

AEROSPACE MATERIAL SPECIFICATION



AMS 4590B

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Superseding AMS 4590A

Extrusions, Nickel-Aluminum Bronze, Martensitic
78.5Cu - 10.5Al - 5.1Ni - 4.8Fe
Solution Heat Treated and Tempered (TQ50)
(Composition similar to UNS C63020)

1. SCOPE:

1.1 Form:

This specification covers one type of nickel-aluminum bronze in the form of extruded bars, rods, and tubes.

1.2 Application:

These extrusions have been used typically for parts requiring a combination of high strength and hardness with some ductility and toughness, but usage is not limited to such applications.

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 canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

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

AMS 2221	Tolerances, Copper and Copper Alloy Bars and Rods
MAM 2221	Tolerances, Metric, Copper and Copper Alloy Bars and Rods

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2.2 ASTM Publications:

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

ASTM B 249	General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes, and Forgings
ASTM B 249M	General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes, and Forgings (Metric)
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 478	Chemical Analysis of Copper Alloys

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 478, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element (3.1.1)	min	max
Aluminum	10.0	11.0
Nickel (including Cobalt)	4.2	6.0
Iron	4.0	5.5
Manganese	--	1.5
Zinc	--	0.30
Tin	--	0.25
Cobalt	--	0.20
Silicon	--	0.15
Chromium	--	0.05
Lead	--	0.03
Copper	--	(See 3.1.2)
Sum of Named Elements (3.1.3)	99.5	--

- 3.1.1 These composition limits do not preclude the presence of other elements. Limits may be established and analysis required for unnamed elements by agreement between the manufacturer or supplier and purchaser.

3.1.2 Copper may be reported as “remainder”, or as the difference between the sum of results for all elements and 100%, or as the result of direct analysis.

3.1.3 When all named elements in Table 1 are analyzed, the sum shall be 99.5% minimum, but such determination is not required for routine acceptance of each lot.

3.2 Condition:

Extruded, solution heat treated, tempered (TQ50), and straightened, having an as-extruded surface finish (See 8.2).

3.3 Heat Treatment:

Product shall be solution heat treated by heating to a temperature within the range 1550 to 1650 °F (843 to 899 °C), holding at the selected temperature within ± 25 F (± 14 C) degrees for not less than two hours, and quenching in water and tempered by heating to a temperature within the range 900 to 1000 °F (482 to 538 °C), holding at the selected temperature within ± 15 F (± 8 C) degrees for not less than two hours, and cooling in air to room temperature.

3.4 Properties:

Product 4.00 inches (101.6 mm) and under in nominal diameter or distance between parallel sides shall conform to the following requirements:

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

TABLE 2A - Minimum Tensile Properties, Inch/Pound Units

Nominal Diameter or Distance Between Parallel Sides (bars, rods)	Tensile Strength	Yield Strength	Elongation in
Nominal Wall Thickness (tubing) Inches	ksi	at 0.2% Offset ksi	2 inches or 4D %
Up to 1.00, incl	135	100	6
Over 1.00 to 2.00, incl	130	95	6
Over 2.00 to 4.00, incl	130	90	6

TABLE 2B - Minimum Tensile Properties, SI Units

Nominal Diameter or Distance Between Parallel Sides (bars, rods) Nominal Wall Thickness (tubing) Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
Up to 25.4, incl	931	689	6
Over 25.4 to 50.8, incl	896	655	6
Over 50.8 to 101.6, incl	896	621	6

3.4.2 Hardness: Shall be not lower than 26 HRC, or equivalent, determined in accordance with ASTM E 18.

3.5 Quality:

The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the product.

3.6 Tolerances:

Shall conform to AMS 2221 or MAM 2221, as applicable to refractory alloys.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the product 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 product conforms to the specified requirements.

4.2 Classification of Tests:

All technical requirements of this specification are acceptance tests and shall be performed on each lot.

4.3 Sampling and Testing:

Shall be in accordance with ASTM B 249 or ASTM B 249M.