

# AERONAUTICAL MATERIAL SPECIFICATIONS

AMS 4146

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York 17, N.Y.

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Revised

ALUMINUM ALLOY FORGINGS  
1Mg - 0.6Si - 0.3Cu - 0.25Cr (6061-T4)

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. FORM: Forgings and forging stock.
3. APPLICATION: Primarily for forged parts which will be welded or brazed to form assemblies and then given further heat treatment to develop full strength of which the alloy is capable.
4. COMPOSITION:

|                         |             |
|-------------------------|-------------|
| Magnesium               | 0.8 - 1.2   |
| Silicon                 | 0.40 - 0.8  |
| Copper                  | 0.15 - 0.40 |
| Chromium                | 0.15 - 0.35 |
| Iron                    | 0.7 max     |
| Zinc                    | 0.25 max    |
| Manganese               | 0.15 max    |
| Titanium                | 0.15 max    |
| Other Impurities, each  | 0.05 max    |
| Other Impurities, total | 0.15 max    |
| Aluminum                | remainder   |

## 5. CONDITION:

- 5.1 Die Forgings and Rolled Rings: Solution heat treated. Quenching from the solution temperature shall be at a rate fast enough for the material to meet the following requirements, but shall be as slow as practicable in order to keep internal stresses at a minimum.

- 5.2 Forging Stock: As fabricated.

## 6. TECHNICAL REQUIREMENTS:

### 6.1 Die Forgings and Rolled Rings:

- 6.1.1 Hardness: Forgings shall have hardness of Brinell 50 - 80, using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or Brinell 55 - 85 using 1000 kg load and 10 mm ball.

- 6.1.2 Properties After Heat Treatment: Forgings after proper precipitation heat treatment shall conform to the following requirements:

#### 6.1.2.1 Tensile Properties:

- 6.1.2.1.1 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                                                                                | 38,000 min |
| Yield Strength at 0.2% Offset or at 0.0111 in.<br>in 2 in. Extension Under Load (E = 9,900,000), psi | 35,000 min |
| Elongation, % in 4D                                                                                  | 10 min     |

- 6.1.2.1.2 Die Forgings, With Grain Flow: When test specimens are machined from forgings not over 4 in. in thickness with the axis approximately parallel to the forging flow lines, the tensile properties shall conform to those specified in 6.1.2.1.1, except that elongation may be as low as 7%, unless otherwise agreed upon by purchaser and vendor.

- 6.1.2.1.3 Die Forgings, Across Grain Flow: When test specimens are machined from die forgings not over 4 in. in thickness so that the axis is other than approximately parallel to the forging flow lines, the tensile properties shall conform to the following requirements:

|                                                                                                      |            |
|------------------------------------------------------------------------------------------------------|------------|
| Tensile Strength, psi                                                                                | 38,000 min |
| Yield Strength at 0.2% Offset or at 0.0111 in.<br>in 2 in. Extension Under Load (E = 9,900,000), psi | 35,000 min |
| Elongation, % in 4D                                                                                  | 5 min      |

- 6.1.2.1.4 Rolled Rings, Tangential: When test specimens are machined from rolled rings not over 2-1/2 in. in thickness with axis tangential to the ring OD (axis parallel to direction of rolling), the tensile properties shall conform to those specified in 6.1.2.1.1, unless otherwise agreed upon by purchaser and vendor.

- 6.1.2.1.5 Rolled Rings, Axial: When test specimens are machined from rolled rings not over 2-1/2 in. in thickness with axis parallel to axis of ring (axis transverse to direction of rolling), the tensile properties shall conform to those specified in 6.1.2.1.1, except that elongation may be as low as 8%, unless otherwise agreed upon by purchaser and vendor.

- 6.1.2.2 Hardness: Forgings shall have hardness not lower than Brinell 80 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or not lower than Brinell 85 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, including proper precipitation heat treatment, a tensile test specimen taken from the heat treated coupon shall have properties not lower than those specified in 6.1.2.1.1 and 6.1.2.2. If a test specimen taken from the stock after heat treatment in the same manner as forgings, including proper precipitation heat treatment, has properties not lower than those specified in 6.1.2.1.1 and 6.1.2.2, the test shall be accepted as equivalent to the test of a forged coupon. Neither of these tests is required in routine inspection.