BRITISH STANDARD

BS 6323-6: 1982

Incorporating Amendment Nos. 1 and 2

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Specification for

Seamless and welded steel tubes for automobile, mechanical and general engineering purposes —

Part 6: Specific requirements for cold finished electric resistance welded (including induction welded) steel tubes

UDC 699.14 – 462.2:621.774.21

Cooperating organizations

The Iron and Steel Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

British Constructional Steelwork Association
British Internal Combustion Engine Manufacturers' Association
British Ironfounders' Association
British Railways Board
British Steel Industry*
British Steel Industry — Wire Section
Concrete Society Ltd
Council of Ironfoundry Associations
Department of Industry (National Physical Laboratory)
Electricity Supply Industry in England and Wales
Engineering Equipment Users' Association
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Institute of Quality Assurance
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International Tin Research Institute
Lloyds Register of Shipping
National Association of Drop Forgers and Stampers
Oil Companies Materials Association
Process Plant Association
Royal Institute of British Architects
Society of Motor Manufacturers and Traders Ltd*
Steel Casting Research and Trade Association
Water-tube Boilermakers' Association

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

Association of Hydraulic Equipment Manufacturers
British Steel Corporation
British Welded Steel Tube Manufacturers' Association
Chartered Institution of Building Services
Confederation of British Industry
Mechanical Handling Engineers' Association
Ministry of Defence
Motor Cycle Association of Great Britain
Coopted members

This British Standard, having been prepared under the direction of the Iron and Steel Standards Committee, was published under the authority of the Board of BSI and comes into effect on
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The following BSI references relate to the work on this standard:
Committee reference PSE/8 (formerly ISE/50)
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5142	June 1986	
6025	June 1989	Indicated by a sideline in the margin

Contents

Foreword

This British Standard has been prepared under the direction of the Iron and Steel Standards Committee. It is a combined standard superseding BS 980:1950, BS 1775:1964 and BS 3014:1958 which are withdrawn.

In BS 6323, manufacturing processes have been aligned with current procedures, and processes no longer used, i.e. oxy-acetylene welding and hydraulic lap welding, have been deleted. Terminology relating to the designation of certain manufacturing processes has been updated, i.e. SAW replaces EFW, and CFS replaces CDS. Additionally, in combining the standards, steel grades have been rationalized and aligned, with delivery conditions now being clearly designated by letter codes.

This standard is published in eight separate Parts as follows:

— *Part 1: General requirements*;

— *Part 2: Specific requirements for hot finished welded steel tubes*;

— *Part 3: Specific requirements for hot finished seamless steel tubes*;

— *Part 4: Specific requirements for cold finished seamless steel tubes*;

— *Part 5: Specific requirements for electric resistance welded (including induction welded) steel tubes*;

— *Part 6: Specific requirements for cold finished electric resistance welded (including induction welded) steel tubes*;

— *Part 7: Specific requirements for submerged arc welded steel tubes*;

— *Part 8: Specific requirements for longitudinally welded stainless steel tubes*.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 6323, which is used in conjunction with Part 1 of the same standard, covers the specific requirements for cold finished electric resistance (including induction welded) steel tubes for use in the automobile, mechanical and general engineering industries. It specifies the chemical composition, mechanical properties, dimensions, dimensional tolerances and technical delivery condition of the tubes.

NOTE 1 For tubes for pressure purposes, attention is drawn to BS 3601 to BS 3605 and for hollow sections for structural purposes to BS 4360, BS 4848-2 and BS 6363.

NOTE 2 The titles of the publications referred to in this Part of this standard are listed on the inside back cover.

2 General

The tubes shall comply with the general requirements of BS 6323-1 and the specific requirements of this Part of the same standard, which covers tubes up to and including 230 mm outside diameter.

The tubes shall be of steel grades 1, 2, 3, 4 and 5. The grade required shall be specified on the enquiry and order, together with other details as specified in clause **5** of BS 6323-1:1982, as appropriate.

If specified in the enquiry and order, tubes having an outside diameter up to and including 76.1 mm, and in the annealed or normalized condition shall be subjected to a leak tightness test (see **9.4**).

