ADOPTION NOTICE

SAE-AMS 4334, "Aluminum Alloy, Forgings 7.8Zn - 2.2Mg - 1.6Cu - 0.15Cr (7249 - T74 and - T7452)"

adopted on 31 August 1995 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: Air Force, ASCIENSI, Building 125, 2335 Seventh Street, Suite 6, Wright-Patterson AFB OH 45433-7809. DoD activities may obtain copies of this standard from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. The private sector and other Government agencies may purchase copies from the Society of of amsh. Automotive Engineers Inc., 400 Commonwealth Drive, Warrendale, PA 15096-0001.

Custodians:

Army - MR

Navy - AS

FORG-0249)

Air Force - 11

Review activities:

Air Force - 99

Adopting Air Force - (Proj No. AREA FORG

Adopting Activity:

Air Force - 11

AMSC N/A

<u>DISTRIBUTION STATEMENT A.</u> Approved for public release; distribution is unlimited.



AEROSPACE MATERIAL SPECIFICATION S4E

AMS 4334

Issued JUL 1995

Submitted for recognition as an American National Standard

ALUMINUM ALLOY, FORGINGS 7.8Zn - 2.2Mg - 1.6Cu - 0.15Cr (7249- T74 and - T7452)

1. SCOPE:

1.1 Form:

This specification covers an aluminum alloy in the form of die forgings, hand forgings, and forging stock.

1.2 Application:

This product has been used typically for parts requiring high strength, high toughness, and good resistance to stress-corrosion cracking, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2201 Tolerances, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled or Cold Finished

MAM 2201 Tolerances, Metric, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled, Drawn, or Cold Finished

AMS 2355 Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Worlded Rings

MAM 2355 Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash

Welded Rings, Metric (SI) Units

AMS 2750 Pyrometry

AMS 2808 Identification, Forgings

SAE Technical Standards Board Rules provide that:: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 594	Ultrasonic Examination of Aluminum-Alloy Wrought Products for Aerospace Applications
ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM E 1417	Liquid Penetrant Examination
ASTM G 34	Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)
ASTM G 47	Determining Susceptibility to Stress-Corrosion Cracking of High-Strength Aluminum Alloy Products

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

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

TABLE 1 - Composition

Element	min	max
Zink	77.5	8.2
Magnesium	2.0	2.4
Copper	1.3	1.9
Chromium	0.12	0.18
Iron		0.12
Manganese		0.10
Silicon		0.10
Titanium		0.06
Other Impurities, each		0.05
Other Impurities, total		0.15
Aluminium	remainder	

3.2 Condition:

The product shall be supplied in the following condition:

- 3.2.1 Die Forgings: Solution and precipitation heat treated to an overaged condition (-T74 temper).
- 3.2.2 Hand Forgings: Solution heat treated, stress relieved by compressing to produce a 1 to 5% permanent set, and precipitation heat treated to an overaged condition (-T7452 temper).

- 3.2.2.1 Other amounts of permanent set may be used for stress relieving parts of unusual geometry or for other parts when specified on the engineering drawing or approved by the cognizant engineering organization.
- 3.2.3 Forging Stock: As ordered by the forging manufacturer.
- 3.3 Heat Treatment:

Forgings, prolongations, or test coupons representing the forgings shall be heat treated as follows; pyrometry shall be in accordance with AMS 2750.

- 3.3.1 Solution Heat Treatment: Heat to 875 °F ± 10 (468 °C ± 6), hold at heat for 60 minutes per inch (25 mm) of thickness but not less than 60 minutes, and quench in room temperature water (100 °F (38 °C) maximum).
- 3.3.2 Holding Period: Hold at room temperature for 48 to 72 hours prior to precipitation heat treatment.
- 3.3.3 Recommended Precipitation Heat Treatment: Heat to 250 °F ± 10 (121 °C ± 6), hold at heat for 10 hours ± 1; increase temperature to 325 °F ± 5 (163 °C ± 3), hold at heat for 7 hours ± 0.5, cool in air (See 8.1).
- 3.4 Properties:

Forgings, prolongations, or test coupons representing the forgings shall conform to the following requirements after heat treatment and precipitation hardening, determined in accordance with AMS 2355 or MAM 2355:

- 3.4.1 Tensile Properties: Shall be as follows:
- 3.4.1.1 Die Forgings: Specimens machined from forgings with axis of specimen in area of gage length varying not more than 15 degrees from parallel to forging flow lines (longitudinal) and specimens machined from forgings with axis of specimen in area of gage length varying not more than 15 degrees from transverse to forging flow lines, heat treated in the indicated thickness, shall have the properties shown in Table 2.

