8 5.4 6.3	18.2 19.4 21.7 25.2	23.1 24.7 27.6 32.0	19 921 19 771 19 473 19 030	5 287	5 002 4 983 4 946 4 889	777.2 824.78 917.7 1 053	92.4 98.01 109.0 125.0	5.79 5.78 5.76 5.73	33.56 33.42 33.21 32.85
175	193.7	Light Medium Heavy	4.8 5.4 5.9	22.4 25.1 27.3	28.5 32.0 34.8	26 606 26 260 25 974	6 085	5 781 5 743 5 712	1 271.71 1 417 1 535.2	131.31 146 158.65	6.68 6.66 6.64	44.63 44.36 41.11
200	219.1	Light Medium Heavy	4.8 5.6 5.9	25.4 29.5 31.0	32.3 37.5 39.5	34 454 33 930 33 734	6 883	6 578 6 528 6 509	1 856.51 2 141 2 247	169.47 195 205	7.58 7.55 7.54	57.45 57.02 56.86
225	244.5	Heavy	5.9	34.7	44.2	42 507	7 681	7 307	3 149	258	8.44	71.21
250	273.0	Heavy	5.9	38.9	49.5	53 557	8 578	8 202	4 412	323	9.45	89.30
300	323.9	Heavy	6.3	49.3	62.8	76 073	10 177	9 775	7 992	493	11.2	125.44
350	355.6	Heavy	8.0	68.6	87.3	90 533	11 173	10 663	13 111	737	12.3	151.29

Medium } Heavy }	± 10 percent
2) 10 tonne lots light	± 5 percent
Medium } Heavy }	± 7.5 percent

NOTE — For 10 tonne lots, the weighment may be done in convenient smaller lots and added up at the option of the manufacturer.

## 7 WORKMANSHIP

7.1 The tubes shall be cleanly finished and reasonably free from scale. They shall be free from cracks, surface flaws, laminations and other defects. The ends shall be cut cleanly and square with the axis of tube, unless otherwise specified.

Surface imperfections such as handling marks, light die or roll marks, or shallow pits shall not be considered as defects provided the imperfections are removable within minimum wall thickness permitted. Removal of such surface imperfections is not required. Welded tubing shall be free of protruding metal on the outside surface of the weld seam.

## 8 GALVANIZING

8.1 If the tubes are required in galvanized condition the zinc coating on the tubes shall be conforming to the requirements and tested as per methods, specified in IS 4736.

## 9 STRAIGHTNESS

9.1 Unless otherwise agreed to between the purchaser and the manufacturer, tubes shall not deviate from straightness by more than 1 mm in any 600 mm length.

## 10 LENGTHS

10.1 The tubes shall normally be supplied in random lengths at 4 to 7 m. If ordered in exact lengths, the tolerances shall be subject to prior agreement between the manufacturer and the purchaser.

## 11 MECHANICAL TESTS

11.1 The following tests shall be carried out on the selected tube, strip or plate. For mechanical tests, tubes shall be sampled in accordance with IS 4711.

### 11.2 Tensile Test

The tensile strength, the yield stress and the percentage elongation shall be determined in accordance with the methods specified in IS 1608 and shall be not less than

the values specified for the relevant grades of tubes given in Table 2.

11.2.1 The tensile test shall be made on:

- a length cut from the end of the selected tube (the ends of the length being plugged for grips, where necessary); or
- a longitudinal strip cut from the tube, not including the weld, if any, and tested in the curved condition, the choice resting with the manufacturer.

**Table 2 Tensile Properties of Steel Tubes for Structural Purposes**

(Clauses 3.1 and 11.2)

Grade	Tensile Strength	Yield Stress	Elongation
	(Min)	(Min)	on Gauge Length
	MPa	MPa	5.65 $\sqrt{S_0}$ , Min Percent
YSt 210	330	210	20
YSt 240	410	240	17
YSt 310	450	310	14

#### NOTES

1 1 MPa = 1N/mm<sup>2</sup> = 0.102 kgf/mm<sup>2</sup>.

2 Elongation percent for tubes up to and including 25 mm nominal bore for all grades shall be 12 minimum.

**Table 3 Steel and Supply Conditions**

(Clause 5.1)

Sl No.	Manufacturing Process	Steel	Supply Conditions
i)	HPW	IS 10748	Only YSt 210 or YSt 240
ii)	HFS	Bars/ingots with suitable chemical composition as per IS 10748 to achieve mechanical properties for respective grades	YSt 210, YSt 240 or YSt 310
iii)	ERW/HRIW	IS 10748	YSt 210, YSt 240 or YSt 310 as welded, heat treated or cold drawn and normalized

NOTE — If required the copper bearing steel may be used to impart weather resistant properties in the steel. Copper content shall be between 0.20 to 0.35 percent subject to mutual agreement between the supplier and the purchaser.

### 11.3 Ductility Test

#### 11.3.1 Cold Bend Test ( Up to and Including 50 mm NB )

When tested in accordance with IS 2329 an unfilled length of tube shall be capable of being bent cold by tube bending machine around a grooved former (with radius at bottom of the groove equal to  $6 \times O. D.$  of the tube) through  $180^\circ$  (with weld at  $90^\circ$  to the plane of bending) without showing any crack at the weld or the metal.

