

ADOPTION NOTICE

SAE-AMS5583, "NICKEL ALLOY, CORROSION AND HEAT RESISTANT, SEAMLESS TUBING 72NI - 15.5CR - 0.95 CB - 2.5TI - 0.70AL - 7.0FE SOLUTION HEAT TREATED", was adopted on 15-AUG-90 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: ASC/ENOI, Building 560, 2530 Loop Road West, Wright-Patterson AFB, OH 45433-7101. Copies of this document may be purchased from the Society of Automotive Engineers 400 Commonwealth Drive Warrendale, Pennsylvania, United States, 15096-0001.
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AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard



AMS 5583C

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Superseding AMS 5583B

NICKEL ALLOY, CORROSION AND HEAT RESISTANT, SEAMLESS TUBING
72Ni - 15.5Cr - 0.95Cb - 2.5Ti - 0.70Al - 7.0Fe
Solution Heat Treated

UNS NO7750

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 requiring high strength up to 1100 °F (593 °C), but usage is not limited to such applications. Parts may be formed and then heat treated to improve strength at elevated temperatures.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2263 Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Tubing

MAM 2263 Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Tubing

AMS 2269 Chemical Check Analysis Limits, Nickel, Nickel Alloys, and Cobalt Alloys

AMS 2371 Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock

AMS 2634 Ultrasonic Testing, Thin Wall Metal Tubing

AMS 2750 Pyrometry

AMS 2807 Identification, Carbon and Low-Alloy Steels, Corrosion and Heat Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

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2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 8	Tension Testing of Metallic Materials
ASTM E 8M	Tension Testing of Metallic Materials (Metric)
ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 112	Determining the 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) Testing of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar Alloys
ASTM E 1417	Liquid Penetrant Examination

2.3 U.S. Government Publications:

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

MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

(R)

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	--	0.08
Manganese	--	0.35
Silicon	--	0.35
Phosphorus	--	0.015
Sulfur	--	0.010
Chromium	14.00	17.00
Nickel	70.00	--
Columbium	0.70	1.20
Titanium	2.25	2.75
Aluminum	0.40	1.00
Iron	5.00	9.00
Cobalt (3.1.1)	--	1.00
Tantalum (3.1.1)	--	0.05
Copper	--	0.50

3.1.1 Determination not required for routine acceptance.

3.1.2 Check Analysis: Composition variations shall meet the requirements of AMS 2269.

3.2 Melting Practice:

Alloy shall be multiple melted using consumable electrode practice in the remelt cycle. If consumable electrode remelting is not performed in vacuum, electrodes which have been produced by vacuum induction melting shall be used for remelting.

3.3 Condition:

Solution heat treated and descaled.

3.4 Heat Treatment: (R)

Tubing shall be solution heat treated by heating to a temperature not lower than 1800 °F (982 °C), holding at the selected temperature within ± 25 °F (± 14 °C), for a time commensurate with cross-sectional thickness, and cooling at a rate equivalent to an air cool or faster. Pyrometry shall be in accordance with AMS 2750.

3.5 Properties

Tubing shall conform to the following requirements:

3.5.1 As Solution Heat Treated:

3.5.1.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M.

TABLE 2 - Tensile Properties

Property	Value
Tensile Strength, maximum	140 ksi (965 MPa)
Yield Strength at 0.2% Offset, maximum	80.0 ksi (552 MPa)
Elongation in 2 Inches (50.8 mm) or 4D, minimum	
Strip Specimen	30%
Full Tube	35%

3.5.1.2 Average Grain Size: Shall be ASTM No. 5 or finer, determined in accordance with ASTM E 112.

3.5.1.3 Flarability: Specimens as in 4.3.1 from tubing 0.188 to 2.000 inches (4.78 to 50.80 mm), inclusive, in nominal OD 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 1.20 times the original nominal OD.

3.5.2 After Precipitation Heat Treatment: Tubing shall have the following properties after being precipitation heat treated by heating to $1350^{\circ}\text{F} \pm 25$ ($732^{\circ}\text{C} \pm 14$) holding at heat for not less than 8 hours, cooling at a rate of 100°F (56°C) degrees per hour to $1150^{\circ}\text{F} \pm 25$ ($621^{\circ}\text{C} \pm 14$), holding at $1150^{\circ}\text{F} \pm 25$ ($621^{\circ}\text{C} \pm 14$) for 8 hours + 0.5, and air cooling. instead of the 100°F (56°C) degrees per hour cooling rate to $1150^{\circ}\text{F} \pm 25$ ($621^{\circ}\text{C} \pm 14$), tubing may be furnace cooled at any rate provided the time at $1150^{\circ}\text{F} \pm 25$ ($621^{\circ}\text{C} \pm 14$) is adjusted to give a total precipitation heat treatment time of not less than 18 hours.

3.5.2.1 Tensile Properties: Shall be as shown in Table 3, determined in accordance with ASTM E 8 (R) or ASTM E 8M.

TABLE 3 - Minimum Tensile Properties

Property	Value
Tensile Strength	170 ksi (1172 MPa)
Yield Strength at 0.2% Offset	115 ksi (793 MPa)
Elongation in 2 Inches (50.8 mm) or 4D	
Strip Specimen	12%
Full Tube	15%

3.5.2.2 Hardness: Should be not lower than 30 HRC, or equivalent (See 8.2), determined in (R) accordance with ASTM E 18. Tubing shall not be rejected on the basis of hardness if the tensile property requirements of 3.5.2.1, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness, are acceptable.

3.6 Quality:

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 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.

3.6.1 When specified by purchaser, tubing shall be subjected to fluorescent penetrant inspection in accordance with ASTM E 1417, to ultrasonic inspection in accordance with AMS 2634, to electromagnetic (eddy-current) inspection in accordance with ASTM E 426, or to any combination thereof. Tubing shall meet the requirements of 3.6 and other acceptance criteria established by the cognizant engineering organization.

3.7 Tolerances:

Shall conform to all applicable requirements of AMS 2263 or MAM 2263.

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 performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tubing conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), tensile properties (3.5.1.1 and 3.5.2.1), average grain size (3.5.1.2), nondestructive inspection when specified (3.6.1), and tolerances (3.7) are acceptance tests and shall be performed on each heat or lot, as applicable.

4.2.2 Periodic Tests: Flarability (3.5.1.3) and hardness (3.5.2.2) 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: (R)

Shall be in accordance with AMS 2371 and the following:

4.3.1 Specimens for flarability test (3.5.1.3) 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.

4.4 Reports:

The vendor of tubing shall furnish with each shipment a report showing the results of tests for chemical composition of each heat and the results of tests on each lot to determine conformance to the other acceptance test requirements and, when performed, to the periodic test requirements. This report shall include the purchase order number, heat and lot numbers, AMS 5583C, size, and quantity.

4.5 Resampling and Retesting:

Shall be in accordance with AMS 2371.

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).