



AEROSPACE MATERIAL

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

AMS 4131

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Revised

ALUMINUM ALLOY FORGINGS

5.6Zn - 2.5Mg - 1.6Cu - 0.26Cr (7075-T736)
Solution and Precipitation Heat Treated

1. SCOPE:

- 1.1 Form: This specification covers an aluminum-base alloy in the form of die forgings and hand forgings.
- 1.2 Application: Primarily for structural applications requiring material with high strength and resistance to stress-corrosion cracking.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

- 2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2375 - Approval and Control of Critical Forgings
AMS 2630 - Ultrasonic Inspection
AMS 2645 - Fluorescent Penetrant Inspection
AMS 2808 - Identification, Forgings

- 2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM B342 - Electrical Conductivity by Use of Eddy Currents
ASTM E8 - Tension Testing of Metallic Materials
ASTM E10 - Brinell Hardness of Metallic Materials
ASTM E34 - Chemical Analysis of Aluminum and Aluminum-Base Alloys

- 2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

3. TECHNICAL REQUIREMENTS:

- 3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E34, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

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	min	max
Zinc	5.1	- 6.1
Magnesium	2.1	- 2.9
Copper	1.2	- 2.0
Chromium	0.18	- 0.35
Iron	--	0.50
Silicon	--	0.40
Manganese	--	0.30
Titanium	--	0.20
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.2 Condition: Solution and precipitation heat treated to develop the specified properties and resistance to stress-corrosion cracking.

3.3 Properties:

3.3.1 Tensile Properties: Shall be as follows; test specimens and testing procedures shall be in accordance with ASTM E8:

3.3.1.1 Die Forgings: Shall conform to the following requirements, provided that the as-forged thickness is not more than twice the maximum thickness at time of heat treatment.

3.3.1.1.1 With Grain Flow: Test specimens, machined from forgings or from prolongations on such forgings, with the axis of specimen varying not more than 15 deg (0.262 rad) from parallel to the forging flow lines in the area of the gage length of the specimen, shall conform to the requirements shown in Table I:

TABLE I

Nominal Thickness At Time Of Heat Treatment Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
Up to 3, incl	76,000	66,000	7
Over 3 to 4, incl	73,000	63,000	7
Over 4 to 5, incl	70,000	61,000	7
Over 5 to 6, incl	68,000	58,000	7

TABLE I (SI)

Nominal Thickness At Time Of Heat Treatment Millimeters	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Up to 76, incl	524	455	7
Over 76 to 102, incl	503	434	7
Over 102 to 127, incl	483	421	7
Over 127 to 152, incl	469	400	7

3.3.1.1.2 Across Grain Flow: Test specimens, machined from forgings or from prolongations on such forgings, with the axis of specimen varying more than ± 15 deg (0.262 rad) from parallel to the forging flow lines, shall conform to the requirements shown in Table II:

TABLE II

Nominal Thickness At Time Of Heat Treatment Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
Up to 3, incl	71,000	62,000	4
Over 3 to 4, incl	70,000	60,000	4
Over 4 to 5, incl	68,000	58,000	4
Over 5 to 6, incl	65,000	55,000	4

TABLE II (SI)

Nominal Thickness At Time Of Heat Treatment Millimeters	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Up to 76, incl	490	427	4
Over 76 to 102, incl	483	414	4
Over 102 to 127, incl	469	400	4
Over 127 to 152, incl	448	379	4

3.3.1.2 Hand Forgings: Test specimens machined from forgings having a rectangular cross section shall conform to the requirements shown in Table III provided that the as-forged thickness does not exceed 6.0 in. (152 mm):

TABLE III

Nominal Thickness At Time Of Heat Treatment Inches	Test Direction	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
Up to 2, incl	Longitudinal	73,000	63,000	9
	Long Trans.	71,000	60,000	5
Over 2 to 3, incl	Longitudinal	73,000	63,000	9
	Long Trans.	71,000	60,000	5
	Short Trans.	69,000	60,000	4
Over 3 to 4, incl	Longitudinal	71,000	61,000	9
	Long Trans.	70,000	58,000	5
	Short Trans.	68,000	57,000	4
Over 4 to 5, incl	Longitudinal	68,000	57,000	8
	Long Trans.	67,000	56,000	5
	Short Trans.	66,000	55,000	4
Over 5 to 6, incl	Longitudinal	65,000	54,000	8
	Long Trans.	64,000	52,000	5
	Short Trans.	63,000	52,000	4

TABLE III (SI)

Nominal Thickness At Time Of Heat Treatment Millimeters	Test Direction	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Up to 51, incl	Longitudinal	503	434	9
	Long Trans.	490	414	5
Over 51 to 76, incl	Longitudinal	503	434	9
	Long Trans.	490	414	5
	Short Trans.	476	414	4
Over 76 to 102, incl	Longitudinal	490	421	9
	Long Trans.	483	400	5
	Short Trans.	469	393	4
Over 102 to 127, incl	Longitudinal	469	393	8
	Long Trans.	462	386	5
	Short Trans.	455	379	4
Over 127 to 152, incl	Longitudinal	448	372	8
	Long Trans.	441	359	5
	Short Trans.	434	359	4

3.3.1.3 Special Forgings: Tensile specimens cut from special purpose forgings or forgings beyond the size and configuration limits covered by this specification shall conform to the tensile property requirements specified on the drawing or agreed upon by purchaser and vendor.

3.3.2 Hardness: Forgings should have hardness not lower than 135 HB/10/500 or 135 HB/14.3/1000, or not lower than 140 HB/10/1000, determined in accordance with ASTM E10, but forgings shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.3.3 Conductivity:

3.3.3.1 If the conductivity is below 38% IACS (International Annealed Copper Standard), determined in accordance with ASTM B342, the material is considered unsatisfactory and must be reprocessed regardless of mechanical property level.

3.3.3.2 If the conductivity is 40% IACS or higher and longitudinal tensile properties meet specified requirements, the forgings are acceptable.

3.3.3.3 If the conductivity is 38 - 40% IACS, the longitudinal tensile properties meet the specified requirements, and if the longitudinal yield strength does not exceed the specified minimum by more than 11,900 psi (82 MPa), the forgings are acceptable.

3.3.3.4 If the conductivity is below 40% IACS and longitudinal yield strength exceeds the specified minimum value by 12,000 psi (83 MPa) or more, the forgings are suspect.

3.3.3.5 When forgings are suspect, they may be reprocessed or a sample of the forgings may be heated for not less than 30 min. at $870^{\circ}\text{F} \pm 10$ ($465.6^{\circ}\text{C} \pm 5.6$) and quenched in cold water. Conductivity shall be measured within 15 min. of quenching. If the difference between this measurement and the original measurement is 6% or more, the forgings are satisfactory. If the difference is less than 6% the forgings must be reprocessed.

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