[3 T. 2. June, 1942.]
(*Cancelling B.S. Specification 2 T. 2.*)

NOTE.—*The Institution desires to call attention to the fact that this Specification is intended to include the technical provisions necessary for the supply of the material herein referred to, but does not purport to comprise all the necessary provisions of a contract.*

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BRITISH STANDARD SPECIFICATION

FOR

85 TON NICKEL CHROMIUM STEEL TUBES

FOR AIRCRAFT PURPOSES.

Section I. Provisions applicable to all tubes.

Section II. Mechanical tests on :—

(1) Straight circular tubes.

(2) Bent circular tubes for which the Manufacturer's proof bend testing machine is suitable.

Section III. Mechanical tests on :—

(1) Straight circular tubes which are too short for proof bend testing.

(2) Bent circular tubes other than those covered by Section II.

(3) Non-circular tubes.

SECTION I.

Provisions applicable to all tubes.

1. **Chemical Composition.** (*a*) The chemical composition of the tubes shall be :—

Carbon - -	not less than 0·20 and not more than 0·35 per cent.
Silicon - -	not more than 0·35 per cent.
Manganese -	not less than 0·45 and not more than 0·70 per cent.
Sulphur - -	not more than 0·05 per cent.
Phosphorus -	not more than 0·05 per cent.
Nickel - -	not less than 3·0 and not more than 5·0 per cent.
Chromium - -	not less than 0·50 and not more than 1·50 per cent.

Any of the following elements may be present at the option of the Steel-maker :—

Vanadium - -	not more than 0·25 per cent.
Molybdenum -	not more than 0·50 per cent.
Tungsten - -	not more than 1·00 per cent.

(*b*) The complete analysis of every cast shall be supplied to the Inspector.

Price 1s. 3d., post free 1s. 5d.
(Australian Currency).

2. **Izod Test.** A suitable test piece (Fig. 7 or 10, B.S. Specification 2 A. 4) from each cast of steel shall be air cooled from a temperature not less than 800° C. nor more than 900° C. and shall be reheated at a temperature not less than 275° C. nor more than 325° C., and maintained at that temperature for 30 minutes and subsequently cooled in still air. The resulting test piece shall have an Izod value of not less than 10 ft. lb.

The cutting of the notches shall be finished after the heat treatment.

3. **Manufacture.** (*a*) The billets or blooms used in the manufacture of the tubes shall be either rough-machined or ground.

(*b*) The tubes shall be seamless and may be turned but shall be finished by cold drawing or by grinding.

(*c*) After air hardening the tubes may be straightened before tempering and proof loading. At the option of the Manufacturer, tubes which have been cold worked after tempering may be subjected to a stress-relieving treatment by heating at a temperature not exceeding that used in the original tempering operation and not less than 200° C. Any re-straightening of tubes covered by Section II which may be necessary after tempering, shall not be carried out until the tubes have been subjected to the proof bend test.

4. **Heat-Treatment.** (*a*) Unless otherwise specified on the order, the tubes shall be delivered in the finally heat-treated condition.

(*b*) The tubes shall be hardened by heating at a temperature not exceeding 900° C. and cooling in air or quenching in oil. They shall then be tempered, to give the specified mechanical properties.

(*c*) No tube shall be re-hardened more than three times.

5. **Freedom from Defects.** (*a*) The tubes shall be free from defects.

(*b*) Any tube may be rejected for faults in manufacture, notwithstanding that it has been passed previously on chemical composition and mechanical tests.

6. **Dimensions.** (*a*) *Circular Tubes.* (i) The dimensions of the tubes shall comply with Table I (pages 9 and 10).

(*b*) *Tubes other than Circular tubes.* The dimensions of tubes other than circular tubes shall comply with the nominal dimensions given in the tables of the latest issue of B.S. Specification T. 50. The tolerances shall be stated on the order.

NOTE. The tolerances given in B.S. Specification T. 50 and certain of the sizes specified therein, namely, the smallest diameters and thinnest gauges may be impracticable in material complying with B.S. Specification 3 T. 2.

7. **Straightness.** The tubes shall be free from kinks and shall not depart from straightness over any selected straight length of 20 inches or more by an amount exceeding 1/600th of the length measured.

