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| <b>AEROSPACE<br/>MATERIAL SPECIFICATION</b>   | <b>AMS4108™</b>   | <b>REV. F</b> |
|   | Issued 1992-01<br>Revised 2003-08<br>Reaffirmed 2015-10<br><br>Superseding AMS4108E |               |
| Aluminum Alloy, Hand Forgings<br>6.2Zn - 2.3Cu - 2.2Mg - 0.12Zr (7050-T7452)<br>Solution Heat Treated, Compression Stress-Relieved, and Overaged<br>(Composition similar to UNS A97050) |   |               |

RATIONALE

AMS4108F has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

1.1 Form:

This specification covers an aluminum alloy in the form of hand forgings 8 inches (203 mm) and under in nominal thickness, and of forging stock.

1.2 Application:

These forgings have been used typically for machined structural parts subject to warpage during machining and requiring high strength and resistance to stress-corrosion cracking, 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 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.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or [www.sae.org](http://www.sae.org).

- |          |   |
|----------|---|
| AMS 2355 | Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings |
| AMS 2808 | Identification, Forgings  |
| AMS 2772 | Heat Treatment of Aluminum Alloy Raw Materials  |
| AS1990   | Aluminum Alloy Tempers  |

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<http://www.sae.org/technical/standards/AMS4108F>

## 2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or [www.astm.org](http://www.astm.org).

|            |  |
|------------|--|
| ASTM B 594 | Ultrasonic Inspection of Aluminum-Alloy Wrought Products for Aerospace Applications      |
| ASTM B 645 | Plane Strain Fracture Toughness Testing of Aluminum Alloys                               |
| ASTM B 660 | Packaging/Packing of Aluminum and Magnesium Products                                     |
| ASTM E 399 | Plane-Strain Fracture Toughness of Metallic Materials                                    |
| 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 2XXX and 7XXX Aluminum Alloys |

## 2.3 ANSI Publications:

Available from ANSI, 25 West 43rd Street, New York, NY 10036 or [www.ansi.org](http://www.ansi.org).

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

## 3. TECHNICAL REQUIREMENTS:

### 3.1 Composition:

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

TABLE 1 - Composition

| Element               | min       | max  |
|-----------------------|-----------|------|
| Silicon               | --        | 0.12 |
| Iron                  | --        | 0.15 |
| Copper                | 2.0       | 2.6  |
| Manganese             | --        | 0.10 |
| Magnesium             | 1.9       | 2.6  |
| Chromium              | --        | 0.04 |
| Zinc                  | 5.7       | 6.7  |
| Titanium              | --        | 0.06 |
| Zirconium             | 0.08      | 0.15 |
| 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 heat treated, stress-relieved by compressing to produce 1 to 5% permanent set, and precipitation heat treated to the T7452 temper (See AS1990). Heat treatment shall be performed in accordance with AMS 2772.

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 AMS 2355.

#### 3.3.1 Forgings:

3.3.1.1 Tensile Properties: Specimens machined from forgings having essentially a rectangular or square cross-section, heat treated in the indicated thickness, shall have the properties shown in Table 2 provided that the as-forged thickness does not exceed 8.0 inches (203 mm). The long-transverse direction for square forgings shall be identified by the vendor.

