# AEROSPACE MATERIAL SPECIFICATION

| AMS4310 | REV. E |
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Reaffirmed 2013-12

Superseding AMS4310D

# Aluminum Alloy, Rolled or Forged Rings
# 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr (7075-T651, 7075-T652)
# Solution Heat Treated, Mechanically Stress Relieved, and Precipitation Heat Treated
# (Composition similar to UNS A97075)

RATIONALE

AMS4310E 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 rolled or forged rings.

### 1.2 Application

These rings have been used typically for high strength machined parts where good stability is required during machining, but usage is not limited to such applications. These rings are not recommended for fusion welding.

1.2.1 Certain design and fabricating procedures may cause these rings to become susceptible to stress-corrosion cracking; ARP823 recommends practices to minimize such conditions.

### 1.3 Classification

Rings are classified by type of mechanical stress relief as follows:

7075-T651 Stress relieved by tension
7075-T652 Stress relieved by compression

1.3.1 Either type may be supplied, unless a specific type is ordered.

## 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.





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**http://www.sae.org/technical/standards/AMS4310E**

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 Materials |
| AMS2808 | Identification, Forgings |
| ARP823 | Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products |

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 Wrought Products for Aerospace Applications |
| ASTM B 660 | Packaging/Packing of Aluminum and Magnesium Products |

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

Rings shall be supplied in the following condition; heat treatments shall be performed in accordance with AMS2772 to the following tempers:

3.2.1 7075-T651 (Type 1)

Solution heat treated, stress-relieved by stretching to produce a permanent set of 1 to 5%, and precipitation heat treated.

3.2.2 7075-T652 (Type 2)

Solution heat treated, stress-relieved by compression to produce a permanent set of 1 to 5%, and precipitation heat treated. During compression, primary forces shall be applied in the axial direction and on individual rings approximating final dimensions.

3.3 Properties

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

3.3.1 Tensile Properties

3.3.1.1 Rings with OD to Wall Thickness Ratio of 10 or Greater

Shall be in accordance with Table 2. Tensile tests are not required in any direction from which a specimen at least 2.375 inches (60.32 mm) in length cannot be obtained.

TABLE 2A - MINIMUM TENSILE PROPERTIES, INCH/POUND UNITS

| Nominal Thickness at Time of Heat Treatment Inches (See 3.3.1.1.1) | Specimen Orientation (See 3.3.1.1.2) | Tensile Strength ksi | Yield Strength at 0.2% Offset ksi | Elongation in 4D % |
|---|---|---|---|---|
| Up to 2, incl | Tangential | 74 | 63 | 9 |
| | Axial | 73 | 61 | 4 |
| Over 2 to 3, incl | Tangential | 73 | 61 | 9 |
| | Axial | 71 | 59 | 4 |
| | Radial | 69 | 57 | 2 |
| Over 3 to 4, incl | Tangential | 71 | 60 | 8 |
| | Axial | 70 | 58 | 3 |
| | Radial | 68 | 56 | 1 |
| Over 4 to 5, incl | Tangential | 69 | 58 | 7 |
| | Axial | 68 | 56 | 3 |
| | Radial | 66 | 55 | 1 |
| Over 5 to 6, incl | Tangential | 68 | 56 | 6 |
| | Axial | 66 | 55 | 3 |
| | Radial | 65 | 54 | 1 |

TABLE 2B - MINIMUM TENSILE PROPERTIES, SI UNITS

| Nominal Thickness at Time of Heat Treatment Millimeters (See 3.3.1.1.1) | Specimen Orientation (See 3.3.1.1.2) | Tensile Strength MPa | Yield Strength at 0.2% Offset MPa | Elongation in 4D % |
|---|---|---|---|---|
| Up to 51, incl | Tangential | 510 | 434 | 9 |
| | Axial | 503 | 421 | 4 |
| Over 51 to 76, incl | Tangential | 503 | 421 | 9 |
| | Axial | 490 | 407 | 4 |
| | Radial | 476 | 393 | 2 |
| Over 76 to 102, incl | Tangential | 490 | 414 | 8 |
| | Axial | 483 | 400 | 3 |
| | Radial | 469 | 386 | 1 |
| Over 102 to 127, incl | Tangential | 476 | 400 | 7 |
| | Axial | 469 | 386 | 3 |
| | Radial | 455 | 379 | 1 |
| Over 127 to 152, incl | Tangential | 469 | 386 | 6 |
| | Axial | 455 | 379 | 3 |
| | Radial | 448 | 372 | 1 |

3.3.1.1.1 Thickness shall be the smaller of the wall thickness (one-half the difference between nominal OD and nominal ID) and height (axial) dimensions.

3.3.1.1.2 Tangential requirements apply to specimens machined with axis of specimen tangential to the ring OD (parallel to the direction of rolling). Axial requirements apply to specimens machined with axis of specimen parallel to the ring axis (long transverse to the direction of rolling). Radial requirements apply to specimens machined with axis of specimen parallel to the radius of the ring (short transverse to the direction of rolling). All specimens shall be machined from the core of the ring.

3.3.1.1.3 Elongation requirements do not apply to test specimens having a gage-length diameter under 0.250 inch (6.35 mm), or located in immediate proximity to an abrupt change in section thickness, or located so that any part of the specimen gage length is located within 0.125 inch (3.18 mm) of the trimmed flash line.

3.3.2 Hardness

Shall be not lower than 135 HB/10/500 or 140 HB/10/1000.

3.4 Quality

Rings, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign material and from imperfections detrimental to usage of the rings.

3.4.1 Each ring shall be ultrasonically inspected in accordance with ASTM B 594 and shall meet Class A acceptance limits of that specification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of rings 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 rings conform to specified requirements.

4.2 Classification of Tests

All technical requirements are acceptance tests and, except for composition, shall be performed on each lot.

4.3 Sampling and Testing

Shall be in accordance with AMS2355 and the following:

4.3.1 Except when testing in one or more directions is not required by 3.3.1, tensile specimens in the tangential, axial, and radial directions shall be taken from a ring or ring segment representing the lot. When ring segments are used for testing, the segments shall be cut from a ring which has been solution heat treated and stress-relieved with the production rings. Solution heat treated and stress-relieved ring segments shall be included in each precipitation heat treatment furnace load.

4.3.1.1 When requested by purchaser, at least one half of each ring segment obtained as in 4.3.1, or one half of each ring prolongation tested, shall be submitted to the purchaser with the rings represented.

4.3.2 Hardness

Each ring. If hardness of any ring indicates low tensile properties, the ring having the lowest hardness shall be tested for tensile properties.