8. **Protection against Corrosion.** Unless otherwise specified on the order, the tubes shall be protected against corrosion by an approved method.

9. **Identification.** All tubes passed by the Inspector shall be identified by the mark of the Inspector and such other marking as shall ensure full identification of the material.

SECTION II.

Mechanical tests on :—

(1) Straight circular tubes.

(2) Bent circular tubes for which the Manufacturer's proof bend testing machine is suitable.

10. **Selection and Preparation of Tensile Test Samples.** (*a*) The Inspector shall select one tube from each cast to represent all tubes of the same nominal dimensions from that cast. A test sample shall be cut from this tube for the tensile test specified in Clause 11.

(*b*) All test samples shall be marked as directed by the Inspector before they are cut from the tubes and shall be heat treated with a parcel of the tubes they represent or under identical conditions. The test samples shall not be further heated or cold-worked before testing.

(*c*) The test samples may be cut to shape or reduced in thickness before heat treatment.*

11. **Tensile Test.** (*a*) The test pieces selected and prepared as specified in Clause 10 must comply with the following tensile test :—

Ultimate Tensile Stress	Not less than 85 and not more than 110 tons per sq. in.
Elongation on gauge length of $4\sqrt{\text{area}}$	Not less than 8 per cent on a full section of the tube or 5 per cent on a machined test piece.

The ultimate tensile stress value shall be calculated on the actual dimensions of the test piece.

Should a tensile test piece break outside the middle half of its gauge length the test may be discarded and another test made.

(*b*) *Re-tests.* If any test piece fails to comply with the tensile test, the Inspector may reject the tubes represented by that test piece, or, at the request of the Manufacturer, adopt either of the following procedures :—

(i) Select for test from these tubes two other samples from each 400 feet. One sample must be from the tube from which the original sample was taken, unless that tube has been withdrawn by the Manufacturer. All the test pieces prepared from these further samples must comply with the tensile test specified in paragraph (*a*) above.

(ii) Allow these tubes to be re-heat-treated in accordance with Clause 4, and re-tested in accordance with Clauses 10 and 11.

12. **Proof Bend Test.** (*a*) One end of each tube shall be subjected to the appropriate proof bending moment specified in Col. 7 of Table I. Alternate ends of the tubes in each batch heat-treated together, or at the same time, shall be tested.

When the tubes are 10 feet long and over, 10 per cent of the tubes shall in addition be tested near the middle of their length.

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*Suitable test pieces are shown in B.S. Specification No. 18—Tensile Testing of Metals.

The tube shall be supported at two points in its length and loaded at a third and may be tested either as a cantilever or as a beam. The supports shall consist of two metal blocks (Fig. 1 (*a*) which are grooved to embrace the tube round approximately half its circumference. The diameter of the groove at the centre of the length (L) shall be D + q where D is the nominal outside diameter of the tube and q is 0·004 inch for tubes up to and including 2 inches diameter and 0·001 inch for each ½ inch of diameter for diameters greater than 2 inches. The surface of the groove shall have a radius of sixty times the nominal outside diameter of the tube as shown in Fig. 1 (*b*). The length (L) of the blocks shall not exceed the outside diameter of the tube and shall be pivoted at the centre of their length (*see* Fig. 1 (*a*)) so as to turn when the tube deflects.

The resulting set shall be determined at a point in the length subjected to bending and near to or at the point of loading and shall be measured with reference to a line through the remaining two points.

The set shall not exceed 7½ per cent of the deflection, which may be calculated from the formulas given in the Appendix or measured direct on the proof bend testing machines.

The deflection shall be based on a bending stress of 78 tons per square inch, the nominal outside diameter and thickness of the tube and a value for Young's Modulus of 13,300 tons per sq. inch.

(*b*) *Re-tests.* If any tube fails to comply with the proof bend test all the tubes in the same parcel shall be subjected to the proof bend test at both ends, and if 10 feet long and over, 20 per cent of the tubes shall in addition be tested near the middle of their length. Tubes which fail to comply with the proof bend test may be rejected by the Inspector or, at the request of the Manufacturer, re-heat-treated in accordance with Clause 4 and re-tested at both ends, and if 10 feet long and over, they shall in addition be tested near the middle of their length.