3 Method of manufacture

The tubes shall be manufactured from flat rolled strip, longitudinally welded continuously by the passage of an electric current across the abutting edges without the addition of filler metal. They are subsequently cold finished normally on both the inside and outside surfaces, where it is permissible to have both an adherent layer of residual lubricant originating from the drawing process and visible traces of the internal weld upset (but see **8.2**).

If phosphate or other residues are detrimental to subsequent processing, then their removal shall be the subject of an agreement between the manufacturer and the purchaser.

4 Delivery condition

4.1 The tubes shall be supplied in one of the following delivery conditions (see Table 3 in BS 6323-1:1982).

a) Cold finished/hard (cold finished as drawn): BK;

b) Cold finished/soft (lightly cold worked): BKW (see note to **4.2**);

c) Annealed: GBK (see **4.2**);

d) Annealed (including de-scaling): GZF;

e) Normalized: NBK (see **4.2**);

f) Normalized (including de-scaling): NZF.

4.2 It is permissible for tubes supplied in the GBK and NBK conditions to be discoloured, but they shall be free from loose scale.

Where tubes, in the GBK condition are required bright annealed, this shall be the subject of an agreement between the purchaser and the manufacturer.

NOTE Tubes in the BKW condition may be tempered at the option of the manufacturer.

5 Chemical composition

The steel shall show on ladle analysis the composition given in Table 1 appropriate to the steel grade specified.

6 Mechanical properties

The tensile properties of the tubes, appropriate to their steel grade and delivery condition, determined in accordance with **15.2** of BS 6323-1:1982 shall be as given in Table 1.

For other mechanical properties, see clause **9**.

7 Dimensions

The dimensions of tubes shall be designated either by the outside diameter and thickness or by the inside diameter and thickness. A list of the sizes most commonly used is given in Table 6.

NOTE By agreement between the purchaser and the manufacturer tubes may be designated by the outside and inside diameter.

Table 1 — Chemical composition and mechanical properties (see note)

Designation	Chemical composition (ladle analysis)					Mechanical properties											
						BK[c] (cold finished/hard)			BKW[c] (cold finished/soft)			GBK and GZF (annealed)			NBK and NZF (normalized)		
	C max.	Si max.	Mn max.	P max.	S max.	R_e min.	R_m min.	A min.	R_e min.	R_m min.	A min.	R_e min.	R_m min.	A min.	R_e min.	R_m min.	A min.
	%	%	%	%	%	N/mm²	N/mm²	%	N/mm²	N/mm²	%	N/mm²	N/mm²	%	N/mm²	N/mm²	%
CEW 1[a]	0.13	—	0.60	0.050	0.050	320	400	6	245	350	10	150	270	27	155	280	25
CEW 2[a]	0.16	—	0.70	0.050	0.050	355	420	6	260	370	10	160	300	27	195	320	25
CEW 3[a]	0.20	0.35	0.90	0.050	0.050	360	450	6	280	400	9	170	340	26	215	360	24
CEW 4[b]	0.25	0.35	1.20	0.050	0.050	415	520	5	315	450	8	200	400	24	235	410	22
CEW 5[b]	0.23	0.50	1.50	0.050	0.050	480	600	4	385	550	6	–	–	–	340	490	20

NOTE Welding of these tubes does not require special techniques but care should be taken and welding carried out in accordance with the guidance given in the appropriate British Standard for welding, e.g. BS 5135.

[a] If rimming or semi-killed steel is used for grade 1 or 2, the carbon content may be increased to 0.19 %, and if used for grade 3, to 0.23 %.

[b] Grain refining elements may be added to this grade at the option of the manufacturer.

[c] If tubes in the BK or BKW condition are subsequently welded, brazed or heated, the mechanical properties in the heat affected zone may be reduced to those given for the delivery condition GBK or NBK.

8 Tolerances

8.1 Diameter. The tolerance on the diameter, including ovality, as designated in clause **7** for tubes having a diameter to thickness ratio not exceeding 33 : 1 shall be as given in Table 2.

