BRITISH STANDARD

BS 3 T 51: 1945

(Cancelling BS Specification 2 T 51) Incorporating Amendment No. 1

OBSOLESCENT
MARCH 1983

Specification for Aircraft Material

High pressure seamless copper tubes

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.*

UDC 629.13:621.643.2 — 186.5:669.3 — 462

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 3 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.

This Specification having been approved by the Aircraft Industry Committee was published by the authority of the Council of the Institution as a British Standard on 4 May 1945

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Amendments issued since publication

Amd. No.	Date of issue	Comments
4235	March 1983	Indicated by a sideline in the margin

Contents

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Obsolescent (by Amendment No. 1)

The need for the material covered by this British Standard has been reviewed and it has been decided that, in the interests of rationalization, it should be regarded as obsolescent. Its use for new design is not therefore recommended. The standard will be withdrawn in due course.

1 Chemical composition

a) The chemical composition of the tubes shall be:—

Copper	—	Not less than 99.20 per cent.
Arsenic (if present)	—	Not more than 0.50 per cent.

Impurities:—

Antimony	—	Not more than 0.05 per cent.
Bismuth	—	Not more than 0.01 per cent.

b) The analysis of not less than 5 per cent of the casts of alloy shall be submitted to the inspector. The minimum number of analyses required may be increased by the inspector if he is not satisfied with the conditions of manufacture.

c) A cast shall be defined as:—

i) The product of one furnace melt.

ii) The product of one crucible melt.

iii) The product of a number of crucible or furnace melts where such are aggregated and mixed prior to casting.

iv) When a continuous melting process is employed, a cast shall be taken as the amount of metal tapped from the furnace without any further additions of metal having been made to the charge, or

v) As may be otherwise defined from time to time.

2 Manufacture

a) The tubes shall be solid drawn and free from defects.

b) The tubes shall not be re-drawn from tubes that have been used previously.

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

3 Condition

The condition in which the tubes are supplied shall be at the discretion of the manufacturer. The condition shall however be such as will ensure compliance with the tests specified in Clause **5**. When tubes are annealed they should be annealed at a temperature not exceeding 700 °C.

4 Dimensions

a) The maximum length of the tubes shall not exceed 17 ft. 6 in.

b) The outside diameter and thickness of the tubes shall be as specified in the following table:—

Nominal Thickness		**Outside Diameter**							
S.W.G.	nch	inch							
16	0.064	—	3/16	1/4	—	3/8	—	1/2	—
18	0.048	1/8	—	—	—	—	7/16	—	—
20	0.036	—	3/16	1/4	5/16	3/8	7/16	—	5/8
21	0.032	1/8	—	—	—	—	—	—	—
22	0.028	—	3/16	—	—	—	—	—	—

c) The outside diameter and mean thickness of all tubes shall not vary from the nominal dimensions by more than the following tolerances:—

i) The outside diameter shall not vary from the nominal diameter by more than ± 0.003 inch.

ii) The thickness of all tubes shall not vary from the nominal thickness more than the following:—

Nominal Thickness		Tolerance on mean thickness	Maximum thickness at any point	Minimum thickness at any point
S.W.G.	inch	inch	inch	inch
16 and 18	0.064 and 0.048	± 0.004	Nominal plus 0.006	Nominal minus 0.006
20 to 22	0.036 to 0.028	± 0.003	Nominal plus 0.004	Nominal minus 0.004

5 Mechanical tests

a) All tests shall be carried out to the satisfaction of the inspector.

b) A piece of tube selected as specified in Clause **6**, flattened or plugged sufficiently for gripping, and having an effective unflattened or unplugged length of not less than 4 inches, must when tested in tension give the following result:—

Ultimate Tensile Stress
Not less than 14 nor more than 20 tons per sq. inch.

c) *Flattening test*. A test piece, not less than 2 inches long, cut from each selected tube must withstand without showing signs of cracking being flattened down until the interior surfaces of the tube meet as shown in Figure 1.

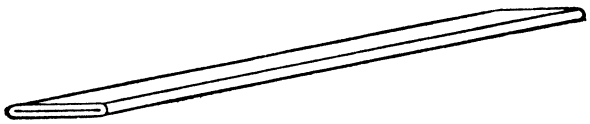

Figure 1

d) *Bore test.*

i) The bore of each tube shall be such as to permit of a metallic bob, a wire with metallic bob attached, or a wire, being passed through freely. The diameter of the bob or wire shall be 80 per cent of the nominal bore diameter of the tube. The length of the bob shall be not less than twice its diameter.

ii) All tubes which fail to comply with the bore test will be rejected.

e) *Hydraulic test*.

i) All tubes must be subjected to and must withstand without showing signs of failure the appropriate internal test pressure. The test pressures for the various sizes of tubes are given in the following table:—

Nominal Outside Diameter		Nominal Thickness		Test Pressure
inch		S.W.G.	inch	lb. per sq. in.
1/8	0.1250	18	0.048	6 000
1/8	0.1250	21	0.032	6 000
3/16	0.1875	16	0.064	6 000
3/16	0.1875	20	0.036	4 000
3/16	0.1875	22	0.028	4 000
1/4	0.2500	16	0.064	6 000
1/4	0.2500	20	0.036	2 500
5/16	0.3125	20	0.036	2 500
3/8	0.3750	16	0.064	4 000
3/8	0.3750	20	0.036	2 500
7/16	0.4375	18	0.048	2 500
7/16	0.4375	20	0.036	2 500
1/2	0.5000	16	0.064	4 000
5/8	0.6250	20	0.036	1 000

ii) All tubes which fail to comply with the hydraulic test will be rejected.

6 Selection of test samples

a) Tubes of the same nominal diameter and gauge, shall be grouped into parcels of not more than 5 cwt. No parcel shall contain more than 5 000 ft. When tubes are finally annealed, a parcel shall contain only tubes which have been annealed together.

b) The Inspector shall select test samples from each parcel as follows:—

i) *Tensile test*. One test sample from each parcel for the tensile test specified in Clause **5** b).

ii) *Flattening test*. Two and a half per cent of the tubes in each parcel for the flattening test specified in Clause **5** c).

iii) The test samples shall be marked as directed by the inspector and shall not be further mechanically worked or heat treated before they are tested.

7 Retests

a) *Tensile test*. If any test piece fails to comply with the tensile test, two other samples from the same parcel as that which failed shall be selected by the inspector and tested in the same manner. One of the samples must be from the tube from which the original sample was taken, unless that tube has been withdrawn by the manufacturer. All test pieces prepared from these further samples must comply with the tensile test specified in Clause **5** b).

b) *Flattening test*. If any test piece fails to comply with the flattening test an additional five per cent of the tubes in the same parcel as that which failed shall be selected by the inspector and tested in the same manner. This further selection must include tubes from which the previous samples which failed were taken, unless those tubes have been withdrawn by the manufacturer. All the test pieces prepared from these further tubes must comply with the flattening test specified in Clause **5** c).

8 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 and of the internal proof pressure applied.

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