13. **Hardness Test.** (*a*) All tubes in each parcel shall be tested for hardness by an approved method and the hardness numbers must be not less than 388 nor more than 514 on the Brinell scale, or their equivalent values on the scale of the method adopted. Tubes over 5 feet long shall be tested for hardness at each end.

(*b*) Tubes which fail to comply with the hardness test may be rejected by the Inspector or, at the request of the Manufacturer, be re-heat-treated in accordance with Clause 4 and re-tested in accordance with Clauses 11, 12 and 13.

SECTION III.

Mechanical tests on:—

(1) Straight circular tubes which are too short for proof bend testing.

(2) Bent circular tubes other than those covered by Section II.

(3) Non-circular tubes.

14. **Selection and Preparation of Tensile Test Samples.** (*a*) Tubes of the same cast and of the same nominal dimensions and heat treated as specified in Clause 4 at the same time and/or under identical conditions shall be regarded as one parcel. The Inspector shall select one tube from each 400 feet in the parcel and a test sample shall be cut from this tube for the tensile test specified in Clause 15.

(*a*) All test samples shall be marked as directed by the Inspector before they are cut from the tubes and shall be heat treated with the parcel of tubes they represent. The test sample shall not be further heated or cold-worked before testing.

(*c*) The test samples may be cut to shape or reduced in thickness before heat treatment.*

15. **Tensile Test.** (*a*) The test pieces selected and prepared as specified in Clause 14 must comply with the following tensile test:—

0·2 per cent Proof Stress - Not less than 78 tons per sq. in.

Ultimate Tensile Stress - Not less than 85 and not more than 110 tons per sq. in.

Elongation on gauge length of $4\sqrt{\text{area}}$ - Not less than 8 per cent on a full section of the tube or 5 per cent on a machined test piece.

The proof stress and ultimate tensile stress values shall be calculated on the actual dimensions of the test piece.

Should a tensile test piece break outside the middle half of its gauge length the test may be discarded and another test made.

Proof stress determinations shall be carried out as follows:—

(i) On one test piece from each cast of steel the proof stress shall be obtained from an accurately determined load-elongation diagram, the proof stress being defined as that stress at which the load-elongation curve departs by 0·2 per cent of the gauge length from the straight line of proportionality.

(ii) On all remaining tensile test pieces proof stress determinations shall be carried out by any approved method.

(*b*) *Re-tests.* If any test piece fails to comply with the tensile test, the Inspector may reject the complete parcel from which that test piece was selected or, at the request of the Manufacturer, adopt either of the following procedures:—

(i) Select for test from the same parcel two other samples from each 400 feet in the parcel. One sample must be from the tube from which the original sample was taken, unless that tube has been withdrawn by the Manufacturer. All the test pieces prepared from these further samples must comply with the tensile test specified in paragraph (*a*) above.

(ii) Allow the parcel to be re-heat-treated in accordance with Clause 4, and re-tested in accordance with Clauses 15 and 16.

16. **Hardness Test.** (*a*) All tubes in each parcel shall be tested for hardness by an approved method and the hardness numbers must be not less than 388 nor more than 514 on the Brinell scale, or their equivalent values on the scale of the method adopted. Tubes over 5 feet long shall be tested for hardness at each end.

(*b*) Tubes which fail to comply with the hardness test may be rejected by the Inspector or, at the request of the Manufacturer, be re-heat-treated in accordance with Clause 4 and re-tested in accordance with Clauses 14, 15 and 16.

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*Suitable test pieces are shown in B.S. Specification No. 18—Tensile Testing of Metals.

APPENDIX.

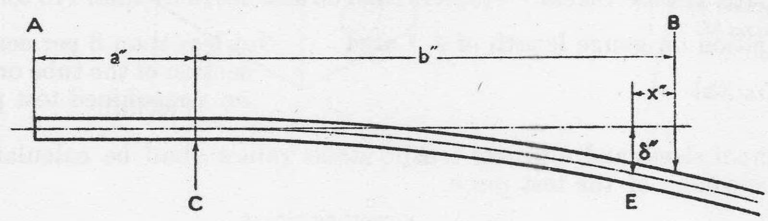
Method of measuring Set and calculating Elastic Deflection.