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

Nominal Thickness at	Tensile	Yield Strength at	
Time of Heat Treatment	Strength	0.2% Offset	Elongation in 4D
Inches	ksi	ksi	%
Up to 1.5, incl	76.0	68.0	12
Over 1.5 to 2.0, incl	75.0	67.0	12
Over 2.0 to 2.5, incl	74.0	66.0	12
Over 2.5 to 3.0, incl	73.0	64.0	12
Over 3.0 to 3.5, incl	72.0	63.0	12
Over 3.5 to 3.9, incl	71.0	61.0	12
Over 3.9 to 4.5, incl	69.0	59.0	12
Over 4.5 to 5.0, incl	68.0	58.0	12
Over 5.0 to 5.5, incl	67.0	56.0	€ 312
Over 5.5 to 6.0, incl	66.0	55.0	12

00.0	ეე.0	6 12
		allie
2B - Minimum Te	nsile Properties, SI Units)\
Tensile	Yield Strength at	
Strength	0.2% Offset	Elongation in 4D
MPa	MPa	%
524	4 69	12
517	462	12
510	455	12
503	441	12
496	434	12
490	420	12
476	407	12
469	400	12
462	386	12
455	379	12
	2B - Minimum Te Tensile Strength MPa 524 517 510 503 496 490 476 469 469 462	2B - Minimum Tensile Properties, SI Units Tensile Yield Strength at 0.2% Offset MPa MPa 524 469 517 462 510 455 503 441 496 434 490 420 476 407 469 400 462 386

- Elongation requirements do not apply to specimens having a gage-length diameter 3.4.1.1.1 under 0.250 inch (6.35 mm), to specimens immediately adjacent to an abrupt change in section thickness or to specimens located so that any part of the specimen gage length is within 0.125 inch (3.18 mm) of the trimmed flash line.
- Hand Forgings: Specimens machined from forgings having an essentially square or 3.4.1.2 rectangular cross-section, heat treated in the indicated thickness, shall have the properties shown in Table 3.

TABLE 3A - Minimum Tensile Properties, Inch/Pound Units

		Yield	
Nominal Thickness at	Tensile	Strength at	Percent
•	cimen Strength	n 0.2% Offset	Elongation
Inches Orien	tation ksi	ksi	in 4D
Up to 1.5, incl Longit		68.0	12
	ransverse 76.0	68.0	12
Over 1.5 to 2.0, incl Longity		67.0	12
	ransverse 75.0	67.0	12
Over 2.0 to 2.5, incl Longity	udinal 74.0	66.0	12
Long 7	ransverse 74.0	66.0	12
Over 2.5 to 3.0, incl Longity	udinal 73.0	64.0	12
Long 1	ransverse 73.0	64.0	12
Over 3.0 to 3.5, incl Longiti	udinal 72.0	63.0	12
Long 7	ransverse 72.0	63.0	10
Short ⁻	Fransverse 72.0	59.0	5
Over 3.5 to 3.9, incl Longiti	udinal 71.0	61.0	12
Long 7	ransverse 71.0	61.0	10
Short ⁻	Fransverse 71.0	58.0	5
Over 3.9 to 4.5, incl Longity	udinal 69.	59.0	12
	ransverse 69.0	59.0	10
Short ⁻	Fransverse 🔏 🖰 69.0	57.0	5
Over 4.5 to 5.0, incl Longity	udinal 68.0	58.0	12
Long 1	ransverse 68.0	58.0	10
Short ⁻	Fransverse 68.0	56.0	5
Over 5.0 to 5.5, incl Longiti	udinal 67.0	56.0	12
Long 7	ransverse 67.0	56.0	10
Short [*]	Fransverse 67.0	54.0	5
Over 5.5 to 6.0, incl Longite	udinal 66.0	55.0	12
Long 1	ransverse 66.0	55.0	10
Short ⁻	Fransverse 66.0	53.0	5

