AEROSPACE MATERIAL SPECIFICATION

AMS5587™	REV. F

Issued 1965-02
Revised 2010-01
Reaffirmed 2016-03

Superseding AMS5587E

Nickel Alloy, Corrosion and Heat Resistant, Seamless Tubing
47.5Ni - 22Cr - 1.5Co - 9.0Mo - 0.60W - 18.5Fe
Solution Heat Treated
(Composition similar to UNS N06002)

RATIONALE

AMS5587F has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE

1.1 Form

This specification covers a corrosion and heat resistant nickel alloy in the form of seamless tubing.

1.2 Application

This tubing has been used typically for fluid lines operating in service under appreciable stresses at elevated temperatures, but usage is not limited to such applications. This alloy has good strength up to 1800 °F (982 °C) and oxidation resistance up to 2200 °F (1204 °C).

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2263	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Tubing
AMS2269	Chemical Check Analysis Limits, Nickel, Nickel Alloys and Cobalt Alloys
AMS2371	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS2632	Inspection, Ultrasonic, of Thin Materials, 0.50 Inch (12.7 mm) and Under in Cross-Sectional Thickness
AMS2807	Identification, Carbon and Low-Alloy Steels, Corrosion and Heat Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

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http://www.sae.org/technical/standards/AMS5587F

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E 8/E 8M Tension Testing of Metallic Materials
ASTM E 112 Determining Average Grain Size
ASTM E 354 Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys
ASTM E 426 Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar Alloys
ASTM E 1417 Liquid Penetrant Testing

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - COMPOSITION

Element	min	max
Carbon	0.05	0.15
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	20.50	23.00
Cobalt	0.50	2.50
Molybdenum	8.00	10.00
Tungsten	0.20	1.00
Iron	17.00	20.00
Boron	--	0.010
Copper	--	0.30
Nickel	remainder	

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3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2269.

3.2 Condition

Cold drawn, solution heat treated, and unless solution heat treatment is performed in an atmosphere yielding a bright finish, pickled as required. No specific solution heat treating instructions are specified but it is recommended that the tubing be solution heat treated by heating in a suitable protective atmosphere to 2150 °F ± 25 (1177 °C ± 14), holding at heat for not more than 30 minutes, and cooling rapidly. In no case shall the solution heat treatment temperature be lower than 2100 °F (1149 °C).

3.3 Fabrication

Tubing shall be produced by a seamless and cold drawn process. The external and internal surface finishes may be produced by pickling, bright annealing, or any method which will provide the required surface condition and which will not affect limits of wall thickness or corrosion resistance with the exception that centerless grinding is not acceptable. A light polish to improve surface appearance may be employed.

3.4 Properties

Tubing shall conform to the following requirements:

3.4.1 Tensile Properties

Shall be as shown in Table 2, determined in accordance with ASTM E 8/E 8M on tubing having nominal OD of 0.125 inch (3.18 mm) and over with nominal wall thickness of 0.015 inch (0.38 mm) and over.

TABLE 2 - MINIMUM TENSILE PROPERTIES

Property	Value
Tensile Strength	100 ksi (689 MPa)
Yield Strength at 0.2% Offset	45.0 ksi (310 MPa)
Elongation in 2 Inches (50.8 mm)	
Strip Specimens	20%
Full-Section Specimens	25%

3.4.2 Average Grain Size

Shall be ASTM No. 4 or finer, determined in accordance with ASTM E 112, for tubing 0.125 inch (3.18 mm) and under in nominal wall thickness.

3.4.3 Flarability

Specimens as in 4.3.1 shall withstand flaring at room temperature without formation of cracks or other visible defects, by being forced axially with steady pressure over a hardened and polished tapered steel pin having a 74-degree included angle to produce a flare having a permanent expanded OD not less than 1.2 times the original nominal OD.

3.4.4 Pressure Test

Tubing, when subjected to an internal hydrostatic pressure (P) as determined from Equation 1, shall show no bulges, leaks, pinholes, cracks, or other defects except that a diametric permanent set of 0.002 inch per inch (0.002 mm/mm) of diameter is acceptable.

$$P = S\frac{D^2 - d^2}{D^2 + d^2} \quad \text{(Eq. 1)}$$

where:

P = Test pressure in ksi (MPa)
S = 40.0 ksi (276 MPa)
D = Nominal OD
d = Nominal ID

3.5 Quality

3.5.1 Tubing, as received by purchaser, shall be uniform in quality and condition and shall have a finish conforming to the best practice for high quality aircraft tubing. It shall be smooth and free from grease, oil and other matter, heavy scale or oxide, burrs, seams, tears, grooves, laminations, slivers, pits, and other imperfections detrimental to usage of the tubing. Surface imperfections such as handling marks, straightening marks, light mandrel and die marks, shallow pits, and scale pattern will not be considered injurious if the imperfections are removable within the tolerances specified for wall thickness but removal of such imperfections is not required.

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3.5.2 Metallic flakes or particles shall not be collected on a clean white cloth drawn through the length of the bore of a test sample. Discoloration of the cloth, without the presence of flakes or particles, is acceptable.

3.5.3 When specified, tubing shall be subjected to fluorescent penetrant inspection in accordance with ASTM E 1417, to ultrasonic inspection in accordance with AMS2632, to electromagnetic (eddy- current) inspection in accordance with ASTM E 426, or to any combination thereof. Standards for such inspections shall be as agreed upon between purchaser and vendor(See 8.4).

3.6 Tolerances

Shall conform to AMS2263.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of tubing shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tubing conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.4.1), average grain size (3.4.2), quality (3.5.1), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests

Flarability (3.4.3) and pressure test (3.4.4) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2371 and the following:

4.3.1 Specimens for flarability test (3.4.3) shall be full tubes or sections cut from a tube. The end of the specimen to be flared shall be cut square, with the cut end smooth and free from burrs, but not rounded.

4.3.2 When nondestructive inspection (3.5.2) is required, each length of tubing shall be inspected.

4.4 Reports

The vendor of tubing shall furnish with each shipment a report showing the results of tests for composition of each heat and for tensile properties and average grain size of each lot, and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS5587F, size, and quantity.

4.5 Resampling and Retesting

Shall be in accordance with AMS2371.

5. PREPARATION FOR DELIVERY

5.1 Sizes

Except when exact lengths or multiples of exact lengths are ordered, straight tubing will be acceptable in mill lengths of 6 to 24 feet (1.8 to 7.3 m) but not more than 25% of any shipment shall be supplied in lengths of 6 to 9 feet (1.8 to 2.7 m).

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