After removal of the load the resulting set is measured.

The apparatus for measuring the set consists of a fairly heavy plunger which is freely guided so that it may move vertically downwards when the tube deflects. One end of a fine cord is attached to the top of the plunger and the other end passes round a spindle carrying a pointer which moves over a graduated dial, thus recording the movements of the plunger on a magnified scale. The cord may be maintained at a definite tension by a small weight or by a spring. (*See* Fig. 2).

(*a*) *Cantilever loading.*

The elastic deflection is calculated from the following formula :—



A and C are the points of support.

B is the point at which load W (pounds) is applied.

E is the point for which the elastic deflection "δ" is calculated and at which the set is measured.

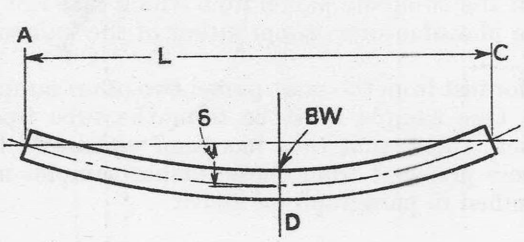
$$\delta = \frac{S}{20{,}000\ D}\left(b\,(a+b) - \frac{X}{2}\,(3b+2a) + \frac{X^3}{2b} \right)$$

S = 78 tons per sq. in.

D = Nominal outside diameter of the tube in inches.

Bending moment = W × b inch pounds.

(*b*) *Beam loading.*



A and C are the points of support.

B is the point at which load W (pounds) is applied.

D is the point for which the elastic deflection "δ" is calculated and at which the set is measured.

$$\delta = \frac{WL^3}{48\ E\ I}$$

W = Total load in pounds.

L = Length between supports A and C in inches.

E = 29,800,000 lb. sq. in.

I = Moment of inertia in inches.

Bending moment $= \frac{WL}{4}$ inch pounds.

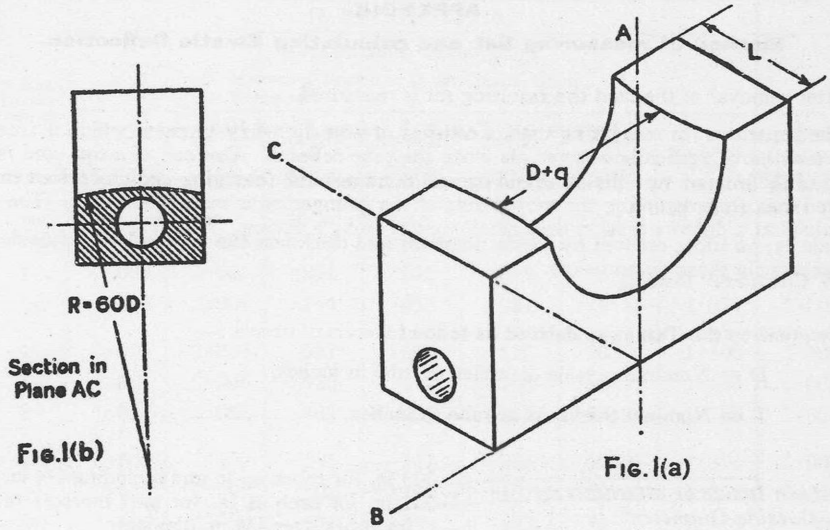


FIG. 1. Supporting blocks.

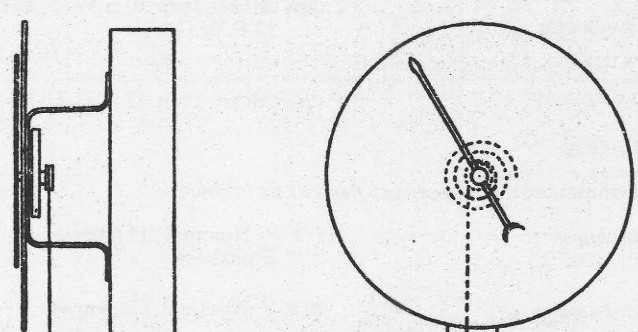


FIG. 2. Apparatus for measuring set.