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

| Nominal Thickness<br>at Time<br>of Heat Treatment<br>Inches | Specimen<br>Orientation | Tensile<br>Strength<br>ksi | Yield Strength<br>at 0.2% Offset<br>ksi | Elongation<br>in 4D<br>% |
|---|-------------------------|----------------------------|---|--------------------------|
| Up to 2, incl   | Longitudinal            | 72.0                       | 63.0                                    | 9                        |
|   | Long-Trans.             | 71.0                       | 61.0                                    | 5                        |
| Over 2 to 3, incl   | Longitudinal            | 72.0                       | 62.0                                    | 9                        |
|   | Long-Trans.             | 70.0                       | 60.0                                    | 5                        |
|   | Short-Trans.            | 67.0                       | 55.0                                    | 4                        |
| Over 3 to 4, incl   | Longitudinal            | 71.0                       | 61.0                                    | 9                        |
|   | Long-Trans.             | 70.0                       | 59.0                                    | 5                        |
|   | Short-Trans.            | 67.0                       | 55.0                                    | 4                        |
| Over 4 to 5, incl   | Longitudinal            | 70.0                       | 60.0                                    | 9                        |
|   | Long-Trans.             | 69.0                       | 58.0                                    | 4                        |
|   | Short-Trans.            | 66.0                       | 54.0                                    | 3                        |
| Over 5 to 6, incl   | Longitudinal            | 69.0                       | 59.0                                    | 9                        |
|   | Long-Trans.             | 68.0                       | 56.0                                    | 4                        |
|   | Short-Trans.            | 66.0                       | 53.0                                    | 3                        |
| Over 6 to 7, incl   | Longitudinal            | 68.0                       | 58.0                                    | 9                        |
|   | Long-Trans.             | 67.0                       | 56.0                                    | 4                        |
|   | Short-Trans.            | 65.0                       | 52.0                                    | 3                        |
| Over 7 to 8, incl   | Longitudinal            | 67.0                       | 57.0                                    | 9                        |
|   | Long-Trans.             | 66.0                       | 52.0                                    | 4                        |
|   | Short-Trans.            | 64.0                       | 50.0                                    | 3                        |

TABLE 2B - Minimum Tensile Properties, SI Units

| Nominal Thickness<br>At Time<br>Of Heat Treatment<br>Millimeters | Specimen<br>Orientation | Tensile<br>Strength<br>MPa | Yield Strength<br>at 0.2% Offset<br>MPa | Elongation<br>in 5D<br>% |
|--|-------------------------|----------------------------|---|--------------------------|
| Up to 51, incl   | Longitudinal            | 496                        | 434                                     | 8                        |
|  | Long-Trans.             | 490                        | 421                                     | 5                        |
| Over 51 to 76, incl  | Longitudinal            | 496                        | 427                                     | 8                        |
|  | Long-Trans.             | 483                        | 414                                     | 5                        |
|  | Short-Trans.            | 462                        | 379                                     | 4                        |
| Over 76 to 102, incl   | Longitudinal            | 490                        | 421                                     | 8                        |
|  | Long-Trans.             | 483                        | 407                                     | 5                        |
|  | Short-Trans.            | 462                        | 379                                     | 4                        |
| Over 102 to 127, incl  | Longitudinal            | 483                        | 414                                     | 8                        |
|  | Long-Trans.             | 476                        | 400                                     | 4                        |
|  | Short-Trans.            | 455                        | 372                                     | 3                        |
| Over 127 to 152, incl  | Longitudinal            | 476                        | 407                                     | 8                        |
|  | Long-Trans.             | 469                        | 386                                     | 4                        |
|  | Short-Trans.            | 455                        | 365                                     | 3                        |
| Over 152 to 178, incl  | Longitudinal            | 469                        | 400                                     | 8                        |
|  | Long-Trans.             | 462                        | 386                                     | 4                        |
|  | Short-Trans.            | 448                        | 359                                     | 3                        |
| Over 178 to 203, incl  | Longitudinal            | 462                        | 395                                     | 8                        |
|  | Long-Trans.             | 455                        | 365                                     | 4                        |
|  | Short-Trans.            | 441                        | 345                                     | 3                        |

3.3.1.1.1 Tensile specimens shall be excised from the T/2 and W/2 location at a distance not less than T from the "as heat treated" edges of the forging.

3.3.1.2 Corrosion Resistance: Resistance to stress-corrosion cracking and to exfoliation-corrosion is acceptable if the requirements of 3.3.1.2.1 and 3.3.1.2.2 are met.

3.3.1.2.1 Electrical Conductivity: Shall be not lower than 38.0% IACS (International Annealed Copper Standard) (22.0 MS/m).

3.3.1.2.2 Stress-Corrosion Susceptibility Factor (SCF): Shall be not greater than 32.0 (220), determined by subtracting the electrical conductivity, AA.A% IACS (12 times BB.B MS/m), from the long transverse yield strength, XX.X ksi (YYY MPa).

