

AEROSPACE MATERIAL SPECIFICATION

SAE AMS4141F

Issued 1966-03
Revised 2008-10

Superseding AMS4141E

Aluminum Alloy Die Forgings
5.6Zn – 2.5Mg – 1.6Cu – 0.23Cr (7075-T73)
Solution and Precipitation Heat Treated

(Composition similar to UNS A97075)

RATIONALE

AMS4141F results from a Five Year Review and update of this specification.

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of die forgings and forging stock ordered to inch/pound units.

1.2 Application

These forgings have been used typically for parts requiring good resistance to stress-corrosion cracking but with lower strength than AMS4126, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order form 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 canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

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

AMS2355	Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
AMS2772	Heat Treatment of Aluminum Alloy Raw Material
AMS2808	Identification, Forgings
AS1990	Aluminum Alloy Tempers

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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 B 594	Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM E 1417	Liquid Penetrant Examination

2.3 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036, Tel: 212-642-4900, www.ansi.org.

ANSI H35.2	Dimensional Tolerances for Aluminum Mill Products
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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

The product shall be supplied in the following condition:

3.2.1 Forgings

Solution and precipitation heat treated to the -T73 temper in accordance with AMS2772 (See AS1990).

3.2.2 Forging Stock

As ordered by the forging manufacturer.

3.3 Properties

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

3.3.1 Forgings

3.3.1.1 Tensile Properties

Shall be as specified in Table 2 or Table 3.

3.3.1.1.1 With Grain Flow

Specimens, machined from forgings 6 inches and under in nominal thickness at time of heat treatment or from prolongations on such forgings, with axis of specimen in the area of gage length varying not more than 15 degrees from parallel to the forging flow lines, shall have properties specified in Table 2 provided the as-forged thickness is not more than twice the heat treated thickness.

TABLE 2 - MINIMUM TENSILE PROPERTIES

Nominal Thickness at Time of Heat Treatment Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %, min
Up to 3, incl	66.0	56.0	7
Over 3 to 4, incl	64.0	55.0	7
Over 4 to 5, incl	62.0	53.0	7
Over 5 to 6, incl	61.0	51.0	6

3.3.1.1.2 Across Grain Flow

Specimens, machined from forgings 6 inches and under in nominal thickness at time of heat treatment or from prolongations on such forgings, with axis of specimen in the area of gage length varying not more than 15 degrees from perpendicular to the forging flow lines, shall have properties as specified 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, properties of the forgings shall be as agreed upon by purchaser and vendor.

TABLE 3 - MINIMUM TENSILE PROPERTIES

Nominal Thickness at Time of Heat Treatment Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %, min
Up to 3, incl	62.0	53.0	3
Over 3 to 4, incl	61.0	52.0	2
Over 4 to 5, incl	59.0	51.0	2
Over 5 to 6, incl	58.0	50.0	2

3.3.1.2 Stress-Corrosion Resistance

Forgings shall meet the conductivity test of 3.3.1.2.1 or shall exhibit no evidence of stress-corrosion cracking when tested in accordance with 3.3.1.2.2. The test of 3.3.1.2.2 need not be performed on forgings meeting the requirements of 3.3.1.2.1.1, 3.3.1.2.1.2, and 3.3.1.2.1.3.

3.3.1.2.1 Conductivity

Shall be as follows, determined on the surface of the sample:

- 3.3.1.2.1.1 If the conductivity is 40.0% IACS (International Annealed Copper Standard) or higher and longitudinal (with grain flow) tensile properties meet specified requirements, the forgings are acceptable.

- 3.3.1.2.1.2 If the conductivity is between 38.0 to 39.9% IACS, inclusive, if the longitudinal (with grain flow) tensile properties meet specified properties, and if the longitudinal yield strength does not exceed the specified minimum by more than 11.9 ksi, the forgings are acceptable.
- 3.3.1.2.1.3 If the conductivity is between 38.0 to 39.9% IACS, inclusive, and longitudinal (with grain flow) yield strength exceeds the specified minimum value by more than 11.9 ksi, the forgings shall be given additional precipitation heat treatment. If, after such treatment, the forgings meet the requirements of 3.3.1.2 and 3.3.1.2.1.1 or 3.3.1.2.1.2, the forgings are acceptable.
- 3.3.1.2.1.4 If the conductivity is below 38.0% IACS, the forgings are not acceptable but may be re-heat treated or given additional precipitation heat treatment to meet the specified requirements.

3.3.1.2.2 Stress-Corrosion Cracking Resistance

Specimens, cut from forgings 0.750 inch and over in nominal thickness, shall exhibit no evidence of stress-corrosion cracking when stressed in the short-transverse (across grain flow) direction to 75% of the specified minimum longitudinal (with grain flow) yield strength.

3.3.2 Forging Stock

When a sample of stock is forged to a test coupon, with a degree of mechanical working not greater than that of the forgings, and heat treated in the same manner as forgings, tensile specimens taken from the heat treated coupon shall conform to the requirements of 3.3.1.1.1. If specimens taken from the stock after heat treatment in the same manner as forgings conform to the requirements of 3.3.1.1.1, the tests shall be accepted as equivalent to tests of a forged coupon.

3.4 Quality

The product, 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 product.

- 3.4.1 Forgings shall be etched to produce a surface suitable for visual inspection of the forging surfaces. Surfaces shall be evaluated for defects such as seams, laps, bursts, and quench cracks. Surface imperfections which can be removed so that they do not reappear on re-etching and the required section thickness can be maintained are acceptable.

3.4.1.1 When specified, a sampling plan may be used in lieu of etching each forging.

3.4.2 When specified, die forgings shall be ultrasonically inspected in accordance with ASTM B 594 or other method acceptable to purchaser and shall meet Class B requirements.

3.4.3 When specified, forgings shall be subjected to fluorescent penetrant inspection in accordance with ASTM E 1417 or other method acceptable to purchaser. Standards for acceptance shall be established by the cognizant engineering organization.

3.4.4 Grain flow of die forgings, except in areas which contain flash-line end grain, shall follow the general contour of the forgings showing no evidence of reentrant grain flow.

3.5 Tolerances

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

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of the product 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 product conforms to specified requirements.