AEROSPACE MATERIAL SPECIFICATION

AMS4126™	REV. E

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Superseding AMS4126D

Aluminum Alloy, Die and Hand Forgings and Rolled Rings, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr (7075-T6), Solution and Precipitation Heat Treated

(Composition similar to UNS A97075)

RATIONALE

AMS4126E results from a Five-Year Review and update of this specification with changes to remove obsolete weight criteria from Ultrasonic Inspection (see 3.4.1), update wording to prohibit unauthorized exceptions (see 3.3.1.1.5 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 die forgings 4 inches (102 mm) and under in nominal thickness at time of heat treatment, hand forgings up to 6 inches (152 mm), inclusive, in as-forged thickness, rolled rings with wall thickness up to 3.5 inches (89 mm), inclusive, and stock of any size for forging or rolled rings (see 8.6).

1.2 Application

These products have been used typically for applications requiring high strength in light-to-medium sections, but usage is not limited to such applications.

1.2.1 Certain design and processing procedures 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)
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Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS4126E/

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 Alloy and Temper Designation Systems for Aluminum

ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products

ANSI H35.2M Dimensional Tolerances for Aluminum Mill Products (Metric)

2.4 Definitions

Terms used in AMS are defined in AS7766 and the following:

2.4.1 DIE FORGING

A forging shaped by working stock in closed dies.

2.4.2 HAND FORGING

A forging worked between flat or simply shaped dies by repeated strokes or blows and manipulation of the piece, intending to convert the metallurgical structure from cast to wrought prior to machining into a final part.

2.4.3 ROLLED RING

A cylindrical product of relatively short height circumferentially rolled from a hollow section.

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	--	0.40
Iron	--	0.50
Copper	1.2	2.0
Manganese	--	0.30
Magnesium	2.1	2.9
Chromium	0.18	0.28
Zinc	5.1	6.1
Titanium	--	0.20
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.2 Condition

Shall be as follows:

3.2.1 Die Forgings, Hand Forgings, and Rolled Rings

Solution and precipitation heat treated in accordance with AMS2772 to the -T6 temper (refer to ANSI H35.1/H35.1M).

3.2.2 Stock for Forging or Rolled Rings

As ordered by the forging or rolled-ring manufacturer (see 8.6).

3.3 Properties

The product shall conform to the manufacturing method (see 2.4 and 8.6) and the following requirements, determined on the requested mill product in accordance with AMS2355:

3.3.1 Die Forgings, Hand Forgings, and Rolled Rings

3.3.1.1 Tensile Properties

Shall be as follows:

3.3.1.1.1 Die Forgings

####### 3.3.1.1.1.1 With Grain Flow

Specimens, machined from forgings 4 inches (102 mm) and under in nominal thickness at time of heat treatment or from integral prolongations on such forgings, with axis of specimen in area of gauge length varying not more than 15 degrees from parallel to the forging flow lines, shall have the properties shown in Table 2 provided the as-forged thickness is not more than twice the heat-treated thickness.

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

Nominal Thickness at Time of Heat Treatment Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
Up to 1, incl	75.0	64.0	7
Over 1 to 3, incl	74.0	63.0	7
Over 3 to 4, incl	73.0	62.0	7

Table 2B - Minimum tensile properties, SI units

Nominal Thickness at Time of Heat Treatment Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
Up to 25, incl	517	441	7
Over 25 to 76, incl	510	434	7
Over 76 to 102, incl	503	427	7

3.3.1.1.1.2 Across Grain Flow

Specimens, machined from forgings 4 inches (102 mm) and under in nominal thickness at time of heat treatment or from prolongations on such forgings, with axis of specimen in area of gauge length varying not more than 15 degrees from perpendicular to the forging flow lines, shall have the properties shown in Table 3 provided the as-forged thickness is not more than twice the heat-treated thickness. If configuration of the forging or prolongation cannot accommodate the transverse specimen described, acceptance of the forging shall be based on testing as in 3.3.1.1.1.3.

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

Nominal Thickness at Time of Heat Treatment Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
Up to 2, incl	71.0	61.0	3
Over 2 to 3, incl	70.0	60.0	3
Over 3 to 4, incl	70.0	60.0	2

Table 3B - Minimum tensile properties, SI units

Nominal Thickness at Time of Heat Treatment Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
Up to 51, incl	490	421	3
Over 51 to 76, incl	483	414	3
Over 76 to 102, incl	483	414	2

3.3.1.1.1.2.1 Elongation requirements shall not apply to specimens having a gauge length diameter less than 0.250 inch (6.35 mm) or located in immediate proximity to an abrupt change in thickness or located so that any part of the specimen gauge length is located within 1/8 inch (3.2 mm) of the trimmed flash line.

3.3.1.1.1.3 At Angle to Grain Flow

Specimens, machined from forgings 4 inches (102 mm) and under in nominal thickness at time of heat treatment or from prolongations on such forgings, with axis of specimen in area of gauge length varying more than 15 degrees from parallel and also more than 15 degrees from perpendicular to the forging flow lines, shall have the properties shown in Table 3 provided the as-forged thickness is not more than twice the heat-treated thickness. Such test results shall be identified as neither longitudinal nor transverse tensile properties.

3.3.1.1.2 Hand Forgings

Specimens, machined from forgings having an essentially square or rectangular cross section, shall have the properties shown in Table 4 provided the as-forged thickness does not exceed 6 inches (152 mm).

