SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

AMS 7488E

Issued MAR 1955
Revised OCT 2006

Superseding AMS 7488D

Rings, Flash Welded
Aluminum and Aluminum Alloys

RATIONALE

AMS 7488E is a Five Year Review and update of this specification.

1. SCOPE

1.1 Form

This specification covers flash welded rings made of aluminum and aluminum alloys.

1.2 Application

These products have been used typically for parts such as flanges and rings, 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 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.

AMS 2350	Standards and Test Methods
AMS 2355	Quality Assurance Sampling and Testing of Aluminum-Base and Magnesium-Base Alloys, Wrought Products (Except Forgings and Forging Stock) and Flash Welded Rings

3. TECHNICAL REQUIREMENTS

3.1 Material

Shall be as specified on the drawing.

3.2 Fabrication

3.2.1 Forming

Rings shall be formed from suitably rolled, extruded, or forged shapes. Grain flow in the formed rings shall be substantially circumferential.

3.2.2 Preparation for Welding

Formed rings shall be clean and free from foreign materials in the area of electrode contact and at the surfaces to be welded.

3.2.3 Welding

The ends of the formed rings shall be flash butt-welded together: there shall be only one weld per ring, unless otherwise permitted by purchaser. Welding shall be performed on a machine provided with accurate control of feed of joint during flashing, rate and distance of travel of sections to be welded, secondary voltage and current magnitude, and timing and current cut-off. The flash shall be maintained during the flashing interval of the welding operation. The amount of manual flashing, for purposes of preheating, shall be limited to 10% of total flashing distance. The machine shall be capable of repeating the sequence of operations independently of the skill of the operator. A record of all machine settings and sequence of operations for welding each different ring shall be kept by the vendor and be made available to the purchaser upon written request.

3.2.4 Annealing

Unless otherwise specified, the welded rings shall be annealed by heating to the proper temperature, holding at heat for the proper time, and cooling to room temperature.

3.2.5 Proof Testing of Welds (Sizing)

Each ring, after cooling to room temperature, shall be tested to determine the quality of the weld, unless otherwise specified. Each ring shall have flash and excess metal at the weld removed by within +1/32 inch (+0.8 mm) of parent metal surface, either before or after annealing as in 3.2.4 but before sizing. Preliminary sizing may be done before cooling but final sizing shall be done at room temperature. The stress applied for final sizing shall be sufficient to provide a permanent expansion of not less than 1% across a 2 inch (50.8 mm) gage length centered on the weld. Sizing shall be performed in such a way as to provide uniform stress distribution throughout the ring.

3.2.5.1 For rings made of product less than 0.188 inch (4.78 mm) in nominal thickness, flash removal may reduce thickness below that of parent metal provided that the finished weld blends smoothly into adjacent metal and provided that thickness is not reduced below the minimum specified on the drawing for the parent metal; proof testing of such rings shall be waived if welding precedes a final forming operation which involves an expansion of the weld equivalent to or exceeding that required by 3.2.5.

3.2.6 When the drawing or applicable material specification requires additional heat treatment, rings shall be so heat treated after sizing.

3.2.7 Restoration to Shape

If it is necessary to restore shape of rings following sizing, such operation shall be done on suitable presses and not by localized blows as from a hammer. Rings may be heated to a temperature not higher than the annealing temperature for such operation except that rings furnished solution heat treated or solution and precipitation heat treated shall be heated to the applicable precipitation heat treatment temperature or lower.

3.3 Properties

Rings shall conform to the following requirements, determined in accordance with AMS 2355:

3.3.1 Tensile Properties Through Welded Area

Shall be as shown in Table 1, determined on specimens cut, after final heat treatment of the lot, from welded rings processed to this specification. When permitted by purchaser, rings to be supplied with additional heat treatment after annealing may be tested in the annealed condition by the vendor, but the final basis for acceptance shall be tests made on fully heat treated rings. Tensile testing will not be required on rings made from product less than 0.188 inch (4.78 mm) in nominal thickness for which proof testing is waived in 3.2.5.1, unless otherwise specified.

TABLE 1 - MINIMUM TENSILE PROPERTIES

Property	Value
Tensile Strength	85% of parent metal in same ring
Elongation in 4D	
Heat Treatable Alloys	25% of parent metal in same ring
Non-Heat Treatable Alloys	60% of parent metal in same ring

3.3.1.1 When permitted by purchaser, rings not conforming to 3.3.1 will be acceptable if the tensile properties through the welded area, determined after final heat treatment, are not lower than the minimum requirements of the material specification or of the drawing.

3.3.2 Hardness

Hardness of heat-treatable alloy rings shall conform to the applicable material specification.

3.4 Quality

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

3.4.2 Rings shall be subject to nondestructive testing as agreed upon by purchaser and vendor.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of rings shall supply all samples and shall be responsible for the performance of all required tests. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the rings conform to specified requirements.

4.2 Classification of Tests

Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and as preproduction tests.

4.3 Sampling

Shall be in accordance with AMS 2355.

4.4 Approval

4.4.1 Sample parts shall be approved by purchaser as in 4.4.2, unless such approval is waived.

4.4.2 When a new vendor is being considered, new welding equipment is being placed in operation, settings on an old machine are changed, or changes in joint size of shape are made, the welding procedure shall be approved in the following manner: One or more rings from the first shipment of each size ring shall be selected at random. The ring or rings shall be subjected to tensile tests, hardness determinations, and examination of structure. If the requirements of 3.3.1 and 3.3.2 are met and the structure of the weld is satisfactory, the equipment and procedure will be considered satisfactory for making that weld.

4.4.3 Vendor shall use the same size, type, and shape of stock, type of forming equipment, heating cycles for forming and preheating, welding schedule (except that current settings may be changed by ± 10%), heating and cooling procedures and atmospheres for heat treatment, cleaning operations, and methods of routine inspection for production rings as for approved sample rings. If necessary to make any change in any of these factors, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested, sample rings. Production rings incorporating the revised operations shall not be shipped prior to receipt of reapproval.

4.5 Reports

4.5.1 The vendor of welded rings shall furnish with each shipment a report showing the results of tests for tensile properties and hardness of each lot. This report shall include the purchase order number, AMS 7488E, lot number and quantity from each lot. When material for making rings is produced or purchased by the ring vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of the applicable material specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 7488E, contractor or other direct supplier of welded rings, part number, and quantity. When welded rings for making parts are produced or purchased by the parts vendor, that vendor shall inspect each lot of rings to determine conformance to the requirements of this specification and the applicable material specification, or shall include in the report a statement that the rings conform to both applicable specifications, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.6 Resampling and Retesting

Shall be in accordance with AMS 2355.

5. PREPARATION FOR DELIVERY

5.1 Identification

Rings shall be identified as agreed upon by purchaser and vendor.

5.2 Packaging

Rings shall be prepared for shipment in accordance with commercial practice to ensure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

6. ACKNOWLEDGMENT

A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS

Rings not conforming to this specification or to authorized modifications will be subject to rejection.