D.T.D. 477

Ministry of Defence
Defence Procurement Agency, ADRP2
Abbey Wood
Bristol
BS34 8JH

OBSOLESCENCE NOTICE

All DTD specifications were declared obsolescent from 1st April 1999. All DTD 900 series approvals also lapsed at that time. The standards will no longer be updated but will be retained as obsolescent documents to provide for the servicing of existing equipment.

Further Guidance

The aim in declaring the specifications obsolescent is to recognise that the documents are not being updated and thus should be used with care by both purchaser and supplier. For example, a specification could contain valid technical information but may also contain type approval clauses that contradict procurement policy and/or use materials that do not comply with environmental legislation. The obsolescent specification can still be used as a basis for a purchase provided that the supplier and purchaser agree suitable changes to the specification within the purchase order/contract.

For the DTD 900 system, each specification has provided an MoD approved material and process. For these items, the declaration of obsolescence will constitute the termination of both the extant MoD approval and the continuing MoD assessment that had underpinned those approvals. Again, the technical content of the document remains valid and can be used by both purchaser and supplier as a basis for a contract but an acceptable (to the parties) approval/assessment procedure would be required.

PROCUREMENT EXECUTIVE
MINISTRY OF DEFENCE

D.T.D. 477
Amendment No. 2
April 1981

Aerospace Material Specification
HIGH NICKEL-COPPER ALLOY TUBES

Delete: Existing Clause 1.

Insert: 1 Chemical Composition

a. The chemical composition of the tubes shall be:

Element	Per cent	
	min	max
Carbon	—	0.3
Silicon	—	0.5
Manganese	—	2.0
Sulphur	—	0.02
Aluminium	—	0.5
Cobalt	—	2.0
Copper	28.0	34.0
Iron	—	2.5
Nickel + Cobalt	63.0	—

b. The manufacturer shall supply the analysis of each cast to the Inspector.

4. Tests

b. Hydraulic Tests

Delete: Existing sub clause (f).

Insert: f. Hydraulic Test

i All tubes must be subjected to and must withstand one of the following internal proof test pressures:

a. 4500 pounds per square inch.
b. 3000 pounds per square inch (minimum)
b. 750 pounds per square inch (minimum).
d. 300 pounds per square inch (minimum).

The Purchaser shall specify on the order the test pressure required, which shall be not less than one and one half times the maximum working pressure in service.

ii The sizes of tubes appropriate for the various proof test pressures are shown in Appendix 1.

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

Appendix 1.

Delete: Existing Clause 1 High Pressure.

Insert: 1 High Pressure

a. Tubes to withstand a proof test pressure of 4500 lb. per square inch, i.e. for a maximum working pressure of 3000 lb per square inch, may be ordered in any of the following sizes:

Outside diameter	inch	3/16	1/4	5/16	3/8
Wall thickness	SWG	22	22	22	22

b. Tubes to withstand a proof test pressure of 3000 lb. per square inch, i.e. for a maximum working pressure of 2000 lb. per square inch, may be ordered in any of the following sizes in addition to those given in (a) above:

Outside diameter	inch	7/16	1/2
Wall thickness	SWG	20	20

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MINISTRY OF SUPPLY

D.T.D. 477

June, 1943
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Incorporating Amendment No. 1

Aircraft Material Specification

HIGH NICKEL-COPPER ALLOY TUBES

NOTE.— This specification is one of a series issued by the Ministry of Supply, either to meet a limited requirement not covered by any existing British Standard Specification or to serve as a basis for inspection of materials the properties and uses of which are not sufficiently developed as to warrant submission to the British Standards Institution for standardisation.

NOTE.— Attention is drawn to the internal hydraulic test specified in clause 4 (f) herein. Where tubes are not required to withstand internal pressures in service the order may be endorsed accordingly and the hydraulic test specified in clause 4 (f) waived.

1. **Chemical composition.**

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

Copper	not less than 28.0 per cent. nor more than 34.0 per cent.
Manganese	not less than 0.3 per cent. nor more than 2.0 per cent.
Iron	not more than 2.0 per cent.
Total Impurities	not more than 0.3 per cent.
Nickel	the remainder.

(b) The manufacturer shall supply the analysis of each cast to the Inspector.

2. **Manufacture.**

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

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

(c) The tubes shall be supplied in the annealed condition and shall be free from scale. At the option of the Manufacturer, the tubes may be subjected to a sizing pass after the annealing treatment.

(d) Any tube may be rejected for faults in manufacture, although it has been passed previously on analysis and mechanical tests.

3. **Dimensions.**

(a) The maximum length of the tubes shall be as follows :—

Bore Diameter.	*Maximum Length.*
1 inch and over	10 feet 6 inches.
Below 1 inch	17 feet 6 inches.

(b) The outside diameter and mean thickness shall not vary from the nominal dimensions by more than the following tolerances : —

(i) Outside diameter :—

Nominal Outside Diameter.	*Tolerance.*
Inch.	*Inch.*
Up to and including ⅜	±0.003
Over ⅜ and up to and including 1½	±0.004

(ii) Thickness :—

Nominal Thickness.		*Tolerance on Mean Thickness.*	*Maximum Thickness at any Point.*	*Minimum Thickness at any Point.*
S.W.G.	*Inch.*	*Inch.*	*Inch.*	*Inch.*
20 to 22	0.036 to 0.028	±0.003	Nominal plus 0.004	Nominal minus 0.004

(c) Ovality.— Each tube shall be capable of entering a bell-mouthed ring gauge. This gauge shall have a circular section at its smallest diameter which shall not be greater than the maximum permissible outside diameter of the tube being tested.

