D.T.D. 237

Ministry of Defence
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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.

MINISTRY OF AVIATION

D.T.D.237

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Aircraft Material Specification
45 PER CENT NICKEL ALLOY SHEETS AND STRIPS OF 15 TONS 0.1 PER CENT PROOF STRESS

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

SECTION I

Provisions applicable to all material to this specification

1. Chemical composition

(a) The chemical composition of the sheets and strips shall be:—

Nickel	not less than 43.0 nor more than 48.0 per cent.
Zinc	not less than 21.0 nor more than 25.0 per cent.
Iron	not more than 20 per cent.
Manganese	not more than 20 per cent.
Total impurities	not more than 1.0 per cent.
Copper	the remainder.

(b) Unless otherwise agreed with the Director of Aeronautical Inspection, the complete analysis of every cast shall be supplied to the inspector.

2. Freedom from defects

(a) The material shall be free from harmful defects.

(b) Any sheet or strip may be rejected for faults in manufacture, although it has been passed previously on chemical composition and mechanical tests.

(c) The sheets shall be so free from curvature that when laid out flat no part of their edges shall be distant from a 6-feet chord by more than $\frac{1}{16}$ inch.

(d) The strips shall be so free from curvature that when laid out flat no part of their edges shall be distant from a 10-foot chord by more than $\frac{1}{4}$ inch.

3. Margins of manufacture

The margins of manufacture for the sheets and strips shall be in accordance with Tables A and B respectively.

4. Heat treatment

The sheets and strips shall be delivered in the softened condition.

5. Identification

All sheets and strips passed by the inspector shall be stamped with the mark of the inspector and such other marking as will ensure full identification of the material.

SECTION II

Sheets

6. Selection and preparation of mechanical test samples

(a) Sheets of the same nominal thickness and from the same cast shall be grouped in parcels of not more than 10 sheets.

(b) Sheets 12 S.W.G. and thinner.-Each sheet 12 S.W.G. and thinner shall be subjected to a single bend test on a corner as specified in Clause 7 *(d).* and the inspector shall select from each test parcel one sheet, from which test samples shall be cut for a tensile test, a single bend test and a reverse bend test as specified in Clause 7.

(c) Sheets thicker than 12 S.W.G.-Each sheet thicker than 12 S.W.G. shall be submitted to the Brinell (or other approved) hardness test. The inspector shall then select from each parcel the sheets giving the highest and lowest hardness number respectively, and a test sample shall be cut from each selected sheet for the tensile test specified in Clause 7 *(a).*

(d) All tensile test samples shall be cut from the selected sheets so that the longitudinal axis of the test piece is in a direction at right angles to the direction of final rolling.

(e) All single bend and reverse bend test pieces shall be ½ inch wide, and shall be cut from each selected sheet so that the longitudinal axis of each test piece is in a direction at right angles to the direction of final rolling. The edges of the test pieces may be smoothed and rounded by filing or machining. Each test piece shall be bent in such a manner that the axis of the bend lies in a direction parallel to the direction of final rolling.

(f) The test samples shall be marked as directed by the inspector before they are cut from the sheets, and shall not be heat treated or mechanically worked before being tested.

7. Mechanical tests

The mechanical properties of the test pieces machined from the samples selected and prepared as specified in Clause 6 must comply with the following test requirements to the satisfaction of the inspector:—

(a) Tensile test

0.1 per cent proof stress*	not less than 15 tonf per sq in.
Tensile strength	not less than 35 tonf per sq in.
Elongation on 2 inches (for sheets thicker than 12 S.W.G.)	not less than 25 per cent.

The testing appliances shall be such that the load when applied is axial. Should a tensile test piece break outside the middle half of its gauge length the test may be discarded and another test made.

(b) Single bend test (12 S.W.G. and thinner).-The test pieces must withstand without cracking being bent through 180° and closed down flat.

(c) Reverse bend test (12 S.W.G. and thinner).-One end of each test piece shall be fixed in a vice between suitable formers, the inner edges of which are rounded to the appropriate radius as shown below. The projecting length of the test piece shall then be bent at right angles to the fixed end, first to one side and then to the other until the test piece breaks. Each test piece must withstand, without cracking, two bends through 180°, the first bend through 90° not being counted.

Material of 12 to 20 S.W.G. inclusive, over a radius of 5T.

Material thinner than 20 S.W.G. over a radius of 3T.

The fractured surfaces must show freedom from pipe or other defect.

(d) Single bend test on the corner of each sheet (12 S.W.G. and thinner).-Each sheet 12 S.W.G. and thinner shall be subjected to a single bend test at one corner. The material must withstand without cracking being bent through 180° and closed down flat. All sheets failing in this test will be rejected. The portion bent over shall carry the identification marks.