#### 11.3.2 Flattening Test ( Tubes Above 50 mm NB )

Rings, not less than 40 mm in length cut from the ends of selected tubes with edges rounded shall be flattened between parallel plates with the weld, if any, at  $90^\circ$  (point of maximum bending) in accordance with IS 2328. No opening shall occur by fracture in the weld until the distance between the plates is less than the value specified for each grade in col 4 of Table 4 and no cracks or breaks in the metal elsewhere than in the weld shall occur until the distance between the plates is less than the value specified for each grade in col 5 of Table 4.

#### 11.4 Retest

Should any one of the test pieces first selected fail to pass any of the tests specified, two further samples shall be selected for testing in respect of each failure from the same lot. Should the test pieces from both these additional samples pass, the material represented by the test samples shall be deemed to comply with the requirement 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 or the manufacturer may select to test individually the remaining lengths in the lot for the test failed to comply in the preceding tests.

### 11.5 Sampling

#### 11.5.1 Sampling of Tubes

For the purpose of drawing samples all mild steel 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.

#### 11.5.2 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 shall be as given in IS 4711.

### 12 MARKING

12.1 Each tube shall be suitably marked with the manufacturer's name or trade-mark, and class of the tube.

12.1.1 The tubes may also be marked with the Standard Mark.

12.1.2 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.

### 13 OILING AND PAINTING

13.1 All tubes shall, unless otherwise specified, be varnished, painted or oiled externally.

### 14 BUNDLING AND PACKING

14.1 Where tubes are to be bundled for transport, they shall unless otherwise specified, be packed in accordance with IS 4740.

**Table 4 Flattening Requirement in Metal**

( Clause 11.3.2 )

Sl No.	Manufacturing Process Metal	Steel Grade	Weld (Distance Between the Plates)	Parent (Distance Between the Plates)
i)	HFW/HFS/ERW/HFIW	YSt 210	75 percent of O.D. <sup>1)</sup>	60 percent of O.D.
ii)	HFW/HFS/ERW/HFIW	YSt 240	85 percent of O.D.	75 percent of O.D.
iii)	FHS/ERW/HFIW	YSt 310	85 percent of O.D.	75 percent of O.D.

<sup>1)</sup> O.D. = Outside diameter.

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### Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc : No. MTD 19 ( 4099 ).

### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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AMENDMENT NO. 1 MARCH 2000  
TO  
IS 1161 : 1998 STEEL TUBES FOR STRUCTURAL  
PURPOSES — SPECIFICATION  
( *Fourth Revision* )

( *Page 5, clause 12.1, line 2* ) — Insert 'grade of the steel' after the words  
'trade-mark'.

( MTD 19 )

Reprography Unit, BIS, New Delhi, India

**AMENDMENT NO. 2 APRIL 2006  
TO  
IS 1161 : 1998 STEEL TUBES FOR STRUCTURAL  
PURPOSES — SPECIFICATION**

*( Fourth Revision )*

*( Page 1, clause 1, line 4 )* — Substitute 'HFIW' in parenthesis for 'HRIW' in parenthesis.

*( Page 1, clause 5.1 )* — Substitute the following for the existing clause:

'Steel tubes shall be manufactured through one of the following processes as given in Table 3 and shall be supplied in conditions as shown therein:

- 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 standard.'

*( Page 1, clause 6.1 )* — Substitute 'mass' for 'weights'.

*( Page 2, Table 1, col heading 5 )* — Substitute 'Mass' for 'Weight'.

[ *Page 4, Table 3, Sl No. (ii)* ] — Substitute 'HFS/CDS' for 'HFS'.

[ *Page 4, Table 3, Sl No. (iii)* ] — Substitute 'ERW/HFIW' for 'ERW/HRIW'.

*( Page 5, Table 4, under col 2 )* — Substitute the following for the existing:

**Manufacturing Process**

- i) HFW/HFS/CDS/ERW/HFIW
- ii) HFW/HFS/CDS/ERW/HFIW
- iii) HFS/CDS/ERW/HFIW

( MTD 19 )

**AMENDMENT NO. 3 MAY 2008**  
**TO**  
**IS 1161 : 1998 STEEL TUBES FOR STRUCTURAL**  
**PURPOSES — SPECIFICATION**

( Fourth Revision )

(Page 3, Table 1, col 3, against Nominal Bore 150 mm, Outside Diameter 165.1 mm) — Substitute 'Heavy 1' for 'Heavy'.

(Page 3, Table 1, col 3, against Nominal Bore 200 mm, Outside Diameter 219.1 mm) — Substitute 'Heavy 1' for 'Heavy'.

(Page 3, Table 1, col 3, against Nominal Bore 250 mm, Outside Diameter 273.0 mm) — Substitute 'Heavy 1' for 'Heavy'.

(Page 3, Table 1, col 3, against Nominal Bore 300 mm, Outside Diameter 323.9 mm) — Substitute 'Heavy 1' for 'Heavy'.