4. **Tests.**

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

(b) Tensile test. — A piece of tube selected as specified in clause 5, flattened or plugged for gripping, or a strip cut from a tube, must, when tested in tension, give the following results :—

Ultimate tensile strength .. .. not less than 32 tons per square inch.

(c) Drifting test.-Each end of each selected tube shall be subjected to a drifting test as follows :—

Tubes up to and including ½ inch outside diameter shall be drifted to an angle of 30° as shown in Fig. l, without signs of cracking, until the outside diameter of each drifted end is not less than 50 per cent. greater than the original outside diameter of the tube.

Tubes above ½ inch outside diameter shall be similarly drifted until the outside diameter of each drifted end is not less than 25 per cent. greater than the original outside diameter of the tube.

Drifting tests are to be made by the application of steadily applied pressure to the drift. Belling of the tube by spinning methods for test purposes is not acceptable.

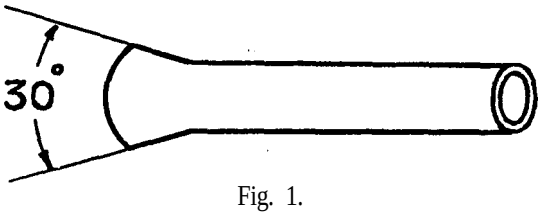

Fig. 1.

(d) Flattening test.— *A* test piece, not less than 2 inches long, cut from each selected tube must, without showing signs of cracking, be flattened down until the interior surfaces of the tubes meet as shown in Fig. 2.

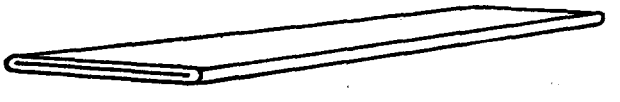

Fig. 2.

(e) Bore test.-(i) Tubes having a bore diameter of 1 in. and over. The bore of each tube shall be examined and shall be to the satisfaction of the Inspector.

(ii) Tubes having a bore diameter less than 1 inch. The bore of each tube shall be such as to permit a brass bob, a wire with brass 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.

(iii) All tubes which fail to pass the appropriate bore test will be rejected.

(f) Hydraulic test.— (i) All tubes must be subjected to and must withstand one of the following internal proof test pressures :—

(a) 4,500 pounds per square inch.

(b) 750 pounds per square inch (minimum).

(c) 300 pounds per square inch (minimum).

The Purchaser shall specify on the order the test pressure required, which shall be not less than one and one-half times the maximum working pressure in service.

(ii) The sizes of tubes appropriate for the various proof test pressures are shown in Appendix I.

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

5. **Selection of test samples.**

(a) Tubes of the same diameter and gauge, and softened together, shall be grouped, into parcels as follows :—

Weight per Foot Run.	*Maximum Size of Parcel.*
Less than 1 lb.	500 feet
1 lb. and up to and including 10 lb.	5 cwt.
Over 10 lb.	50 feet.

(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 4 *(b).*

(ii) *Drifting test.* —Ten per cent. of the tubes in each parcel for the drifting test specified in clause 4 *(c).*

(iii) *Flattening test.*—Two and a half per cent. of the tubes in each parcel for the flattening test specified in clause 4 *(d).*

(c) 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.

6. **Re-tests.**

(a) Tensile test.—If any test piece fails to pass 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 the test pieces prepared from these further samples must pass the tensile test in clause 4 *(b).*

(b) Drifting test.—If any tube fails to pass the drifting test, each tube in the same parcel as that which failed shall be tested similarly at each end. All the tubes which fail to pass the test will be rejected.

(c) Flattening test.—If any test piece fails to pass the flattening test an additional 5 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 these further test pieces must pass the flattening test specified in clause 4 *(d).*

7. **Identification.**

All tubes passed by the Inspector shall be identified by the mark of the Inspector and such other marking as will ensure full identification of the material and of the internal proof test pressure applied.

APPENDIX I

Sizes of Tubes appropriate for the various Hydraulic Proof Test Pressures

1. **High pressure.**

Tubes to withstand a proof test pressure of 4,500 lb. per square inch, i.e. for a maximum working pressure of 3,000 lb. per square inch, may be ordered in any of the following sizes :—

Outside diameter, inch	3/16	1/4	5/16	3/8	7/16	1/2
Wall thickness, S.W.G	22	22	22	22	20	20

2. **Medium pressure.**

Tubes to withstand a minimum proof test pressure of 750 lb. per square inch, i.e. for a maximum working pressure of 500 lb. per square inch, may be ordered in any of the following sizes in addition to those given in 1 above :—

Outside diameter, inch	5/8	3/4	7/8	1
Wall thickness, S.W.G.	20	20	20	20

3. **Low pressure.**

Tubes to withstand a minimum proof test pressure of 300 lb. per square inch, i.e. for a maximum working pressure of 200 lb. per square inch, may be ordered in any of the following sizes in addition to those given in 1 and 2 above :—

Outside diameter, inch	1 1/4	1 1/2
Wall thickness, S.W.G.	20	20

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