Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4311

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Revised

UNS A97075

ALUMINUM ALLOY RINGS, ROLLED OR FORGED
5.6Zn - 2.5Mg - 1.6Cu - 0.26Cr (7075-T7351, 7075-T7352)
Mechanically Stress Relieved

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of rolled or forged rings.

1.2 Application: Primarily for structural applications requiring material with a combination of good strength and resistance to stress-corrosion cracking, and where good stability is required during machining. Not recommended for fusion welding.

1.3 Classification: The rings covered by this specification are classified by type of mechanical stress relief as follows:

Type 1 - Stress relieved by stretching (7075-T7351)
Type 2 - Stress relieved by compression (7075-T7352)

1.3.1 Either type may be supplied, unless a specific type is ordered.

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., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2375 - Approval and Control of Critical Forgings
AMS 2808 - Identification, Forgings

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

ASTM B342 - Electrical Conductivity by Use of Eddy Currents
ASTM B557 - Tension Testing Wrought and Cast Aluminum and Magnesium Alloy Products
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, PA 19120.

2.3.1 Federal Standards:

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

2.3.2 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys
MIL-I-8950 - Inspection, Ultrasonic, Wrought Metals, Process for

Printed in U.S.A.

2.3.3 Military Standards:

MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

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:

	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 + Zirconium	--	0.25
Titanium	--	0.20
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.2 Condition: Rings shall be supplied in the following condition; heat treatments shall be performed in accordance with MIL-H-6088:

3.2.1 Type 1: Solution heat treated, stress relieved by stretching to produce a permanent set of 1 - 5% and precipitation heat treated.

3.2.2 Type 2: Solution heat treated, stress relieved by compression to produce a permanent set of 1 - 5%, and precipitation heat treated. During compression, primary forces shall be applied in the axial direction and on individual rings approximating final dimensions.

3.3 Properties: Rings shall conform to the following requirements:

3.3.1 Tensile Properties:

3.3.1.1 Rings with OD to Wall Thickness Ratio Less than 10: Shall be as agreed upon by purchaser and vendor.

3.3.1.2 Rings with OD to Wall Thickness Ratio of 10 or Greater: Shall be in accordance with Table I, determined in accordance with ASTM B557. Tensile tests are not required in any direction from which a specimen at least 2.375 in. (60.32 mm) in length cannot be obtained.

TABLE I

Nominal Thickness at Time of Heat Treatment Inches (See 3.3.1.2.1)	Specimen Orientation (See 3.3.1.2.2)	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
Up to 3, incl	Tangential	66,000	54,000	7
	Axial	64,000	50,000	4
	Radial	61,000	50,000	3
Over 3 to 4, incl	Tangential	64,000	53,000	7
	Axial	63,000	48,000	3
	Radial	60,000	48,000	2
Over 4 to 5, incl	Tangential	62,000	51,000	7
	Axial	61,000	46,000	3
	Radial	58,000	46,000	2
Over 5 to 6, incl	Tangential	61,000	49,000	6
	Axial	59,000	44,000	3
	Radial	57,000	44,000	2

TABLE I (SI)

Nominal Thickness at Time of Heat Treatment Millimetres (See 3.3.1.2.1)	Specimen Orientation (See 3.3.1.2.2)	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Up to 76, incl	Tangential	455	372	7
	Axial	441	345	4
	Radial	421	345	3
Over 76 to 102, incl	Tangential	441	365	7
	Axial	434	331	3
	Radial	414	331	2
Over 102 to 127, incl	Tangential	427	352	7
	Axial	421	317	3
	Radial	400	317	2
Over 127 to 152, incl	Tangential	421	338	6
	Axial	407	303	3
	Radial	393	303	2

3.3.1.2.1 Thickness is defined as the smaller of the wall thickness (one-half the difference between nominal OD and nominal ID) and height (axial) dimensions.

3.3.1.2.2 Tangential test requirements apply to specimens machined with axis of specimen tangential to the ring OD (parallel to the direction of rolling). Axial test requirements apply to specimens machined with axis of specimen parallel to the axis of the ring (long transverse to the direction of rolling). Radial test requirements apply to specimens machined with axis of specimen parallel to the radius of the ring (short transverse to the direction of rolling). All specimens shall be machined from the core of the ring.

3.3.2 Hardness: Should be not lower than 130 HB/10/500, 130 HB/14.3/1000, or 135 HB/10/1000, determined in accordance with ASTM E10, but the rings shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.3.3 Conductivity: Shall be as follows, determined in accordance with ASTM B342:

3.3.3.1 If the conductivity is 40% IACS (International Annealed Copper Standard) or higher and tensile properties meet specified requirements, the rings are acceptable.

3.3.3.2 If the conductivity is 38 - 39.9%, incl, IACS, if the tensile properties meet the specified requirements, and if the tangential yield strength does not exceed the specified minimum by more than 11,900 psi (82 MPa), the rings are acceptable.

3.3.3.3 If the conductivity is below 40% IACS and the tangential yield strength exceeds the specified minimum value by more than 11,900 psi (82 MPa), the rings are suspect.

3.3.3.3.1 When rings are suspect, they may be reprocessed or a sample of the rings may be heated for not less than 30 min. at 875° F ± 10 (465.6° C ± 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 on the ring is 6% IACS or more, the rings are acceptable. If the difference is less than 6%, the rings must be reprocessed.

3.3.3.4 If the conductivity is below 38% IACS, the rings are not acceptable and must be reprocessed regardless of mechanical property level.

3.3.4 Resistance to Stress-Corrosion Cracking: A test specimen, cut from a ring, ring prolongation, or ring segment having radial thickness not less than 0.750 in. (19.05 mm), stressed to 75% of the required tangential yield strength specified in Table I with axis of loading of the specimen parallel to the radial direction of the ring and held at constant strain in a suitable fixture shall show no evidence of stress-corrosion cracking after being subjected to cyclic immersion at room temperature for 30 days in a 3-1/2% solution of sodium chloride in accordance with Federal Test Method Standard No. 151, Method 823.

3.4 Quality: Rings, as received by the purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the rings.

3.4.1 Each ring shall be ultrasonically inspected in accordance with MIL-I-8950, unless otherwise specified, and shall meet the Class A acceptance limits of that specification.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of rings shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the rings conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to composition (3.1), tensile property (3.3.1), hardness (3.3.2), electrical conductivity (3.3.3), and quality (3.4) requirements are classified as acceptance tests.

4.2.2 Periodic Tests: Tests to determine conformance to stress-corrosion (3.3.4) requirements are classified as periodic tests.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests.