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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-T-6735B

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Cancelled 2007-12

Superseding AMS-T-6735A

Tubing, Chrome-Molybdenum, 4135 Steel, Seamless Aircraft Quality

RATIONALE

AMS-T-6735A has been designated cancelled as similar requirements are provided by AMS 6365.

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE International, as of December, 2007. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications indicating that it has been "CANCELLED".

Cancelled specifications are available from SAE.

Similar, but not necessarily identical products are covered in the following specification. However, this listing is provided for information only and does not constitute authority to substitute these specifications for the "CANCELLED" specification.

AMS 6365 Steel Tubing, Seamless, 0.95Cr - 0.20Mo (0.33-0.38C) (SAE 4135) Normalized or Stress Relieved

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

1. SCOPE:

This specification covers chrome-molybdenum (4135) seamless steel tubing of aircraft quality.

1.2 Classification:

Tubing shall be of the following types and physical conditions, as specified (see 6.2):

Type I - Round
Type II - Rectangular or square
Type III - Streamline
Type IV - Oval

Physical condition:

(A) - Annealed
(N) - Normalized or stress relieved
(HT-125) - Heat treated to a minimum tensile strength of 125,000 psi
(HT-150) - Heat treated to a minimum tensile strength of 150,000 psi
(HT-180) - Heat treated to a minimum tensile strength of 180,000 psi
(HT-200) - Heat treated to a minimum tensile strength of 200,000 psi

1.2.1 Unless otherwise specified, tubing shall be furnished in type I, condition (N).

2. APPLICABLE DOCUMENTS:

The following publications, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2301	Aircraft Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
AMS 2640	Magnetic Particle Inspection
AMS-STD-183	Continuous Identification Marking of Iron and Steel Products

2.2 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-PRF-16173E	Corrosion Preventive Compound, Solvent Cutback, Cold Application
MS33534	Standard Dimensions for Streamline and Oval Tubular Shapes

3. REQUIREMENTS:

3.1 Data:

Unless otherwise specified in the contract or order, no data are required by this specification or any of the documents referenced in section 2 (see 6.2).

3.2 Material:

The tubing shall be of aircraft quality. The material shall be magnetically inspected in accordance with the procedures of AMS 2301, and shall not exceed the size and frequency rating limits indicated in the paragraph entitled “Disposition” of AMS 2301 (see 4.5).

3.2.1 Manufacturing Process: The steel shall be manufactured by the open-hearth or electric-furnace process, unless a single process is specified in the contract or purchase order.

3.2.1.1 Sufficient discard shall be taken from each ingot to ensure freedom from piping and undue segregation.

3.3 Chemical Composition:

The chemical composition shall be as specified in Table I.

TABLE I - Chemical Composition

Element	Analysis	Check analysis tolerance [1]
	Percent	Percent
Carbon	0. 32–0. 39	±0. 02
Manganese	. 70– . 90	±. 03
Phosphorus	. 025 (max)	+. 005
Sulfur	. 025 (max)	+. 005
Silicon	. 20–0. 35	±. 02
Chromium	. 80–1. 10	+. 05–0. 03
Molybdenum	. 15–0. 25	±. 03

[1] The average of all the separate determinations shall be within the limits specified in the “Analysis” column. Individual determinations may vary to the extent shown in the “Tolerance” column, except that the several determinations of a single element in any one heat or melt shall not vary both above and below the specified range.

3.4 Mechanical Properties:

After the last cold-draw pass, the tubing shall be normalized, stress relieved, or otherwise heat treated to develop the mechanical properties specified in Table II.

TABLE II - Mechanical Properties

Condition and wall thickness	Tensile strength (min.)	Yield strength at 0.2 percent set or at extension indicated		Elongation in 2 inches	
		(Min.)	Extension under load	Full tube (min.)	Strip (min.)
Inch	psi	psi	Inch in 2 inches	Percent	Percent
(A)	[1] 100, 000				
(N)					
Up to 0.187 incl	100, 000	85, 000	0. 0097	12	7
Over 0.187	95, 000	80, 000	. 0093	15	10
(HT-125) All walls	125, 000	100, 000	. 0107	12	7
(HT-150) All walls	150, 000	135, 000	. 0130	10	6
(HT-180) All walls	186, 000	165, 000	. 0154	8	5
(HT-200) All walls	200, 000	165, 000	. 0154	7	4

[1] Maximum.

3.5 Dimensions:

The dimensions of type I tubing shall conform to the sizes shown on AND10102. The dimensions of types III and IV tubing shall conform to the dimensions on MS33534. The dimensions of type II tubing shall be as negotiated between the supplier and purchaser.

3.6 Tolerances:

The permissible variations in dimensions of type I tubing shall be as shown on MS33529. The permissible variations in dimensions of types II, III, and IV tubing shall be as shown on MS33532.

3.7 Grain Size:

The austenitic grain size of the steel used for this tubing shall be predominantly No. 5 or finer, with grains as large as No. 3 permissible, as determined by the method specified in section 4 on a billet before piercing, hot working, or cold drawing.

