Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 4111

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Revised

ALUMINUM ALLOY FORGINGS
7.7Zn - 2.5Mg - 1.5Cu - 0.15Cr (7049-T73)

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

2. FORM: Die forgings, hand forgings, and forging stock.

3. APPLICATION: Primarily for parts requiring high strength and resistance to stress-corrosion cracking.

4. COMPOSITION:

	min	max
Zinc	7.2	8.2
Magnesium	2.0	2.9
Copper	1.2	1.9
Chromium	0.10	0.22
Iron	--	0.35
Silicon	--	0.25
Manganese	--	0.20
Titanium	--	0.10
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

5. CONDITION:

5.1 Die and Hand Forgings: Solution and precipitation heat treated to develop the required mechanical properties and resistance to stress-corrosion cracking.

5.2 Forging Stock: As ordered by the forging manufacturer.

6. TECHNICAL REQUIREMENTS:

6.1 Tensile Properties:

6.1.1 Die Forgings:

6.1.1.1 Test Specimens: Test specimens machined from separately forged coupons or from forging stock representing the forgings and, in either case, heat treated with the forgings, or machined from prolongations on heat treated forgings shall conform to the following requirements:

Tensile Strength, psi	72,000 min
Yield Strength at 0.2% Offset or at 0.0160 in. in 2 in. Extension Under Load (E = 10,300,000) psi	62,000 min
Elongation, % in 2 in. or 4D	7 min

6.1.1.2 Forgings, Parallel to Grain Flow: When test specimens are machined from forgings with the axis approximately parallel to the forging flow lines, the tensile properties shall conform to the following requirements:

Heat Treated Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation % in 2 in. or 4D, min
Up to 2, incl	72,000	62,000	7
Over 2 to 4, incl	71,000	61,000	7
Over 4 to 5, incl	70,000	60,000	7

6.1.1.3 Forgings, Across Grain Flow: When test specimens are machined from forgings with the axis transverse to the forging flow lines, the tensile properties shall conform to the following requirements:

Heat Treated Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation % in 2 in. or 4D, min
Up to 1, incl	71,000	61,000	3
Over 1 to 3, incl	70,000	60,000	3
Over 3 to 4, incl	70,000	60,000	2
Over 4 to 5, incl	68,000	58,000	2

6.1.1.4 If any individual specimen fails to meet the requirements of 6.1.1.1, two additional specimens for each original nonconforming specimen shall be cut from a forging in the lot represented. Should either of these additional specimens fail to meet the requirements of 6.1.1.2 or of 6.1.1.3 as applicable, the entire lot shall be subject to rejection.

6.1.1.5 The elongation requirement shall not apply to test specimens having a gage length diameter less than 0.25 in., or taken from a location in immediate proximity to an abrupt change in section thickness, or such that any part of the specimen gage length was within 1/8 in. of the trimmed flashline.

6.1.1.6 Tensile properties of die forgings with section thickness greater than 5 in. shall be as agreed upon by purchaser and vendor.

6.1.2 Hand Forgings:

6.1.2.1 Tensile Properties: Specimens machined from hand forgings 5 in. and under in thickness shall conform to the following requirements:

Nominal Thickness Inches	Grain Direction	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation % in 2 in. or 4D, min
2.00 to 3.00, incl	Longitudinal	71,000	61,000	9
	Long Trans.	71,000	59,000	4
	Short Trans.	69,000	58,000	3
Over 3.00 to 4.00, incl	Longitudinal	69,000	59,000	8
	Long Trans.	69,000	57,000	3
	Short Trans.	67,000	56,000	2
Over 4.00 to 5.00, incl	Longitudinal	67,000	56,000	7
	Long Trans.	67,000	56,000	3
	Short Trans.	66,000	55,000	2

6.1.2.2 Tensile properties of hand forgings over 5 in. in thickness or machined prior to heat treatment shall be as agreed upon by purchaser and vendor.

6.2 Hardness: Forgings should have hardness not lower than Brinell 135 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or not lower than Brinell 140 using 1000 kg load and 10 mm ball, but shall not be rejected on the basis of hardness if the tensile property requirements are met.

6.3 Conductivity:

6.3.1 If the conductivity is below 38% IACS (International Annealed Copper Standard), the material is considered unsatisfactory and must be reprocessed, regardless of property level.

6.4 Stress Corrosion Cracking Test: Material shall be capable of showing no evidence of stress corrosion cracking when subjected to the following test:

6.4.1 A tensile test specimen, cut from a forging or from a forged test block heat treated with the forgings so that the axis of the specimen is parallel to the short transverse direction of the forging or test block, shall be stressed to 75% of the minimum longitudinal yield strength and held at constant strain in a suitable fixture. The stressed specimen shall be subjected to cyclic immersion for 30 days in a 3-1/2% solution of sodium chloride conforming to the purity and pH requirements of ASTM B117 and maintained at room temperature; each cycle shall consist of 10 min. immersion in the solution and 50 min. out of the solution. Specimens shall be dried prior to each immersion.

6.5 Forging Stock: When a sample of stock is forged to a test coupon and heat treated in the same manner as forgings, a tensile test specimen taken from the heat treated coupon shall have properties not lower than those specified in 6.1.1.1. If a test specimen taken from the stock after heat treatment in the same manner as forgings has properties not lower than those specified in 6.1.1.1, the test shall be accepted as an equivalent to the test of a forged coupon. Neither of these tests is required in routine inspection.

7. 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.