(Page 3, Table 1, col 3, against Nominal Bore 350 mm, Outside Diameter 355.6 mm) — Substitute 'Heavy 1' for 'Heavy'.

(Page 3, Table 1) — Add the following at the appropriate place:

Nominal Bore mm	Outside Diameter mm	Class	Thickness mm	Weight kg/m	Area of Cross Section cm <sup>2</sup>	Internal Volume cm <sup>3</sup> /m	Surface Area		Moment of Inertia cm <sup>4</sup>	Modulus of Section cm <sup>3</sup>	Radius of Gyration cm	Square of Radius of Gyration cm <sup>2</sup>
							External cm <sup>2</sup> /m	Internal cm <sup>2</sup> /m				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
150	165.1	Heavy 2	5.9	23.2	29.5	18 465.0	5 189	4 818	937	113.4	5.63	31.72
		Heavy 3	6.3	24.7	31.4	18 272.8		4 793	993	120.3	5.62	31.57
		Heavy 4	8.0	31.0	39.5	17 467.1		4 686	1 222	148.0	5.56	30.93
200	219.1	Heavy 2	8.0	41.6	53.1	32 410.4	6 886	6 383	2 960	270	7.47	55.78
		Heavy 3	10.0	51.6	65.7	31 146.4		6 257	3 598	328	7.40	54.78
		Heavy 4	12.0	61.3	78.1	29 907.4		6 132	4 200	383	7.33	53.79
250	273.0	Heavy 2	8.0	32.3	66.6	51 895.6	8 580	8 077	5 832	429	9.37	87.86
		Heavy 3	10.0	64.9	82.6	50 292.8		7 951	7 154	524	9.31	86.59
		Heavy 4	12.0	77.2	98.4	48 715.1		7 826	8 396	615	9.24	85.33
300	323.9	Heavy 2	8.0	62.3	79.4	74 487.6	10 180	9 677	9 910	612	11.2	124.82
		Heavy 3	10.0	77.4	98.6	72 564.8		9 551	12 160	751	11.1	123.29
		Heavy 4	12.0	92.3	118.0	70 667.2		9 425	14 320	884	11.0	121.78
350	355.6	Heavy 2	10.0	85.2	109	88 492.9	11 176	10 547	16 220	912	12.2	149.42
		Heavy 3	12.0	102.0	130	86 396.0		10 422	19 140	1 076	12.2	147.76

**AMENDMENT NO. 4 JUNE 2011**  
**TO**  
**IS 1161 : 1998 STEEL TUBES FOR STRUCTURAL PURPOSES —**  
**SPECIFICATION**

*(Fourth Revision)*

(Page 1, clause 6.1.2) – Add the following new clause after 6.1.2:

‘6.1.3 Tubes of thickness higher than light tubes specified in Table 1 may be mutually agreed between the purchaser and the manufacturer.’

(Page 3, Table 1, col 3, against Nominal Bore 175, Outside Diameter 193.7 mm) — Substitute ‘Heavy 1’ for ‘Heavy’.

[Page 3, Table 1 (see also Amendment No.3)] — Add the following at the appropriate place:

Nominal Bore	Outside Diameter	Class	Thickness	Weight	Area of Cross Section	Internal Volume	Surface Area		Moment of Inertia	Modulus of Section	Radius of Gyration	Square of Radius of Gyration
							External	Internal				
mm	mm		mm	kg/m	cm <sup>2</sup>	cm <sup>3</sup> /m	cm <sup>2</sup> /m	cm <sup>2</sup> /m	cm <sup>4</sup>	cm <sup>4</sup>	cm	cm <sup>2</sup>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
150	168.3	Heavy 3	8.0	31.6	40.3	18 224.9	5 290	4 787	1 297	154.0	5.67	32.20
		Heavy 4	10.0	39.0	49.7	17 280.1		4 661	1 564	186.0	5.61	31.45
175	193.7	Heavy 2	6.3	29.1	33.1	25 770.0	6 088	5 692	1 630	218.0	6.63	43.96
		Heavy 3	8.0	36.6	41.6	24 812.0		5 585	2 016	270.0	6.57	43.16
		Heavy 4	10.0	45.3	51.6	23 707.0		5 459	2 442	328.0	6.50	42.25
175	193.7	Heavy 5	12.0	53.8	61.3	22 628.0	6 088	5 334	2 839	383.0	6.44	41.47

**AMENDMENT NO.5 SEPTEMBER 2012**

**TO**

**IS 1161 : 1998 STEEL TUBES FOR STRUCTURAL  
PURPOSES — SPECIFICATION**

*( Fourth Revision )*

*(Second cover page, FOREWORD) — Substitute 'ISO 4200 : 1991 Plain end steel tubes, welded and seamless – General tables of dimension and masses per unit length' for 'ISO/R 336 : 1976 Plain end steel tubes, welded and seamless – General table of dimensions and masses per unit length. International Organization for Standardization'.*

*(Page 4, clause 6.2, Note, line 1) — Substitute '10 tonne (Min)' for '10 tonne'.*

(MTD 19)

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