3.8 Length:

3.8.1 Exact Lengths: Tubing of all sizes may be ordered to exact lengths or in lengths expressed as a multiple of a definite unit, with tolerances as specified in the contract or purchaser order.

3.8.2 Mill Lengths: When exact or multiple lengths are not specified (see 6.2), tubing will be accepted in mill lengths of 5 to 20 feet, but not more than 10 percent of any order shall be furnished in lengths shorter than 12 feet.

3.9 Decarburization:

The average depth of total decarburization of condition (N) tubing, as received from the tubing manufacturer, shall not exceed the amounts listed in table III. The depth of decarburization in table III is the total decarburization, or the sum of the depths of complete decarburization and partial decarburization on both the inner and outer surfaces of the tube. No more than 75 percent of the amount listed in Table III is to appear on the outer surface of the tube. The depth of complete decarburization shall not exceed one-half the allowable total decarburization. (The word “average” means the result of several readings on a cross section of tubing.)

TABLE III - Decarburization Limits

Nominal (wall) thickness (inch)	Allowable total decarburization (ID+OD) (inch)	Maximum total decarburization (OD) (inch)
Up to 0.040	0.010	0.008
0.041 to 0.050	.012	.009
0.051 to 0.070	.014	.011
0.071 to 0.080	.016	.012
0.081 to 0.090	.018	.014
0.091 to 0.100	.020	.015
0.101 to 0.150	.022	.017
0.151 to 0.200	.026	.020

3.10 Identification of Product:

Each tube shall be marked in accordance with FED-STD-183 and shall include the number of this specification.

3.11 Workmanship:

The tubing shall have a finish conforming to the best practice for aircraft quality material. It shall be smooth, clean, and free from heavy scale or oxide on the interior and exterior surfaces, and shall be free from burrs, seams, tears, grooves, laminations, slivers, pits, and other injurious defects. Surface imperfections such as handling marks, straightening marks, light mandrel and die marks, shallow pits, and scale pattern will not be considered as injurious defects, provided the imperfections are removable without reducing the diameter or wall thickness of the tubing below the permissible tolerance limits. The removal of surface imperfections is not required.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any other commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality Conformance Inspection::

The examination and testing of tubing shall be classified as quality conformance inspection.

4.2.1 Sampling and inspection shall be performed in accordance with FED-STD-151 and as specified herein. If the material is taken from stock and is not identifiable as to heat and method of manufacture, or if the identity of any portion of the shipment is obscure in any respect, additional samples shall be selected to determine conformance of all portions of the shipment to this specification.

4.3 Lot:

A lot shall consist of tubing produced from the same heat and essentially homogeneous in all respects, in the same condition, of the same type, size, and wall thickness offered for delivery at the same time.

4.4 Examinations:

4.4.1 Examination of Product: Each length of tubing shall be visually examined for compliance with surface condition and workmanship requirements. Samples selected in accordance with Table IV shall be examined to assure compliance with the specified dimensions and tolerances, and identification marking requirements.

TABLE IV - Sample Plan

Lot size	Sample size	Acceptance number rejectable
1 to 15	All	0
16 to 180	15	0
181 to 300	35	0
301 to 500	50	1
Over 500	75	2

4.4.2 Examination of Preparation for Delivery: Preparation for delivery shall be examined for conformance to section 5.

4.5 Magnetic Inspection:

Specimens shall be selected, inspected, and rated in accordance with the procedures of AMS 2301. Inspection shall be in accordance with MIL-I-6868 or AMS 2640.

4.6 Chemical Analysis:

4.6.1 Sampling: At least one sample shall be selected for check chemical analysis in accordance with FED-STD-151 to represent each heat in the lot. The sample shall consist of not less than 2 ounces.

4.6.2 Method: Specimens shall be prepared in accordance with Method 111 or 112 of FED-STD-151, and shall be tested by wet chemical or spectrochemical methods. In the event of dispute, analysis shall be by wet chemical methods.

4.6.3 Waiver: Samples for check of chemical analysis may be waived provided that all of the material in the lot can be identified as being made from a heat previously analyzed and found to conform to the chemical composition specified herein.

4.7 Tensile Strength:

4.7.1 Sampling: At least one tensile test sample shall be selected from each 1,000 feet or less of each lot for determination of mechanical properties.

4.7.2 Preparation of Specimens: Tensile test specimens shall be prepared in accordance with Method 211 of FED-STD-151.

4.7.3 Method: Tensile tests and determinations of yield strength and elongation shall be conducted in accordance with Method 211 of FED-STD-151.

4.8 Grain Size:

4.8.1 Sampling: One or more samples shall be selected from one or more billets used in making the tubing and suitable for determining the austenitic grain size.

4.8.2 Preparation of Specimens: The specimens shall be taken one-half way between the center and outside of the billet. The specimens shall be approximately 1-inch square or round, and normalized at 1,650 °F.

4.8.3 Method: The grain size shall be determined by procedure B or D of Method 311 of FED-STD-151.

4.9 Decarburization:

4.9.1 Sampling: At least one cross-sectional sample shall be selected from each 1,000 feet or less of each lot. The sample shall be cut at least three-fourths of an inch from the mill end.