AEROSPACE MATERIAL SPECIFICATION

AMS4144™	REV. H

Issued 1965-09
Reaffirmed 2011-09
Revised 2025-02

Superseding AMS4144G

Aluminum Alloy, Hand Forgings and Rolled Rings, 6.3Cu - 0.30Mn - 0.18Zr - 0.10V - 0.06Ti (2219-T852/T851), Solution Heat Treated, Mechanically Stress Relieved, and Precipitation Heat Treated (Composition similar to UNS A92219)

RATIONALE

AMS4144H results from a Five-Year Review and update of this specification with changes to update wording to prohibit unauthorized exceptions (see 3.3.1.3 and 8.5), relocate Definitions (see 2.4), and update Applicable Documents (see Section 2) and Ordering Information (see 8.6).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of hand forgings 17 inches (432 mm) and under in nominal thickness and rolled rings up to 6 inches (152 mm), inclusive, in nominal thickness at the time of heat treatment (see 8.6).

1.2 Application

These products have been used typically for applications that require good weldability and uniformity of strength of welds, moderate strength at room temperature, good short-term strength in the range of 500 to 600 °F, and for structural parts subject to warpage during machining, but usage is not limited to such applications. Certain design and fabricating procedures and service conditions may cause these products to become susceptible to stress-corrosion cracking; ARP823 recommends practices to minimize such conditions.

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.

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**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS4144H/

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2355 Quality Assurance, Sampling and Testing, Aluminum Alloys and Magnesium Alloy, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings

AMS2772 Heat Treatment of Aluminum Alloy Raw Materials

AMS2808 Identification, Forgings

ARP823 Minimizing Stress-Corrosion Cracking in Wrought High-Strength Aluminum Alloy Products

AS7766 Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B594 Ultrasonic Inspection of Aluminum-Alloy Wrought Products

ASTM B660 Packaging/Packing of Aluminum and Magnesium Products

ASTM E10 Brinell Hardness of Metallic Materials

ASTM E1417/E1417M Liquid Penetrant Testing

2.3 ANSI Accredited Publications

Copies of these documents are available online at https://webstore.ansi.org/.

ANSI H35.1/H35.1M Standard Alloy and Temper Designation System For Aluminum

2.4 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2355.

Table 1 - Composition

Element	Min	Max
Silicon	--	0.20
Iron	--	0.30
Copper	5.8	6.8
Manganese	0.20	0.40
Magnesium	--	0.02
Zinc	--	0.10
Titanium	0.02	0.10
Vanadium	0.05	0.15
Zirconium	0.10	0.25
Other Elements, each	--	0.05
Other Elements total	--	0.15
Aluminum	remainder	

3.2 Condition

The product shall be solution heat treated, mechanically stress relieved, and precipitation heat treated to the T851 or T852 condition as applicable (refer to ANSI H35.1/H35.1M). Heat treatments shall be performed in accordance with AMS2772.

3.2.1 Rolled Rings

Shall be processed by either of the following procedures as specified by the purchaser:

Condition 1: Stress relieve by compression to produce a permanent set of 2 to 5% (-T852)

Condition 2: Stress relieve by tension to produce a permanent set of 2 to 5% (-T851)

3.2.1.1 Rolled rings shall be supplied in either Condition 1 or 2 (see 8.6).

3.2.2 Hand Forgings

Shall be stress relieved by compression to produce a permanent set of 2 to 5% (-T852).

3.3 Properties

The product shall conform to the following requirements, determined in accordance with AMS2355 on the mill product:

3.3.1 Tensile Properties

Shall be as follows:

3.3.1.1 Hand Forgings - T852 Temper

Specimens machined from hand forgings 17 inches (432 mm) and under in nominal thickness shall conform to the requirements of Table 2. Tests may be waived for any test direction having a dimension under 2 inches (51 mm). Tests need not be made in the longitudinal direction unless required by the purchaser (see 8.6).

Table 2A - Minimum tensile properties, inch/pound units

Nominal Thickness Inches	Specimen Orientation	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 4D %
Up to 4.000, incl	Longitudinal	62.0	50.0	6
	Long-Trans.	62.0	49.0	4
	Short-Trans.	60.0	46.0	3
Over 4.000 to 6.000, incl	Longitudinal	58.0	44.0	6
	Long-Trans.	56.0	42.0	4
	Short-Trans.	56.0	41.0	3
Over 6.000 to 8.000, incl	Longitudinal	57.0	43.0	6
	Long-Trans.	55.0	41.0	4
	Short-Trans.	55.0	40.0	3
Over 8.000 to 10.00, incl	Longitudinal	56.0	42.0	6
	Long-Trans.	54.0	41.0	3
	Short-Trans.	54.0	39.0	3
Over 10.00 to 12.00, incl	Longitudinal	54.0	41.0	6
	Long-Trans.	53.0	40.0	3
	Short-Trans.	53.0	39.0	2
Over 12.00 to 14.00, incl	Longitudinal	53.0	40.0	6
	Long-Trans.	52.0	40.0	3
	Short-Trans.	52.0	38.0	2
Over 14.00 to 17.00, incl	Longitudinal	51.0	39.0	6
	Long-Trans.	50.0	39.0	3
	Short-Trans.	50.0	37.0	2

