SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS4314 | REV. D

Issued 1978-01
Revised 2005-02
Reaffirmed 2012-04

Superseding AMS4314C

Aluminum Alloy Rings, Rolled or Forged
4.5Cu - 0.85Si - 0.80Mn - 0.50Mg (2014-T651, 2014-T652)
Solution Heat Treated, Mechanically Stress Relieved, and Precipitation Heat Treated
(Composition similar to UNS A92014)

RATIONALE

AMS4314D has ben reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

1.1 Form:

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

1.2 Application:

These rings have been used typically to form moderately high strength structural machined parts where good stability is required during machining, but usage is not limited to such applications.

1.2.1 This material is not recommended for fusion welding.

1.2.2 Certain design and fabricating procedures may cause these products to become 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.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS4314D

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2355	Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
AMS 2772	Heat Treatment of Aluminum Alloy Raw Materials
AS 1990	Aluminum Alloy Tempers
ARP 823	Minimizing Stress-Corrosion Cracking in Wrought Heat Treatable Aluminum Alloy Products

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM B 594	Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM B 666/B 666M	Identification of Aluminum and Magnesium Alloy Products
ASTM E 10	Brinell Hardness of Metallic Materials

3. TECHNICAL REQUIREMENTS:

3.1 Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS 2355.

TABLE 1 – Composition

Element	min	max
Silicon	0.50	1.2
Iron	--	0.7
Copper	3.9	5.0
Manganese	0.40	1.2
Magnesium	0.20	0.8
Chromium	--	0.10
Zinc	--	0.25
Titanium	--	0.15
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.2 Condition:

Rings shall be supplied in the following condition; heat treatment shall be performed in accordance with AMS 2772 to the following tempers:

3.2.1 Type 1: Solution heat treated, stress relieved by stretching to produce a permanent set of 1-1/2 to 5%, and precipitation heat treated to the T651 temper (See AS 1990).

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 to the T652 temper (See AS 1990). 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 determined on the mill product in accordance with AMS 2355:

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 cognizant engineering personnel and vendor.

3.3.1.2 Rings With OD to Wall Thickness Ratio of 10 or Greater: Shall meet the requirements of Table 2, determined in accordance with ASTM B 557. Tensile tests are not required in any direction from which a specimen at least 2.375 inches (60 mm) in length cannot be obtained.

TABLE 2A - Minimum Tensile Properties, Inch/Pound Units

Nominal Thickness at Time of Heat Treatment, Inches (See 3.3.1.2.1)	Specimen Orientation (See 3.3.1.2.2)	Tensile Strength ksi	Yield Strength at 2% Offset ksi	Elongation in 4D %
Up to 2, incl	Tangential	65.0	56.0	8
	Axial	65.0	56.0	3
Over 2 to 3, incl	Tangential	64.0	56.0	8
	Axial	64.0	56.0	3
	Radial	62.0	52.0	2
Over 3 to 4, incl	Tangential	63.0	55.0	8
	Axial	63.0	55.0	3
	Radial	61.0	51.0	2
Over 4 to 5, incl	Tangential	62.0	54.0	7
	Axial	62.0	54.0	2
	Radial	60.0	50.0	1
Over 5 to 6, incl	Tangential	61.0	53.0	7
	Axial	61.0	53.0	2
	Radial	59.0	50.0	1
Over 6 to 7, incl	Tangential	60.0	52.0	6
	Axial	60.0	52.0	2
	Radial	58.0	49.0	1
Over 7 to 8, incl	Tangential	59.0	51.0	6
	Axial	59.0	51.0	2
	Radial	57.0	48.0	1

TABLE 2B - Minimum Tensile Properties, SI Units

Nominal Thickness at Time of Heat Treatment, Millimeters (See 3.3.1.2.1)	Specimen Orientation (See 3.3.1.2.2)	Tensile Strength MPa	Yield Strength at 2% Offset MPa	Elongation in 4D %
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	393	331	1

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: Shall be not lower than 120 HB/10/500 or 125 HB/l0/l000, determined in accordance with ASTM E l0 (See 4.3.2).

3.4 Quality:

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

3.4.1 Each ring shall be ultrasonically inspected in accordance with ASTM B 594, 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 for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the rings conform to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), tensile properties (3.3.1), hardness (3.3.2), and ultrasonic soundness (3.4.1) are acceptance tests and, except for composition, shall be performed on each lot.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2355.

4.3.1 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 segments 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.

4.3.1.1 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 purchaser with the rings represented.

4.3.2 Hardness: Each ring. If hardness of any ring indicates low tensile properties, the ring having the lowest hardness shall be tested for tensile properties.