Table 2 — Tolerance on diameter

Diameter		Tolerance
Over	Up to and including	
mm	mm	mm
	30	± 0.10
30	50	± 0.15
50	70	± 0.20
70	90	± 0.25
90	110	± 0.30
110	130	± 0.35
130	160	± 0.45
160	190	± 0.55
190	220	± 0.65
220	250	± 0.75

Where the ratio of diameter to thickness is greater than 33 : 1, the tolerance shall be agreed between the purchaser and the manufacturer.

8.2 Thickness. The tolerance on thickness, including eccentricity and weld upset, shall be ± 7.5 % with a minimum of ± 0.1 mm. If the outside and inside diameters are specified, the eccentricity shall be restricted so that the thickness does not deviate by more than ± 7.5 % of the actual measured mean thickness.

8.3 Length. Tubes shall be supplied in either:

a) random lengths of 2 m to 7 m; or

b) specified cut lengths to the tolerances given in Table 3.

Table 3 — Tolerance on specified cut length

Specified cut length		Tolerance
Over	Up to and including	
mm	mm	mm
	500	+2 –0
500	2 000	+3 –0
2 000	5 000	+5 –0
5 000	7 000	+10 – 0
7 000	—	by agreement

NOTE Closer tolerances may be obtained by agreement between the purchaser and the manufacturer.

9 Tests

9.1 General. In addition to the tensile test specified in clause **6**, annealed or normalized tubes shall be subjected to the flattening test as given in **9.2** and the drift expanding test as given in **9.3**. The tests shall be carried out in accordance with **15.3** and **15.4**, respectively, of BS 6323-1:1982.

9.2 Flattening test. The distance between the platens, or in the case of flattening by hammer blows the distance between the outside surface, shall be not greater than the percentage of the original outside diameter as given in Table 4.

Table 4 — Distance between platens for flattening test

Designation	Distance between platens or outside surfaces
	%
CEW 1	66
CEW 2	75
CEW 3	85
CEW 4	85
CEW 5	85

9.3 Drift expanding test. The drift expanding test applies only to tubes in thicknesses up to and including 8 mm and diameters up to and including 120 mm.

The percentage increase in outside diameter shall be not less than the value given in Table 5.

Table 5 — Minimum expansion for drift expanding test

Designation	Expansion minimum for tube thickness	
	Up to and including 4 mm	Over 4 mm up to and including 8 mm
	%	%
CEW 1	12	8
CEW 2	12	8
CEW 3	10	6
CEW 4	8	5
CEW 5	8	5

9.4 Leak tightness test. When a leak tightness test is required by the purchaser and specified on his enquiry and order, each tube shall be tested by one of the following methods:

a) hydraulic leak tightness test (see **15.7** of BS 6323-1:1982).

b) eddy current test (see **15.8** of BS 6323-1:1982).

c) any other method giving an equivalent assurance of leak tightness as agreed between the manufacturer and the purchaser.

Selection of the test method shall be at the option of the manufacturer, unless a specific test is required by the purchaser, and specified on his enquiry and order.

Table 6 — Dimensions: metric size range in common usage for cold finished electric resistance welded (including induction welded) tubes

