

# AERONAUTICAL MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.  
29 West 39th Street  
New York City

## AMS 4140D

Issued 1-1-42  
Revised 6-15-52

### ALUMINUM ALLOY FORGINGS 4Cu - 2Ni - 0.7Mg (18S-T61)

1. ACKNOWLEDGEMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
2. FORM: Die forgings, and forging stock.
3. APPLICATION: Primarily for pistons.
4. COMPOSITION:

Copper	3.5 - 4.5
Nickel	1.7 - 2.3
Magnesium	0.45 - 0.9
Iron	1.0 max
Silicon	0.9 max
Manganese	0.20 max
Zinc	0.25 max
Titanium	0.05 max
Chromium	0.10 max
Other Impurities, each	0.05 max
Other Impurities, total	0.15 max
Aluminum	remainder

5. CONDITION:

- 5.1 Die Forgings: Solution and precipitation heat treated. Quenching from the solution temperature shall be at a rate not faster than that produced by immersion in water which is boiling at the time of immersion.
- 5.2 Forging Stock: As fabricated.

6. TECHNICAL REQUIREMENTS:

- 6.1 Die Forgings:

- 6.1.1 Tensile Properties:

- 6.1.1.1 Test Specimens: Test specimens, machined from separately forged coupons or from forging stock representing the forgings and in either case heat treated with the forgings, or machined from prolongations on heat treated forgings, shall conform to the following requirements:

Tensile Strength, psi	55,000 min
Yield Strength at 0.2% Offset or at 0.0114 in. in 2 in. Extension Under Load (E = 10,800,000), psi	40,000 min
Elongation, % in 4D	10 min

Section 7C of the SAE Technical Board rules provides that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform, to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

6.1.1.2 Forgings, With Grain Flow: When test specimens are machined from forgings with the axis approximately parallel to the forging flow lines, the tensile properties shall conform to those specified in 6.1.1.1, except that elongation may be as low as 7.0%, unless otherwise agreed upon by purchaser and vendor.

6.1.2 Hardness: Forgings shall have hardness not lower than Brinell 100 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or not lower than Brinell 106 using 1000 kg load and 10 mm ball.

6.1.3 Special Requirements:

6.1.3.1 Piston Forgings: Shall be capable of being heated at 450 F  $\pm$  10 for 5 hr and retaining hardness not lower than Brinell 90 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or not lower than Brinell 93 using 1000 kg load and 10 mm ball.

6.2 Forging Stock:

6.2.1 When a sample of stock is forged to a test coupon and heat treated in the same manner as forgings, a tensile test specimen taken from the heat treated coupon shall have properties not lower than those specified in 6.1.1.1 and 6.1.2. If a test specimen taken from the stock after heat treatment in the same manner as forgings has properties not lower than those specified in 6.1.1.1 and 6.1.2, the test shall be accepted as equivalent to the test of a forged coupon. Neither of these tests is required in routine inspection.

6.2.2 Unless otherwise specified, tolerances shall be in accordance with commercial practice for the class ordered.

7. QUALITY: Material shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external defects detrimental to fabrication or to performance of parts.

8. REPORTS:

8.1 Unless otherwise specified, the vendor of die forgings shall furnish with each shipment three copies of a report stating that the chemical composition, tensile properties and hardness of the forgings conform to the requirements specified. This report shall include the purchase order number, material specification number, size or part number, and quantity.

8.2 Unless otherwise specified, the vendor of forging stock shall furnish with each shipment three copies of a report stating that the chemical composition of the stock conforms to the requirements specified. This report shall include the purchase order number, material specification number, size, and quantity.