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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 4310B

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Superseding AMS 4310A

ALUMINUM ALLOY RINGS, ROLLED OR FORGED
5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr (7075-T651, 7075-T652)
Solution Heat Treated, Mechanically Stress Relieved, and Precipitation Heat Treated

UNS A97075

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 machined parts where good stability is required during machining. Not recommended for fusion welding. Certain design and fabricating procedures may cause these rings to become susceptible to stress-corrosion cracking; ARP 823 recommends practices to minimize such conditions.

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

Type 1 - Stress-relieved by stretching (7075-T651)
Type 2 - Stress-relieved by compression (7075 - 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 and Aerospace Recommended Practices shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2375 - Control of Forgings Requiring First Article Approval
AMS 2808 - Identification, Forgings

2.1.2 Aerospace Recommended Practices:

ARP 823 - Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable 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 B557M - Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products (Metric)
ASTM B594 - Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
ASTM B660 - Packaging/Packing of Aluminum and Magnesium Products
ASTM E10 - Brinell Hardness of Metallic Materials
ASTM E34 - Chemical Analysis of Aluminum and Aluminum Alloys

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, Ø determined by wet chemical methods in accordance with ASTM E34, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Zinc	5.1	6.1
Magnesium	2.1	2.9
Copper	1.2	2.0
Chromium	0.18	0.28
Iron	--	0.50
Silicon	--	0.40
Manganese	--	0.30
Titanium	--	0.20
Residual Elements, each	--	0.05
Residual Elements, 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 or ASTM B557M. Tensile tests are not required in any direction from which a specimen at least 2.375 inches (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, minimum	Elongation in 4D %, minimum
Up to 2, incl	Tangential	74,000	63,000	9
	Axial	73,000	61,000	4
Over 2 to 3, incl	Tangential	73,000	61,000	9
	Axial	71,000	59,000	4
	Radial	69,000	57,000	2
Over 3 to 4, incl	Tangential	71,000	60,000	8
	Axial	70,000	58,000	3
	Radial	68,000	56,000	1
Over 4 to 5, incl	Tangential	69,000	58,000	7
	Axial	68,000	56,000	3
	Radial	66,000	55,000	1
Over 5 to 6, incl	Tangential	68,000	56,000	6
	Axial	66,000	55,000	3
	Radial	65,000	54,000	1

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, minimum	Elongation in 4D %, minimum
Up to 51, incl	Tangential	510	434	9
	Axial	503	421	4
Over 51 to 76, incl	Tangential	503	421	9
	Axial	490	407	4
	Radial	476	393	2
Over 76 to 102, incl	Tangential	490	414	8
	Axial	483	400	3
	Radial	469	386	1
Over 102 to 127, incl	Tangential	476	400	7
	Axial	469	386	3
	Radial	455	379	1
Over 127 to 152, incl	Tangential	469	386	6
	Axial	455	379	3
	Radial	448	372	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 requirements apply to specimens machined with axis of specimen tangential to the ring OD (parallel to the direction of rolling). Axial requirements apply to specimens machined with axis of specimen parallel to the ring axis (long transverse to the direction of rolling). Radial 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.

3.3.1.2.3 Elongation requirements do not apply to test specimens having a Ø gage-length diameter less than 0.250 inch (6.35 mm), or located in immediate proximity to an abrupt change in section thickness, or located so that any part of the specimen gage length is located within 0.125 inch (3.18 mm) of the trimmed flash line.

3.3.1.2.4 Tensile property requirements for rings over 6 inches (152 mm) in nominal thickness at time of heat treatment shall be as agreed upon by purchaser and vendor.

3.3.2 Hardness: Should be not lower than 135 HB/10/500 or 140 HB/10/1000, determined in accordance with ASTM E10, but the rings shall not be rejected on the basis of hardness if the applicable 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 material and from imperfections detrimental to usage of the rings.

3.4.1 Each ring shall be ultrasonically inspected in accordance with ASTM B594, Ø 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 performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform any confirmatory testing deemed 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 all technical requirements of this specification are classified as acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests of rings to determine conformance to all applicable technical requirements of this specification when AMS 2375 is specified are classified as preproduction tests and shall be performed prior to or on the first-article shipment of a ring to a purchaser, when a change in material and/or processing requires reapproval as in 4.4, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction rings shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or 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 eight-hour period and precipitation heat treated as a unit:

4.3.1 Composition: At least one sample shall be taken by the producer from each Ø group of ingots poured simultaneously from the same source of molten metal. Complete ingot analysis records shall be available to the purchaser at the producer's facility.

4.3.1.1 Unless compliance with 4.3.1 is established, an analysis shall be made for each 4000 pounds (1814 kg) or less of alloy 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, tensile 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.