Table 4A - 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 2 Inches or 4D %
Up to 2, incl	Longitudinal	74.0	63.0	9
	Long-Trans.	73.0	61.0	4
Over 2 to 3, incl	Longitudinal	73.0	61.0	9
	Long-Trans.	71.0	59.0	4
	Short-Trans.	69.0	58.0	3
Over 3 to 4, incl	Longitudinal	71.0	60.0	8
	Long-Trans.	70.0	58.0	3
	Short-Trans.	68.0	57.0	2
Over 4 to 5, incl	Longitudinal	69.0	58.0	7
	Long-Trans.	68.0	56.0	3
	Short-Trans.	66.0	56.0	2
Over 5 to 6, incl	Longitudinal	68.0	56.0	6
	Long-Trans.	66.0	55.0	3
	Short-Trans.	65.0	55.0	2

Table 4B - 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 50.8 mm or 4D %
Up to 51, incl	Longitudinal	510	434	9
	Long-Trans.	503	421	4
Over 51 to 76, incl	Longitudinal	503	421	9
	Long-Trans.	490	407	4
	Short-Trans.	476	400	3
Over 76 to 102, incl	Longitudinal	490	414	8
	Long-Trans.	483	400	3
	Short-Trans.	469	393	2
Over 102 to 127, incl	Longitudinal	476	400	7
	Long-Trans.	469	386	3
	Short-Trans.	455	386	2
Over 127 to 152, incl	Longitudinal	469	386	6
	Long-Trans.	455	379	3
	Short-Trans.	448	379	2

3.3.1.1.3 Rolled Rings

Specimens machined from rings with axis of specimen approximately tangential to the ring OD (axis parallel to direction of rolling) or with axis approximately parallel to the axis of the ring (transverse to direction of rolling) shall have the properties shown in Table 5.

Table 5A - Minimum tensile properties, inch/pound units

Nominal Wall Thickness at Time of Heat Treatment Inches	Specimen Orientation	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
Up to 2, incl	Tangential	73.0	62.0	7
	Axial	72.0	61.0	3
Over 2 to 3.5, incl	Tangential	71.0	60.0	6
	Axial	70.0	59.0	3

Table 5B - Minimum tensile properties, SI units

Nominal Wall Thickness at Time of Heat Treatment Millimeters	Specimen Orientation	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
Up to 51, incl	Tangential	503	427	7
	Axial	496	421	3
Over 51 to 89, incl	Tangential	490	414	6
	Axial	483	407	3

3.3.1.1.4 Special Purpose Forgings

Tensile property requirements for specimens cut from special purpose forgings shall be as specified on the drawing or as agreed upon by the purchaser and producer (see 8.6).

3.3.1.1.5 Mechanical property requirements for product outside of the range covered by Tables 2, 3, 4, or 5 shall be agreed upon between the purchaser and producer and reported per 4.4.1.1 (see 8.6).

3.3.1.1.6 Test Specimens

Specimens machined from separately forged coupons shall be heat treated in the same furnace load as the rings or forgings for which the coupons are representative. These coupons shall have the properties shown in Table 6.

Table 6 - Minimum tensile properties

Property	Value
Tensile Strength	75.0 ksi (517 MPa)
Yield Strength at 0.2% Offset	64.0 ksi (441 MPa)
Elongation in 4D	10%

3.3.1.2 Grain Flow

Grain flow of die forgings and rolled rings, except in the areas that contain end grain, shall follow the general contour of the forging or rolled ring showing no evidence of reentrant grain flow.

3.3.2 Stock for Forging or Rolled Rings

When a sample of stock is forged to a test coupon and heat treated in the same manner as a forging or rolled ring as specified in 3.2.1, specimens machined from the heat-treated coupon shall conform to the requirements of Table 6. If specimens taken from the stock prior to forging and after heat treatment in the same manner as forgings and rolled rings as specified in 3.2.1 conform to the requirements of Table 6, the tests shall be accepted as equivalent to tests of a forged coupon. The forging stock supplier, however, shall not be required to use unforged coupons when performing lot conformance testing.

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 ultrasonic inspection in accordance with ASTM B594 and, unless otherwise specified, shall meet the following requirements of that specification:

3.4.1.1 Die forgings and rolled rings 0.500 to 4.000 inches (12.70 to 101.60 mm), inclusive, in nominal thickness shall meet Class B.

3.4.1.2 Hand forgings 1.000 to 6.000 inches (25.40 to 152.40 mm), inclusive, in nominal thickness shall meet Class A.

3.4.1.3 Acceptance criteria for forgings or rolled rings exceeding the limits of 3.4.1.1 or 3.4.1.2 shall be as agreed upon by the purchaser and producer (see 8.6).

3.4.2 When specified, forgings and rolled rings shall be subjected to fluorescent penetrant inspection in accordance with ASTM E1417/E1417M. Standards for acceptance shall be as agreed upon by the purchaser and producer (see 8.6).

3.5 Tolerances

Forging stock shall conform to all applicable requirements of ANSI H35.2 or ANSI H35.2M.

3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.1.1.

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 Acceptance Tests

Composition (see 3.1), tensile properties (see 3.3.1.1), tolerances (see 3.5), and, when specified, ultrasonic and fluorescent penetrant inspection (see 3.4.1 and 3.4.2) are acceptance tests and, except for composition, shall be performed on each inspection lot.

4.2.2 Periodic Tests

Grain flow of die forgings and rolled rings (see 3.3.1.2) and tests of stock for forging or rolled rings to determine the ability to develop specified properties (see 3.3.2) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by the purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2355.