8. Re-tests

If any test piece fails to pass the test specified in Clause 6, the inspector may reject the parcel represented by that test piece, or, at the request of the manufacturer, adopt either of the following procedures:—

(a) select for test from the same parcel two other samples, one of which must be from the sheet from which the original test sample was taken unless that sheet has been withdrawn by the manufacturer. Test pieces prepared from these two further samples as specified in Clause 6 must pass the mechanical tests specified in Clause 7.

(b) allow the parcel to be re-softened and re-tested in accordance with Clauses 6 and 7.

SECTION III

Strips

9. Selection and preparation of mechanical test samples

(a) Each strip 12 S.W.G. and thinner shall be subjected to a single bend test at each end as specified in Clause 10 *(b).* The inspector shall select one tensile test sample from each strip for the tensile test specified in Clause 10 *(a).* These samples shall not be heat treated or mechanically worked before being tested.

(b) Strips of 12 S.W.G. and thinner.—Strips 12 S.W.G. and thinner of the same nominal thickness shall be grouped in parcels of not more than 10 strips, and the inspector shall select from each parcel one strip from which test samples shall be cut for the reverse bend test specified in Clause 10 *(c).*

(c) All tensile test samples shall be cut from the selected strips so that the longitudinal axis of the test piece is in a direction parallel to the length of the strip.

(d) All single and reverse bend test pieces shall be ½ inch wide and shall be cut from each selected strip so that the longitudinal axis of each test piece is in a direction at right angles to the direction of rolling. The edges of the test piece may be smoothed and rounded by filing or machining. Each test piece shall be bent in such a manner that the axis of the bend lies in a direction parallel to the direction of rolling where the width of strip permits.

(e) The test samples shall be marked as directed by the inspector before they are cut from the strips, and shall not be heat treated or mechanically worked before being tested.

**See* Appendix.

10. Mechanical tests

The mechanical properties of the test pieces machined from the samples selected and prepared as specified in Clause 9 must pass the following tests to the satisfaction of the inspector.

(a) Tensile test

0.1 per cent proof stress*	not less than 15 tonf per sq in.
Tensile strength	not less than 35 tonf per sq in.
Elongation on 2 inches (for strips thicker than 12 S.W.G.)	not less than 25 per cent.

The testing appliances shall be such that the load when applied is axial. Should a tensile test piece break outside the middle half of its gauge length, the test may be discarded and another test made.

(b) Single bend test. (12 S.W.G. and thinner).-The test pieces must withstand without cracking being bent through 180° and closed down flat.

(c) Reverse bend test (12 S.W.G. and thinner).—The test pieces shall be bent in the manner specified in Clause 7 *(c).* Each test piece must withstand, without cracking, two bends through 180° over the appropriate radius specified below, the first bend through 90° not being counted.

Material of 12 to 20 S.W.G. inclusive over a radius of 5T.
Material thinner than 20 S.W.G. over a radius of 3T.

The fractured surfaces must show freedom from pipe or other defect.

11. Re-tests

(a) If any test piece fails to pass the tensile or single bend test specified in Clause 10, the inspector may reject the coil represented by that test piece or at the request of the manufacturer adopt either of the following procedures:—

(i) select for test two other samples, one from each end of the strip. Test pieces prepared from these two further samples must pass the tensile and single bend tests specified in Clause 10.

(ii) allow the strip to be re-softened and retested in accordance with Clauses 9 and 10.

(b) If any test piece fails to pass the reverse bend test specified. in Clause 10 (c), the inspector may reject the parcel represented by that test piece or at the request of the manufacturer, adopt either of the following procedures:—

(i) select for test from the same parcel two other samples, one of which must be from the strip from which the original test sample was taken, unless that strip has been withdrawn by the manufacturer. Test pieces prepared from these two further samples as specified in Clause 9 must pass the reverse bend test specified in Clause 10.

(ii) allow the parcel to be re-softened and re-tested in accordance with Clauses 9 and 10.

APPENDIX

0.1 per cent proof stress

The proof stress shall be defined as that stress at which the stress-strain curve departs by 0.1 per cent of the gauge length from the straight line of proportionality. For the purpose of this specification the material shall be deemed to have passed the proof stress test if, when the proof stress is applied to the specimen for a period of 15 seconds and removed, the specimen shall not have received a permanent set greater than 0.1 per cent of the gauge length.

MARGINS OF MANUFACTURE

Table (A) : Sheets

Nominal thickness.		Tolerance in inches.
S.W.G.	Inches.	
4 to 6 inclusive	0.232 to 0.192	+0.014 —0
7 to 9 inclusive	0.176 to 0.144	+0.012 —0
10 to 13 inclusive	0.128 to 0.092	+0.010 —0
14 to 18 inclusive	0.080 to 0.048	+0.006 —0
19 to 22 inclusive	0.040 to 0.028	+0.005 —0
Thinner than 22	Thinner than 0.028	+0.003 —0

For sheets over 3 ft wide an additional plus tolerance of 0.002 will be permitted.

