Society of Automotive Engineers, Inc.
485 LEXINGTON AVENUE, NEW YORK, N.Y. 10017

AEROSPACE MATERIAL SPECIFICATION

AMS 4651

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Revised

COPPER-BERYLLIUM ALLOY BARS AND RODS
98Cu - 1.9Be
Hard

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. APPLICATION: Primarily for parts requiring high strength with good electrical conductivity or lack of magnetic susceptibility.

3. COMPOSITION:

	min	max
Beryllium	1.8	2.0
Cobalt	0.20	--
Nickel + Cobalt + Iron	--	0.60
Copper + Total Named Elements	99.5	--

4. CONDITION: Solution heat treated and cold rolled to hard temper, in a suitable condition for precipitation heat treatment.

5. TECHNICAL REQUIREMENTS:

5.1 Tensile Properties:

Nominal Diameter or Distance Between Parallel Sides Inches	Tensile Strength psi min	Tensile Strength psi max	Elongation % in 2 in. or 4D min
Up to 0.375, incl	95,000	130,000	10
Over 0.375 to 1.000, incl	90,000	120,000	10
Over 1.000 to 2.000, incl	85,000	115,000	8

5.2 Hardness: Material should have hardness as follows, or equivalent, but shall not be rejected on the basis of hardness if the tensile property requirements are met:

Nominal Diameter or Distance Between Parallel Sides Inches	Hardness, Rockwell
Over 0.188 to 0.249, incl	B 88 - 96
Over 0.249 to 0.375, incl	B 92 - 103
Over 0.375 to 1.000, incl	B 91 - 102
Over 1.000 to 2.000, incl	B 88 - 101

5.3 Microstructure: Shall reveal a minimum of beta phase constituent. Any beta phase present shall be fine and well dispersed and shall not be in the form of stringers. Material may be precipitation heat treated as in 5.5 before examination.

5.4 Grain Size: Average grain size, determined in accordance with the issue of ASTM E112 specified in the latest issue of AMS 2350, shall be not larger than shown below. Material may be precipitation heat treated as in 5.5 before examination.

Nominal Diameter or Distance Between Parallel Sides Inches	Average Grain Size mm, max
Up to 1.5 excl	0.050
1.5 to 2.0 incl	0.075

5.5 Properties After Precipitation Heat Treatment: Material shall conform to the following requirements after being precipitation heat treated by heating to 600 - 625 F (315.6 - 329.4 C), holding at heat for 3 hr, and cooling in air.

5.5.1 Tensile Properties:

Nominal Diameter or Distance Between Parallel Sides Inches	Tensile Strength psi		Yield Strength at 0.2% Offset or at Extension Indicated (E = 18,500,000)		Elongation % in 2 in. or 4D, min
	min	max	psi, min	Extension Under Load in. in 2 in.	
Up to 0.375, incl	185,000	215,000	145,000	0.0197	1
Over 0.375 to 1.000, incl	180,000	210,000	145,000	0.0197	1
Over 1.000 to 2.000, incl	175,000	205,000	145,000	0.0197	2

5.5.2 Hardness: Material should have hardness as follows, or equivalent, but shall not be rejected on the basis of hardness if the tensile property requirements are met:

Nominal Diameter or Distance Between Parallel Sides Inches	Hardness, Rockwell
Up to 0.249, incl	C 40 min
Over 0.249 to 0.375, incl	C 39 - 45
Over 0.375 to 1.000, incl	C 38 - 44
Over 1.000 to 2.000, incl	C 37 - 45

6. QUALITY: Material shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.

7. TOLERANCES: Unless specified, tolerances shall conform to all applicable requirements of the latest issue of AMS 2221 for Refractory Alloys.

8. REPORTS:

8.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report showing the results of tests for chemical composition of each heat in the shipment and the results of tests on each size from each heat to determine conformance to the tensile properties and grain size requirements specified. This report shall include the purchase order number, material specification number, size, and quantity.