NOTES ON TABLE I (*pages 9 and 10.*)

On tubes ordered by outside diameter and thickness the tolerances on inside diameter are not necessarily those given below.

Similarly, on tubes ordered by inside diameter and thickness the tolerances on outside diameter are not necessarily those given below.

The limits given in the Table are derived as follows :—

D = Nominal outside diameter of tube in inches.

T = Nominal thickness of tube in inches.

(*a*) *On Mean Inside or alternatively Outside Diameter**
- $\pm$·003 in. for tubes up to and including 1½ in. diameter.
- $\pm$·001 in. for each ½ in. (or part thereof) of diameter for tubes over 1½ in. diameter.

(*b*) *On Extreme Outside Diameter**

$$\pm\left\{ \cdot 005 + \frac{D^3}{(1000\ T)^2} \right\} \text{ in.}$$

Each limit to be taken to the nearest ·001 in. under the calculated figure.

(*c*) *On Mean Thickness* - - -
- Tubes 24 S.W.G. and thinner :— $-\,0 + \cdot 003$ in.
- Tubes thicker than 24 S.W.G. and up to and including 17 S.W.G. :— $-\,0 + \cdot 004$ in.
- Tubes thicker than 17 S.W.G. :— $-\,0 + 8$ per cent.

The maximum and minimum thicknesses are derived as follows :—

(*d*) *Maximum Thickness* - - - - (1·1 × Nominal Thickness) + Tolerance on Mean Thickness.

(*e*) *Minimum Thickness* - - - 0·9 × Nominal Thickness.

The proof bending moment M in 1000 inch lb. is derived from the following formula :—

$$M = S \times \frac{\pi\,(D^4 - d^4)}{32\,D} \times 2 \cdot 24$$

Where S = 78 tons per sq. in.

D = Nominal outside diameter of tube in inches.

d = Nominal bore of tube in inches (*i.e.*, D less twice nominal thickness).

* The limits on extreme outside diameter are based on the nominal diameter, *i.e.*, at no point in the tube must the lowest reading of the diameter be less than (nominal diameter minus the tolerance) and the highest reading must not be more than (nominal diameter plus the tolerance). The average diameter so obtained must be within the limits (nominal diameter plus and minus the tolerance on mean diameter).

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[3 T. 2. June, 1942.**]**

(Cancelling B.S. Specification 2 T. 2.)

TABLE I.
CIRCULAR TUBES.
(See Notes on Table, page 8.)

22 S.W.G. (·028 in.) — Mean thickness ·028 in. $\begin{smallmatrix}-0\\+\cdot004\end{smallmatrix}$; Maximum thickness at any point ·035 in.; Minimum ,, ,, ,, ,, ·025 in.

1 Nominal Outside Diameter.	2 Limits on Diameter: Mean Outside or Inside Diameter.	3 Limits on Diameter: Extreme Outside Diameter.	4 Nominal Area of Section.	5 Moment of Inertia.	6 Modulus of Section.	7 Proof Bending Moment.	8 Maximum Weight.†
in.	in.	in.	sq. in.	in.⁴	in.³	1000in. lb.	lb. per ft.
½	±·003	±·005	·042	·0012	·0046	·804	·161
⅝	±·003	±·005	·053	·0023	·0075	1·31	·203
¾	±·003	±·005	·064	·0041	·011	1·92	·246
⅞	±·003	±·005	·075	·0067	·015	2·62	·289
1	±·003	±·006	·086	·010	·020	3·49	·332
1⅛	±·003	±·006	·096	·015	·026	4·54	·374
1¼	±·003	±·007	·107	·020	·032	5·59	·417
1⅜	±·003	±·007	·118	·027	·039	6·81	·460
1½	±·003	±·009	·129	·035	·047	8·21	·502
1⅝	±·004	±·010	·140	·045	·055	9·61	·545
1¾	±·004	±·011	·151	·056	·064	11·18	·588
1⅞	±·004	±·013	·162	·069	·074	12·93	·631
2	±·004	±·015	·173	·084	·084	14·68	·673
2⅛	±·005	±·017	·184	·101	·095	16·60	·716
2¼	±·005	±·019	·195	·121	·107	18·69	·759
2⅜	±·005	±·022	·206	·142	·120	20·96	·802
2½	±·005	±·024	·217	·166	·133	23·24	·844
2⅝	±·006	±·028	·228	193	·147	25·68	·887
2¾	±·006	±·031	·239	·222	·161	28·13	·930
2⅞	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—
3⅛	—	—	—	—	—	—	—
3¼	—	—	—	—	—	—	—
3⅜	—	—	—	—	—	—	—
3½	—	—	—	—	—	—	—
3⅝	—	—	—	—	—	—	—
3¾	—	—	—	—	—	—	—
3⅞	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