TABLE 3B - Minimum Tensile Properties, SI Units

			Yield	_
Nominal Thickness at		Tensile	Strength at	Percent
Time of Heat Treatment	Specimen	Strength	0.2% Offset	Elongation
Inches	Orientation	MPa	MPa	in 4D
Up to 38, incl	Longitudinal	524	469	12
	Long Transverse	524	469	12
Over 38 to 51, incl	Longitudinal	517	462	12
	Long Transverse	517	462	12
Over 51 to 64, incl	Longitudinal	510	455	12
	Long Transverse	510	455	12
Over 64 to 76, incl	Longitudinal	503	441	12
	Long Transverse	503	441(5)	12
Over 76 to 89, incl	Longitudinal	496	434	12
	Long Transverse	496	434	10
	Short Transverse	496	407	5
Over 89 to 99, incl	Longitudinal	490	420	12
•	Long Transverse	490	420	10
	Short Transverse	490	400	5
Over 99 to 114, incl	Longitudinal	476	407	12
,	Long Transverse	476	407	10
	Short Transverse	476	393	5
Over 114 to 127, incl	Longitudinal	469	400	12
,	Long Transverse	469	400	10
	Short Transverse	469	386	5
Over 127 to 140, incl	Longitudinal	462	386	12
,	Long Transverse	462	386	10
	Short Transverse	462	372	5
Over 140 to 152, incl	Longitudinal	455	379	12
,	Long Transverse	455	379	10
	Short Transverse	455	365	5

3.4.1.3 Test Coupons: Test coupons shall be removed from fully heat treated forgings from locations indicated by the engineering drawing or from locations acceptable to purchaser and vendor. However, when approved by the cognizant engineering organization, mechanical properties may be determined from prolongations or from separately-forged coupons.

- 3.4.1.3.1 Separately-Forged Coupons and Prolongations: The minimum dimension of each coupon or prolongation shall be forged or machined to a length not less than the minimum dimension of the thickest area of the forging at the time of heat treatment. Separately-forged test coupons or prolongations shall be heat treated with the forgings they represent.
- 3.4.1.4 Forging Stock: When a sample of stock is forged in the same manner as forgings to a test coupon having a degree of mechanical working not greater than the forging and is heat treated with the forgings, specimens taken from the heat treated coupon shall conform to the requirements of 3.4.1, 3.4.2, and 3.4.3. If a test specimen taken from the stock after heat treatment with the forgings conforms to the requirements of 3.4.1, 3.4.2, and 3.4.3, the test shall be accepted as equivalent to tests of a forged coupon.
- 3.4.2 Hardness: Forgings shall have hardness not lower than shown in Table 4.

TABLE 4 - Minimum Hardness Values

Nominal Thickness	Nominal Thickness	Hardness	Hardness	
Inches	Millimeters	HB/10/500 🗸	HB 10/1000	
Up to 3, incl	Up to 76, incl	140	145	
Over 3 to 4, incl	Over 76 to 102, incl	138	143	
Over 4 to 5, incl	Over 102 to 127, incl	135	140	

- 3.4.3 Stress-Corrosion Cracking Resistance: Specimens cut from forgings 0.750 inch (19.05 mm) and over in nominal thickness shall show no evidence of stress-corrosion cracking when stressed in the short-transverse direction to 75% of the specified minimum yield strength for the principal test direction (longitudinal for die forgings or long-transverse for hand forgings). Testing shall be in accordance with ASTM G 47.
- 3.4.4 Exfoliation Resistance: At any plane, specimens cut from forgings shall show a level of exfoliation corrosion less than EB as illustrated by Photograph B of Figure 2 of ASTM G 34.
- 3.4.5 Grain Flow of Die Forgings: Except in areas which contain flash-line end grain, grain flow shall follow the general contour of the forgings showing no evidence of re-entrant grain flow.
- 3.5 Quality:

Forgings, 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 forgings.