Outside diameter	Mass per unit length (in kg/m)																	
	Thickness (in mm)																	
mm	0.5	0.8	1.0	1.2	1.5	1.8	2.0	2.2	2.5	2.8	3.0	3.5	4.0	4.5	5.0	5.5	6.0	7.0
6	0.068	0.103	0.123	0.142	0.166													
8	0.092	0.142	0.173	0.201	0.240													
10	0.117	0.182	0.222	0.260	0.314													
12	0.142	0.221	0.271	0.320	0.388	0.453	0.493											
14	0.116	0.260	0.321	0.379	0.462	0.542	0.592											
16	0.191	0.300	0.370	0.438	0.536	0.630	0.691	0.749	0.832									
18		0.339	0.419	0.497	0.610	0.719	0.789	0.857	0.956									
20		0.379	0.469	0.556	0.684	0.808	0.888	0.966	1.08									
22		0.418	0.518	0.616	0.758	0.897	0.986	1.07	1.20									
25		0.477	0.592	0.704	0.869	1.03	1.13	1.24	1.39	1.53	1.63	1.86	2.07					
28		0.537	0.666	0.793	0.980	1.16	1.28	1.40	1.57	1.74	1.85	2.11	2.37					
30		0.576	0.715	0.852	1.05	1.25	1.38	1.51	1.70	1.88	2.00	2.29	2.56	2.83				
32		0.616	0.765	0.911	1.13	1.34	1.48	1.62	1.82	2.02	2.15	2.46	2.76	3.05				
35		0.675	0.838	1.00	1.24	1.47	1.63	1.78	2.00	2.22	2.37	2.72	3.06	3.38				
38		0.734	0.912	1.09	1.35	1.61	1.78	1.94	2.19	2.43	2.59	2.98	3.35	3.72				
40		0.773	0.962	1.15	1.42	1.70	1.87	2.05	2.31	2.67	2.74	3.15	3.55	3.94				
45		0.872	1.09	1.30	1.61	1.92	2.12	2.32	2.62	2.91	3.11	3.58	4.04	4.49				
50			1.21	1.44	1.79	2.14	2.37	2.59	2.93	3.26	3.48	4.01	4.54	5.05				
55				1.59	1.98	2.36	2.61	2.86	3.24	3.60	3.85	4.45	5.03	5.60				
60				1.74	2.16	2.58	2.86	3.14	3.55	3.95	4.22	4.88	5.52	6.16				
70				2.04	2.53	3.03	3.35	3.68	4.16	4.64	4.96	5.74	6.51	7.27	8.01			
80					2.90	3.47	3.85	4.22	4.78	5.33	5.70	6.60	7.50	8.38	9.25			
90					3.27	3.92	4.34	4.76	5.39	6.02	6.44	7.47	8.48	9.49	10.5			
100						4.36	4.83	5.31	6.01	6.71	7.18	8.33	9.47	10.6	11.7			
110							5.33	5.85	6.63	7.40	7.92	9.19	10.5	11.7	12.9	14.2	15.4	17.8
120							5.82	6.39	7.24	8.09	8.66	10.1	11.4	12.8	14.2	15.5	16.9	19.5
140									8.48	9.47	10.1	11.8	13.4	15.0	16.6	18.2	19.8	23.0
160										10.9	11.6	13.5	15.4	17.3	19.1	21.0	22.8	26.4
180												15.2	17.4	19.5	21.6	23.7	25.7	29.9
200												17.00	19.3	21.7	24.0	26.4	28.7	33.3
220													21.3	23.9	26.5	29.1	31.7	36.8
																		$D/a \geqslant 33$

NOTE 1 The outside diameters and thicknesses have been selected from Table 4 of ISO 4200:1980, published by the International Organization for Standardization (ISO). Series 2 sizes are shown in heavy type.

NOTE 2 Outside diameters and thicknesses other than those listed are available by agreement between the purchaser and the manufacturer.

Publications referred to

BS 3601, *Steel pipes and tubes for pressure purposes: carbon steel with specified room temperature properties.*

BS 3602, *Specification for steel pipes and tubes for pressure purposes: carbon and carbon manganese steel with specified elevated temperature properties.*

BS 3603, *Specification for steel pipes and tubes for pressure purposes: carbon and alloy steel with specified low temperature properties.*

BS 3604, *Specification for steel pipes and tubes for pressure purposes: ferritic alloy steel with specified elevated temperature properties.*

BS 3605, *Seamless and welded austenitic stainless steel pipes and tubes for pressure purposes.*

BS 4360, *Specification for weldable structural steels.*

BS 4848, *Hot-rolled structural steel sections.*

BS 4848-2, *Hollow sections.*

BS 5135, *Metal-arc welding of carbon and carbon manganese steels.*

BS 6323, *Specification for seamless and welded steel tubes for automobile, mechanical and general engineering purposes.*

BS 6323-1, *General requirements.*

BS 6363, *Specification for welded cold formed steel structural hollow sections.*

ISO 4200, *Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length.*

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