Table 2B - Minimum tensile properties, SI units

Nominal Thickness Millimeters	Specimen Orientation	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 4D %
Up to 102, incl	Longitudinal	427	345	6
	Long-Trans.	427	338	4
	Short-Trans.	414	317	3
Over 102 to 152, incl	Longitudinal	400	303	6
	Long-Trans.	386	290	4
	Short-Trans.	386	283	3
Over 152 to 203, incl	Longitudinal	393	296	6
	Long-Trans.	379	283	4
	Short-Trans.	379	276	3
Over 203 to 254, incl	Longitudinal	386	290	6
	Long-Trans.	372	283	3
	Short-Trans.	372	269	3
Over 254 to 305, incl	Longitudinal	372	283	6
	Long-Trans.	365	276	3
	Short-Trans.	365	269	2
Over 305 to 356, incl	Longitudinal	365	276	6
	Long-Trans.	358	276	3
	Short-Trans.	358	262	2
Over 356 to 432, incl	Longitudinal	352	269	6
	Long-Trans.	345	269	3
	Short-Trans.	345	255	2

3.3.1.2 Rolled Rings

Shall be as shown in Table 3 for rings in either condition -T851 or -T852.

Table 3A - Minimum tensile properties, inch/pound units

Nominal Thickness at Time of Heat Treatment Inches	Specimen Orientation	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 4D %
Up to 2.500, incl	Tangential	60.0	48.0	6
	Axial	60.0	46.0	4
	Radial	58.0	44.0	3
Over 2.500 to 4.000, incl	Tangential	58.0	46.0	6
	Axial	58.0	44.0	4
	Radial	56.0	42.0	3
Over 4.000 to 5.000, incl	Tangential	56.0	44.0	5
	Axial	56.0	42.0	3
	Radial	54.0	40.0	2
Over 5.000 to 6.000, incl	Tangential	54.0	42.0	5
	Axial	54.0	40.0	3
	Radial	52.0	40.0	2

Table 3B - Minimum tensile properties, SI units

Nominal Thickness at Time of Heat Treatment Millimeters	Specimen Orientation	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 4D %
Up to 64, incl	Tangential	414	331	6
	Axial	414	317	4
	Radial	400	303	3
Over 64 to 102, incl	Tangential	400	317	6
	Axial	400	303	4
	Radial	386	290	3
Over 102 to 127, incl	Tangential	386	303	5
	Axial	386	290	3
	Radial	372	276	2
Over 127 to 152, incl	Tangential	372	290	5
	Axial	372	276	3
	Radial	359	276	2

3.3.1.3 Mechanical property requirements for product outside of the range covered by 1.1 shall be agreed upon between the purchaser and producer and reported per 4.4.1 (see 8.6).

3.3.1.4 Grain flow of hand forgings shall follow the general contour of the forging showing no evidence of reentrant grain flow.

3.4 Quality

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

3.4.1 When specified, forgings and rolled rings shall be subjected to a caustic etch followed by visual examination of the product surfaces for indications by ultrasonic inspection in accordance with ASTM B594 and/or by penetrant inspection in accordance with ASTM E1417/E1417M (see 8.6). Standards for acceptance shall be as agreed upon by the purchaser and producer (see 8.6).

3.5 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for the producer's tests and shall be responsible for the performance of all required tests. The purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests

4.2.1 All technical requirements are acceptance tests and shall be performed on each inspection lot, except as indicated below:

4.2.1.1 Composition (see 3.1): one control sample before and at least one additional sample during the casting of each cast unit (units, if cast simultaneously from the same molten metal source) per AMS2355.

4.2.1.2 Internal quality when specified: ultrasonic soundness (see 3.4.1).

4.2.1.3 Surface quality when specified; visual and penetrant inspection (see 3.4.1).

4.3 Sampling and Testing

Shall be in accordance with AMS2355 and the following:

4.3.1 Tensile Properties

4.3.1.1 Hand Forgings

Two or more tensile specimens shall be taken from a forging or forging prolongation representing the lot. One specimen shall be taken in the long-transverse direction and the other in the short-transverse direction.

4.3.1.2 Rolled Rings

Two or more tensile specimens shall be taken from a ring or ring prolongation representing the lot. One specimen shall be taken tangential to ring OD and the other parallel to the axis of the ring.

4.4 Reports

The producer of the product shall furnish with each shipment a report stating that the product conforms to the composition and showing the numerical results of tests on each inspection lot to determine conformance to the tensile requirements. The report shall state that the product conforms to the other technical requirements and shall include the purchase order number, inspection lot number, AMS4144H, size or part number, and quantity. The report shall also include the identity of the producer, product form, and the size of the mill product.

4.4.1 When material produced to this specification is beyond the sizes allowed in the scope or tables, or other exceptions are taken to the technical requirements listed in Section 3 (see 5.1.1), the report shall contain a statement "This material is certified as AMS4144H(EXC) because of the following exceptions:" and the specific exceptions shall be listed.

4.5 Resampling and Retesting

If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing two additional specimens for each original nonconforming specimen. Retest specimens shall be taken as close as possible to the same location in the same forging or rolled ring or from a second forging or rolled ring from the same lot as was the original unacceptable specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented. Results of all tests shall be reported.