20 S.W.G. (·036 in.) — Mean thickness ·036 in. $\begin{smallmatrix}-0\\+\cdot004\end{smallmatrix}$; Maximum thickness at any point ·044 in.; Minimum ,, ,, ,, ,, ·032 in.

1 Nominal Outside Diameter.	2 Limits on Diameter: Mean Outside or Inside Diameter.	3 Limits on Diameter: Extreme Outside Diameter.	4 Nominal Area of Section.	5 Moment of Inertia.	6 Modulus of Section.	7 Proof Bending Moment.	8 Maximum Weight.†
in.	in.	in.	sq. in.	in.⁴	in.³	1000in. lb.	lb. per ft.
½	±·003	±·005	·052	·0014	·0057	·996	·198
⅝	±·003	±·005	·067	·0029	·0093	1·63	·251
¾	±·003	±·005	·081	·0052	·014	2·45	·304
⅞	±·003	±·005	·095	·0084	·019	3·32	·358
1	±·003	±·005	·109	·013	·025	4·37	·411
1⅛	±·003	±·006	·123	·018	·032	5·59	·464
1¼	±·003	±·006	·137	·025	·041	7·16	·518
1⅜	±·003	±·007	·151	·034	·049	8·56	·571
1½	±·003	±·007	·166	·044	·059	10·30	·624
1⅝	±·004	±·008	·180	·057	·070	12·23	·678
1¾	±·004	±·009	·194	·071	·081	14·16	·731
1⅞	±·004	±·010	·208	·088	·094	16·43	·785
2	±·004	±·011	·222	·107	·107	18·69	·838
2⅛	±·005	±·012	·236	·129	·121	21·13	·892
2¼	±·005	±·013	·250	·153	·136	23·75	·945
2⅜	±·005	±·015	·265	·181	·152	26·56	·999
2½	±·005	±·017	·279	·212	·169	29·52	1·052
2⅝	±·006	±·018	·293	·245	·187	32·67	1·106
2¾	±·006	±·021	·307	·283	·206	35·99	1·159
2⅞	±·006	±·023	·321	·324	·225	39·31	1·212
3	±·006	±·025	·335	·368	·245	42·81	1·266
3⅛	—	—	—	—	—	—	—
3¼	—	—	—	—	—	—	—
3⅜	—	—	—	—	—	—	—
3½	—	—	—	—	—	—	—
3⅝	—	—	—	—	—	—	—
3¾	—	—	—	—	—	—	—
3⅞	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

17 S.W.G. (·056 in.) — Mean thickness ·056 in. $\begin{smallmatrix}-0\\+\cdot004\end{smallmatrix}$; Maximum thickness at any point ·066 in.; Minimum ,, ,, ,, ,, ·050 in.