**See* Appendix.

Table (B) : Strips

1	2	3	4	5
Specified width of strip in inches.	Nominal thickness of strip in inches.	Tolerance on width of pared strip in inches.	Tolerance on thickness in inches.	
			Centre portion.	Edges. (12½ per cent of the total width on each side of the pared strip.)
Under 4 … … …	Under 0.020	+0 —0.010	+0.0015 —0	+0.0015 —0.0010
	0.020 to 0.031	+0 —0.010	+0.0015 —0	+0.0015 —0.0015
	0.032 to 0.047	+0 —0.015	+0.0025 —0	+0.0025 —0.0015
	0.048 to 0.063	+0 —0.015	+0.0025 —0	+0.0025 —0.0015
	0.064 to 0.091	+0 —0.020	+0.0030 —0	+0.0030 —0.0020
	0.092 to 0.127	+0 —0.020	+0.0035 —0	+0.0035 —0.0025
	0.128 to 0.159	+0 —0.025	+0.0040 —0	+0.0040 —0.0025
	0.160 to 0.191	+0 —0.025	+0.0045 —0	+0.0045 —0.0025
	0.192 to 0.232	+0 —0.030	+00050 —0	+0.0050 —0.0030
4 and under 6 … … …	Under 0.020	+0 —0.010	+0.0015 —0	+0.0015 —0.0010
	0.020 to 0.031	+0 —0.015	+0.0015 —0	+0.0015 —0.0015
	0.032 to 0.047	+0 —0.020	+0.0025 —0	+0.0025 —0.0020
	0.048 to 0.063	+0 —0.020	+0.0025 —0	+0.0025 —0.0020
	0.064 to 0.091	+0 —0.025	+0.0030 —0	+0.0030 —0.0020
	0.092 to 0.127	+0 —0.025	+0.0035 —0	+0.0035 —0.0025
	0.128 to 0.159	+0 —0.030	+0.0040 —0	+0.0040 —0.0025
	0.160 to 0.191	+0 —0.030	+0.0050 —0	+0.0050 —0.0025
	0.192 to 0.232	+0 —0.035	+0.0060 —0	+0.0060 —0.0030
6 and under 10 … …	Under 0.020	+0 —0.015	+0.0020 —0	+0.0020 —0.0015
	0.020 to 0.031	+0 —0.020	+0.0020 —0	+0.0020 —0.0020
	0.032 to 0.047	+0 —0.025	+0.0025 —0	+0.0025 —0.0020
	0.048 to 0.063	+0 —0.025	+0.0030 —0	+0.0030 —0.0020
	0.064 to 0.091	+0 —0.030	+0.0040 —0	+0.0040 —0.0025
	0.092 to 0.127	+0 —0.030	+0.0045 —0	+0.0045 —0.0025
	0.128 to 0.159	+0 —0.035	+0.0050 —0	+0.0050 —0.0025
	0.160 to 0.191	+0 —0.035	+0.0060 —0	+0.0060 —0.0030
	0.192 to 0.232	+0 —0.040	+0.0070 —0	+0.0070 —0.0030
10 and under 16 … …	Under 0.020	+0 —0.020	+0.0020 —0	+0.0020 —0.0015
	0.020 to 0031	+0 —0.025	+0.0030 —0	+0.0030 —0.0015
	0.032 to 0.047	+0 —0.030	+0.0030 —0	+0.0030 —0.0015
	0.048 to 0.063	+0 —0.030	+0.0035 —0	+0.0035 —0.0015
	0.064 to 0.091	+0 —0.035	+0.0050 —0	+0.0050 —0.0020
	0.092 to 0.127	+0 —0.035	+0.0050 —0	+0.0050 —0.0025
	0.128 to 0.159	+0 —0.040	+0.0060 —0	+0.0060 —0.0025
	0.160 to 0.191	+0 —0.040	+0.0060 —0	+0.0060 —0.0030
	0.192 to 0.232	+0 —0.045	+0.0070 —0	+0.0070 —0.0030
16 to 30 inclusive … …	0.020 to 0.031	+0 —0.025	+0.0035 —0	+0.0035 —0.0015
	0.032 to 0.047	+0 —0.030	+0.0035 —0	+0.0035 —0.0015
	0.048 to 0.063	+0 —0.035	+0.0040 —0	+0.0040 —0.0015
	0.064 to 0.091	+0 —0.040	+0.0050 —0	+0.0050 —0.0020
	0.092 to 0.127	+0 —0.040	+0.0060 —0	+0.0060 —0.0025
	0.128 to 0.159	+0 —0.045	+0.0060 —0	+0.0060 —0.0025
	0.l60 to 0.191	+0 —0.045	+0.0070 —0	+0.0070 —0.0030
	0.192 to 0.232	+0 —0.050	+0.0080 —0	+00080 —0.0030

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