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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 7493K

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Superseding AMS 7493J

Rings, Flash Welded
Ferritic and Martensitic Corrosion-Resistant Steels

UNS S41000

1. SCOPE:

1.1 Form:

This specification covers flash welded rings made of ferritic and martensitic corrosion-resistant steels.

1.2 Application:

These rings have been used typically for parts, such as flanges, cases, and seal rings, requiring both corrosion and moderate heat resistance, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 5613	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing, and Rings, 12.5Cr (SAE 51410), Annealed
AMS 5616	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing, and Rings, 13Cr - 2.0Ni - 3.0W, Annealed

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 370 Mechanical Testing of Steel Products

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-2073-1 DOD Materiel, Procedures for Development and Application of Packaging Requirements

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Shall be a ferritic or martensitic corrosion-resistant steel 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 surface to be welded.

3.2.3 Welding: The ends of the formed rings shall be flash welded together with only one weld on each ring. Welding shall be performed on a machine provided with accurate control of feed of joint during flashing, rate and distance of travel of section 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 purpose 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 significant machine settings and sequence of operations for welding each different type (part number) ring shall be maintained by the vendor and made available for examination by purchaser upon written request.

3.2.4 Annealing: The welded rings shall be annealed by heating to a temperature within the range 1200 to 1500 °F (649 to 816 °C), holding at the selected temperature within ±25 °F (±14 °C) for not less than 1 hour, and cooling in air or faster. Rings made of AMS 5613 or AMS 5616 may be austenitized by heating to a temperature within the range 1750 to 1850 °F (954 to 1010 °C) and cooling to room temperature before annealing. Annealing shall precede sizing as in 3.2.5 except that non-hardenable steels may be sized before annealing.

3.2.4.1 When the drawing or material specification specifies the annealing cycle, the rings shall be annealed accordingly.

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. Each ring shall have flash and excess metal at the weld removed to 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. 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. The 1% minimum permanent expansion shall be verified by measurement on at least one ring from each welding lot. Sizing shall be performed to provide uniform stress distribution throughout the ring.

3.2.5.1 For rings made from product under 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.

3.2.6 When the drawing or applicable material specification requires additional heat treatment in addition to annealing, rings shall be so heat treated after proof testing in accordance with 3.2.5.

3.2.7 Restoration to Shape: If necessary to restore shape of rings following annealing or final heat treatment, such operations shall be done on suitable presses and not by localized blows as from a hammer. Except as specified in 3.2.7.1, rings may be reheated for such operation but shall not be heated to a temperature higher than any prior tempering temperature.

3.2.7.1 Restoration to shape may be performed in conjunction with cooling from a heat treatment operation by placing the ring on a press which will produce slight (approximately 1/4%) expansion or compression of the ring diameter and flattening of the ring.

3.3 Properties:

Rings shall conform to the following requirements, determined in accordance with ASTM A 370:

3.3.1 Tensile Properties Through Welded Area: Shall be as follows, determined on specimens cut, after final heat treatment of the lot, from welded rings processed to this specification. Tensile testing will not be required on rings made from product under 0.188 inch (4.78 mm) in nominal thickness.

3.3.1.1 Rings Having Specified Maximum Hardness Up to 241 HB, Inclusive, or Equivalent (See 8.2): Shall be as shown in Table 1.

TABLE 1 - Minimum Tensile Properties

Property	Value
Tensile Strength,	90% of parent metal in same ring
Elongation in 4D	60% of parent metal in same ring

3.3.1.2 Rings Having Specified Maximum Hardness Higher than 241 HB or Equivalent (See 8.2): Shall be as shown in Table 2.

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	90% of parent metal in same ring
Elongation in 4D	50% of parent metal in same ring

3.3.1.3 Rings not conforming to 3.3.1.1 or 3.3.1.2 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: Unless otherwise specified, rings shall have hardness not higher than 241 HB, or equivalent (See 8.2).

3.4 Quality:

3.4.1 Rings, 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 rings.

3.4.2 Rings shall be subjected to nondestructive testing. Method of testing and standards for acceptance shall be agreed upon by purchaser and vendor.

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 preproduction tests and shall be performed prior to or on the initial shipment of rings to a purchaser, on each heat or lot as applicable, when a change in material and/or processing requires reapproval as in 4.4.3, and when purchaser deems confirmatory testing to be required.

4.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.