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

AEROSPACE MATERIAL SPECIFICATION

AMS 4314

Issued 1-15-78
Revised

UNS A92014

ALUMINUM ALLOY RINGS, ROLLED OR FORGED
4.5Cu - 0.85Si - 0.80Mn - 0.50Mg (2014-T651, 2014-T652)
Mechanically Stress Relieved

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1. SCOPE:

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

1.2 Application: Primarily for moderately high strength structural machined parts where good stability is required during machining. Not recommended for fusion welding. Certain design and fabricating procedures may cause this material to be subject to stress-corrosion cracking; ARP 823 recommends practices to minimize such conditions.

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 (2014-T651)
Type 2 - Stress relieved by compression (2014-T652)

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) and Aerospace Recommended Practices (ARP) 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

2.1.2 Aerospace Recommended Practices:

ARP 823 - Minimizing Stress-Corrosion in Wrought Heat Treatable Aluminum Alloy Products

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

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.

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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

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
Copper	3.9	5.0
Silicon	0.50	1.2
Manganese	0.40	1.2
Magnesium	0.20	0.8
Iron	--	0.7
Zinc	--	0.25
Zirconium + Titanium	--	0.20
Titanium	--	0.15
Chromium	--	0.10
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

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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 1-1/2 - 5%, and precipitation heat treated.

3.2.2 Type 2: Solution heat treated, stress relieved by compression to produce a permanent set of 1-1/2 - 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 meet the requirements of 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% psi, min	Elongation in 4D %, min
Up to 2, incl	Tangential	65,000	56,000	8
	Axial	65,000	56,000	3
Over 2 to 3, incl	Tangential	64,000	56,000	8
	Axial	64,000	56,000	3
	Radial	62,000	52,000	2
Over 3 to 4, incl	Tangential	63,000	55,000	8
	Axial	63,000	55,000	3
	Radial	61,000	51,000	2
Over 4 to 5, incl	Tangential	62,000	54,000	7
	Axial	62,000	54,000	2
	Radial	60,000	50,000	1
Over 5 to 6, incl	Tangential	61,000	53,000	7
	Axial	61,000	53,000	2
	Radial	59,000	50,000	1
Over 6 to 7, incl	Tangential	60,000	52,000	6
	Axial	60,000	52,000	2
	Radial	58,000	49,000	1
Over 7 to 8, incl	Tangential	59,000	51,000	6
	Axial	59,000	51,000	2
	Radial	57,000	48,000	1

TABLE I (SI)

Norminal 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 4D %, min
Up to 51, incl	Tangential	448	386	8
	Axial	448	386	3
Over 51 to 76, incl	Tangential	441	386	8
	Axial	441	386	3
	Radial	427	359	2
Over 76 to 102, incl	Tangential	434	379	8
	Axial	434	379	3
	Radial	421	352	2
Over 102 to 127, incl	Tangential	427	372	7
	Axial	427	372	2
	Radial	414	345	1
Over 127 to 152, incl	Tangential	421	365	7
	Axial	421	365	2
	Radial	407	345	1
Over 152 to 178, incl	Tangential	414	359	6
	Axial	414	359	2
	Radial	400	338	1
Over 178 to 203, incl	Tangential	407	352	6
	Axial	407	352	2
	Radial	303	331	1

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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 120 HB/10/500, 120 HB/14.3/1000, or 125 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.

3.4 Quality: Rings, as received by 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: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and as preproduction tests.

4.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows; a lot shall be all rings of the same size solution heat treated in the same batch-furnace load or consecutively in a continuous furnace in an 8-hr period and precipitation heat treated as a unit.

4.3.1 Composition: At least one sample shall be taken by the producer from each group of ingots poured simultaneously from the same source of molten metal.

4.3.1.1 Unless compliance with 4.3.1 is established, an analysis shall be made for each 4000 lb (1818 kg) or less of material comprising the lot except that not more than one analysis shall be required per piece.

4.3.2 Tensile Properties: Except when testing in one or more directions is not required by 3.3.1, test specimens in the tangential, axial, and radial directions shall be taken from a ring, ring prolongation, or ring segment representing the lot. When ring sements are used for testing, the segments shall be cut from a ring which has been solution heat treated and stress-relieved with the production rings. Solution heat treated and stress-relieved ring segments shall be included in each precipitation heat treatment furnace load.

4.3.2.1 When requested by purchaser, at least one half of each ring segment obtained as in 4.3.2 or one half of each ring prolongation tested shall be submitted to the purchaser with the rings represented.

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