1 Nominal Outside Diameter.	2 Limits on Diameter: Mean Outside or Inside Diameter.	3 Limits on Diameter: Extreme Outside Diameter.	4 Nominal Area of Section.	5 Moment of Inertia.	6 Modulus of Section.	7 Proof Bending Moment.	8 Maximum Weight.†
in.	in.	in.	sq. in.	in.⁴	in.³	1000in. lb.	lb. per ft.
½	±·003	±·005	·078	·0020	·0078	1·36	·284
⅝	±·003	±·005	·100	·0041	·013	2·27	·364
¾	±·003	±·005	·122	·0074	·020	3·49	·444
⅞	±·003	±·005	·144	·012	·028	4·89	·524
1	±·003	±·005	·166	·019	·037	6·47	·604
1⅛	±·003	±·005	·188	·027	·048	8·39	·684
1¼	±·003	±·005	·210	·038	·060	10·48	·764
1⅜	±·003	±·005	·232	·051	·074	12·93	·844
1½	±·003	±·006	·254	·066	·088	15·38	·924
1⅝	±·004	±·006	·276	·085	·105	18·34	1·004
1¾	±·004	±·006	·298	·107	·122	21·31	1·084
1⅞	±·004	±·007	·320	·132	·141	24·63	1·164
2	±·004	±·007	·342	·162	·162	28·30	1·244
2⅛	±·005	±·008	·364	·195	·183	31·98	1·325
2¼	±·005	±·008	·386	·232	·207	36·16	1·405
2⅜	±·005	±·009	·408	·274	·231	40·35	1·485
2½	±·005	±·010	·430	·321	·257	44·89	1·565
2⅝	±·006	±·010	·452	·373	·284	49·62	1·646
2¾	±·006	±·011	·474	·430	·313	54·68	1·726
2⅞	±·006	±·012	·496	·493	·343	59·92	1·806
3	±·006	±·013	·518	·561	·374	65·34	1·886
3⅛	±·007	±·014	·540	·636	·407	71·11	1·966
3¼	±·007	±·015	·562	·717	·441	77·03	2·046
3⅜	±·007	±·017	·584	·804	·477	83·33	2·127
3½	±·007	±·018	·606	·899	·513	89·62	2·207
3⅝	±·008	±·020	·628	1·000	·552	96·42	2·287
3¾	±·008	±·021	·650	1·109	·591	103·26	2·367
3⅞	±·008	±·023	·672	1·225	·632	110·42	2·447
4	±·008	±·025	·694	1·349	·675	117·94	2·527

†The figures in Column 8 are given for the information of designers and not for purposes of inspection.

(continued on next page)

Note.—Non-circular tubes such as square, streamline and oval sections can be supplied to this Specification.

[3 T. 2. June, 1942.]

(Cancelling B.S. Specification 2 T. 2.)

TABLE I—(*continued.*)

CIRCULAR TUBES.

(See Notes on Table, page 8.)

14 S.W.G. (·080 in.) — Mean thickness ·080 in. $^{-0}_{+\cdot006}$; Maximum thickness at any point ·094 in.; Minimum „ „ „ „ ·072 in.

1 Nominal Outside Diameter.	2 Limits on Diameter. Mean Outside or Inside Diameter.	3 Limits on Diameter. Extreme Outside Diameter.	4 Nominal Area of Section.	5 Moment of Inertia.	6 Modulus of Section.	7 Proof Bending Moment.	8 Maximum Weight.†
in.	in.	in.	sq. in.	in.⁴	in.³	1000 in. lb	lb. per ft.
¾	±·003	±·005	·168	·0096	·026	4·54	·612
1	±·003	±·005	·231	·025	·049	8·56	·841
1¼	±·003	±·005	·294	·051	·081	14·16	1·071
1½	±·003	±·005	·357	·090	·120	20·96	1·300
1¾	±·004	±·006	·420	·147	·168	29·35	1·530
2	±·004	±·006	·483	·223	·223	38·95	1·760
2¼	±·005	±·007	·545	·321	·286	49·97	1·990
2½	±·005	±·007	·608	·446	·357	62·37	2·219
2¾	±·006	±·008	·671	·599	·435	76·00	2·450
3	±·006	±·009	·734	·783	·522	91·20	2·679
3¼	±·007	±·010	·797	1·001	·616	107·63	2·909
3½	±·007	±·011	·860	1·257	·719	125·62	3·139
3¾	±·008	±·013	·922	1·554	·829	144·84	3·369
4	±·008	±·015	·985	1·893	·947	165·46	3·599
4¼	±·009	±·017	1·048	2·279	1·072	187·30	3·829
4½	±·009	±·019	1·111	2·714	1·206	210·71	4·058
4¾	—	—	—	—	—	—	—
5	—	—	—	—	—	—	—

11 S.W.G. (·116 in.) — Mean thickness ·116 in. $^{-0}_{+\cdot009}$; Maximum thickness at any point ·137 in.; Minimum „ „ „ „ ·104 in.