Examples:

|                  |                                  |              |
|------------------|----------------------------------|--------------|
| Inch/Pound Units | 72.0 ksi - 38.5% IACS = 33.5     | Unacceptable |
|                  | 68.0 ksi - 40.2% IACS = 27.8     | Acceptable   |
| SI Units         | 496 MPa - 12 X 22.3 MS/m = 228.4 | Unacceptable |
|                  | 469 MPa - 12 X 23.3 MS/m = 189.4 | Acceptable   |

- 3.3.1.2.3 Forgings not conforming to 3.3.1.3.1 may be given additional overaging and retested to determine conformance to 3.3.1.1, 3.3.1.2.1, and 3.3.1.2.2.
- 3.3.1.3 Exfoliation-Corrosion Resistance: Specimens cut from forgings shall show a level of exfoliation-corrosion at any plane less than that illustrated by Photograph EB, Figure 2, of ASTM G 34.
- 3.3.1.4 Stress-Corrosion Resistance: Specimens as in 4.3.1 cut from forgings shall show no evidence of stress-corrosion cracking when stressed in the short-transverse direction at 35.0 ksi (241 MPa) when tested in accordance with ASTM G 47.
- 3.3.1.5 Fracture Toughness: When specified, forgings shall meet the values of  $K_{IC}$  shown in Table 3, determined in accordance with ASTM B 645.

TABLE 3A - Fracture Toughness Parameters, Inch/Pound Units

| Specimen Orientation | Nominal Thickness Inches  | Minimum $K_{IC}$ ksi $\sqrt{\text{inch}}$ |
|----------------------|---------------------------|---|
| L-T                  | 1.500 to 3.000, incl      | 27  |
|                      | Over 3.000 to 4.000, incl | 26  |
|                      | Over 4.000 to 8.000, incl | 25  |

TABLE 3B - Fracture Toughness Parameters, SI Units

| Specimen Orientation | Nominal Thickness Millimeters | Minimum $K_{IC}$ MPa $\sqrt{\text{m}}$ |
|----------------------|-------------------------------|--|
| L-T                  | 38.10 to 76.20, incl          | 29.7                                   |
|                      | Over 76.20 to 101.60, incl    | 28.6                                   |
|                      | Over 101.60 to 203.20, incl   | 27.5                                   |

- 3.3.1.5.1  $K_Q$  values shall meet all requirements of ASTM E 399 for  $K_{IC}$  except that invalid  $K_Q$  values which are meaningful as defined by ASTM B 645 and which equal or exceed the  $K_{IC}$  limit (3.3.1.6) shall be evidence of acceptable fracture toughness.
- 3.3.2 Forging Stock: When a sample of stock is forged to a test coupon having a degree of mechanical working not greater than the forging and heat treated as in 3.2.1, specimens taken from the heat treated coupon shall conform to the requirements of 3.3.1.1. If specimens taken from the stock after heat treatment as in 3.2.1 conform to the requirements of 3.3.1.1, 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 When specified, forgings shall be subjected to ultrasonic inspection in accordance with ASTM B 594 and shall meet the following requirements:

3.4.1.1 Forgings with nominal section thicknesses from 1.000 to 8.000 inches (25.40 to 203.20 mm), inclusive, and weights of each piece up to 600 pounds (272 kg) shall meet ultrasonic Class A.

3.5 Tolerances:

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

#### 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.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: The following requirements are acceptance tests and, except for composition, shall be performed on each inspection lot as applicable:

4.2.1.1 Composition (3.1).

4.2.1.2 Tensile properties (3.3.1.1), corrosion resistance (3.3.1.2), and, when specified, fracture toughness (3.3.1.5) and ultrasonic soundness (3.4.1) of each inspection lot of forgings.

4.2.1.3 Tolerances (3.5) of forging stock.

4.2.2 Periodic Tests: Exfoliation-corrosion resistance (3.3.1.3), and stress-corrosion resistance (3.3.1.4) and tests of forging stock to demonstrate ability to develop required properties (3.3.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2355 and the following; a lot shall be not more than 6000 pounds (2721 kg) of forgings of the same configuration or part number heat treated in the same batch-furnace load or charged into a continuous furnace consecutively during an eight-hour period.

4.3.1 Stress-Corrosion Resistance: Samples, taken from a forging or a forging prolongation, shall be not less than 0.750 inch (19.05 mm) in thickness.