1 Nominal Outside Diameter.	2 Limits on Diameter. Mean Outside or Inside Diameter.	3 Limits on Diameter. Extreme Outside Diameter.	4 Nominal Area of Section.	5 Moment of Inertia.	6 Modulus of Section.	7 Proof Bending Moment.	8 Maximum Weight.†
in.	in.	in.	sq. in.	in.⁴	in.³	1000 in. lb.	lb. per ft
¾	—	—	—	—	—	—	—
1	±·003	±·005	·322	·032	·064	11·18	1·171
1¼	±·003	±·005	·413	·067	·107	18·70	1·504
1½	±·003	±·005	·504	·122	·162	28·31	1·838
1¾	±·004	±·006	·595	·200	·228	39·84	2·172
2	±·004	±·006	·687	·306	·306	53·47	2·506
2¼	±·005	±·007	·778	·444	·395	69·02	2·841
2½	±·005	±·007	·869	·619	·495	86·49	3·174
2¾	±·006	±·008	·960	·834	·607	106·06	3·509
3	±·006	±·008	1·051	1·094	·730	127·55	3·842
3¼	±·007	±·009	1·142	1·404	·864	150·96	4·177
3½	±·007	±·009	1·233	1·767	1·010	176·47	4·510
3¾	±·008	±·010	1·324	2·188	1·167	203·90	4·845
4	±·008	±·010	1·415	2·671	1·336	233·43	5·178
4¼	±·009	±·011	1·507	3·221	1·516	264·88	5·513
4½	±·009	±·011	1·598	3·841	1·707	298·25	5·847
4¾	±·010	±·012	1·689	4·536	1·910	333·72	6·181
5	±·010	±·014	1·780	5·310	2·124	371·11	6·515

8 S.W.G. (·160 in.) — Mean thickness ·160 in. $^{-0}_{+\cdot013}$; Maximum thickness at any point ·189 in.; Minimum „ „ „ „ ·144 in.

1 Nominal Outside Diameter.	2 Limits on Diameter. Mean Outside or Inside Diameter.	3 Limits on Diameter. Extreme Outside Diameter.	4 Nominal Area of Section.	5 Moment of Inertia.	6 Modulus of Section.	7 Proof Bending Moment.	8 Maximum Weight.†
in.	in.	in.	sq. in.	in.⁴	in.³	1000 in. lb.	lb. per ft.
¾	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
1¼	—	—	—	—	—	—	—
1½	±·003	±·005	·674	·153	·204	35·64	2·457
1¾	±·004	±·006	·799	·255	·291	50·84	2·918
2	±·004	±·006	·925	·394	·394	68·84	3·379
2¼	±·005	±·007	1·051	·576	·512	89·45	3·842
2½	±·005	±·007	1·176	·806	·645	112·70	4·304
2¾	±·006	±·008	1·302	1·095	·797	139·26	4·766
3	±·006	±·008	1·428	1·443	·962	168·08	5·229
3¼	±·007	±·009	1·553	1·858	1·144	199·88	5·693
3½	±·007	±·009	1·679	2·346	1·341	234·30	6·152
3¾	±·008	±·010	1·805	2·913	1·553	271·34	6·616
4	±·008	±·010	1·930	3·564	1·782	311·34	7·076
4¼	±·009	±·011	2·055	4·305	2·026	353·98	7·541
4½	±·009	±·011	2·181	5·143	2 286	399·41	8·002
4¾	±·010	±·012	2·307	6·083	2·561	447·46	8·467
5	±·010	±·012	2·432	7·131	2·852	498·30	8·925

†The figures in Column 8 are given for the information of designers and not for purposes of inspection.

NOTE.—Non-circular tubes, such as square, streamline and oval sections, can be supplied to this Specification.

This Specification having been approved by the Aircraft Industry Committee and endorsed by the Chairman of the Engineering Divisional Council was published under the Authority of the General Council as a British Standard on 29th June, 1942.

NOTE.

In order to keep abreast of progress in the Industries concerned, the British Standard Specifications are subject to periodical review.

Suggestions for improvements, addressed to the British Standards Institution, 28 Victoria Street, London, S.W. 1, will be welcomed at all times. They will be recorded and in due course brought to the notice of the Committees charged with the revision of the Specifications to which they refer.

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