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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

# AEROSPACE STANDARD

SAE AS7325

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Superseding AMS 7325E

## GASKET, METAL O-RING
## Corrosion and Heat Resistant Steel
## Procurement Specification For

FSC 5330

1. SCOPE:

1.1 Type:

This procurement specification covers tubular sealing rings, commonly named METAL O-RING GASKETS, made from a corrosion and heat resistant steel tubing of the type identified under the Unified Numbering System as UNS S32100.

1.3 Application:

Primarily for sealing fluid systems, such as air, at temperatures where the operating conditions are too severe for conventional elastomeric O-ring seals.

2. REFERENCES:

2.1 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 documents shall be the issue in effect on the date of the purchase order.

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

AMS 2410 Plating, Silver, Nickel Strike, High Bake
AMS 2635 Radiographic Inspection
AMS 2645 Fluorescent Penetrant Inspection
AMS 5570 Steel Tubing, Seamless, Corrosion and Heat Resistant, 18Cr-11Ni-0.40Ti (SAE 30321), Solution Heat Treated
AMS 5576 Steel Tubing, Welded, Corrosion and Heat Resistant, 18Cr-10.5Ni-0.40Ti (SAE 30321), Solution Heat Treated

ARP674 Groove Design, Metal O-ring Gasket

2.1.2 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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

| | |
|---|---|
| MS9141 | Gasket, Metal O-ring, .035 Tube x .006 Wall, CRES |
| MS9142 | Gasket, Metal O-ring, .062 Tube x .006 Wall, CRES |
| MS9202 | Gasket, Metal O-ring, .062 Tube x .010 Wall, CRES |
| MS9203 | Gasket, Metal O-ring, .094 Tube x .006 Wall, CRES |
| MS9204 | Gasket, Metal O-ring, .094 Tube x .010 Wall, CRES |
| MS9205 | Gasket, Metal O-ring, .125 Tube x .010 Wall, CRES |
| MS9371 | Gasket, Metal O-ring, .035 Tube x .006 Wall, Silver Plated |
| MS9372 | Gasket, Metal O-ring, .062 Tube x .006 Wall, Silver Plated |
| MS9373 | Gasket, Metal O-ring, .062 Tube x .010 Wall, Silver Plated |
| MS9374 | Gasket, Metal O-ring, .094 Tube x .006 Wall, Silver Plated |
| MS9375 | Gasket, Metal O-ring, .094 Tube x .010 Wall, Silver Plated |
| MS9376 | Gasket, Metal O-ring, .125 Tube x .010 Wall, Silver Plated |

2.2 Definitions:

DEFECTIVE: A defective is a unit of product which contains one or more defects.

PRODUCTION INSPECTION LOT: Shall be all finished parts of the same part number, made from a single heat of alloy, heat treated at the same time to the same specified condition, produced as one continuous run, and submitted for vendor's inspection at the same time.

2.3 Unit Symbols:

% - percent (1% = 1/100)
°F - degree Fahrenheit
° - degree, angular
sp gr - specific gravity

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Shall be AMS 5570 or AMS 5576 steel tubing.

3.2 Design:

Unless otherwise specified on the part drawing, dimensions shall conform to the applicable MS standard listed in 2.1.2.

3.2.1 Plating: Gaskets requiring silver plating in accordance with AMS 2410 shall have plating thickness of 0.0010 to 0.0015 inch. Unless otherwise specified on the part drawing, dimensions apply before plating.

3.3 Fabrication:

3.3.1 Forming: Tubing shall be formed into rings by a suitable rolling or forming process.

3.3.2 Preparation for Welding: Formed rings shall be clean and free from foreign materials at the tubing ends to be butt welded.

3.3.3 Welding: The ends of the formed rings shall be welded by flash butt welding or resistance welding. The weld process shall be so performed and controlled as to prevent misalignment of tubing ends and formation of excessive internal weld flash.

3.3.4 Removal of Weld Flash: The outer diameter welding flash shall be removed with a smooth blend to adjacent surfaces within 0.125 inch of weld. For the MS standard gaskets listed in 2.1.2, dimensions at the blend shall be not more than 0.003 inch below the surfaces away from the blend; for other gaskets, the maximum reduction in cross-section outside diameter of the tube in the flash removal area shall be as specified on the part drawing. If specified on the part drawing, the minimum wall thickness after flash removal shall not be below the specified requirement.

3.3.5 Final Forming: After weld flash removal as in 3.3.4, the welded rings may be formed by coining to meet the axial dimension of the cross-section outside diameter, and by rolling to meet the roundness requirement of the gasket OD, specified on the part drawing.

3.3.6 Cleaning: Finished parts that are to remain unplated shall be degreased and then immersed in one of the following solutions for the time and temperature shown:

a. One volume of nitric acid (sp gr 1.42) and 9 volumes of water for not less than 20 minutes at room temperature.

b. One volume of nitric acid (sp gr 1.42) and 4 volumes of water for 30 to 40 minutes at room temperature.

c. One volume of nitric acid (sp gr 1.42) and 4 volumes of water for 10 to 15 minutes at 140 to 160 °F.

3.4 Properties:

Gaskets shall conform to the following requirements:

3.4.1 Compression Deflection: The load required to compress the gasket at the weld to the minimum gland depth as specified in Table 1 shall not exceed the average of the loads required to compress to the same gland depth at two points away from the weld by more than the specified maximum load increase. Only one determination of load away from the weld shall be made on rings under 4 inches in circumference. Determinations shall be as in 3.4.1.1.

TABLE 1 - Compression Load Increase

| Nominal Tube OD inch | Nominal Wall Thickness inch | Gland Depth Minimum inch | Load Increase % Maximum |
|---|---|---|---|
| 0.035 | 0.006 | 0.023 | 50 |
| 0.062 | 0.006 | 0.045 | 40 |
| 0.062 | 0.010 | 0.045 | 50 |
| 0.094 | 0.006 | 0.074 | 35 |
| 0.094 | 0.010 | 0.074 | 40 |
| 0.125 | 0.010 | 0.100 | 35 |

3.4.1.1 A specimen of at least 4 inches of the circumference shall be cut from a gasket or an entire ring shall be used as the specimen. The specimen shall be held flat on the support plate while being compressed. The support plate shall be so designed that the area of the ring being compressed rests on a 0.250 inch ± 0.010 inch diameter surface (see Figure 1). The specimen shall be compressed to the minimum gland depth at two points, when size permits, at least 1 inch on either side of the weld, and the average load determined. The specimen shall then be compressed to the minimum gland depth at the weld. Load shall be applied through the flat end of a 0.250 inch ± 0.010 inch diameter rod. In accordance with ARP674, the minimum gland depth as specified in Table 1 shall be the same for the plated gaskets and unplated gaskets.

3.5 Identification Marking:

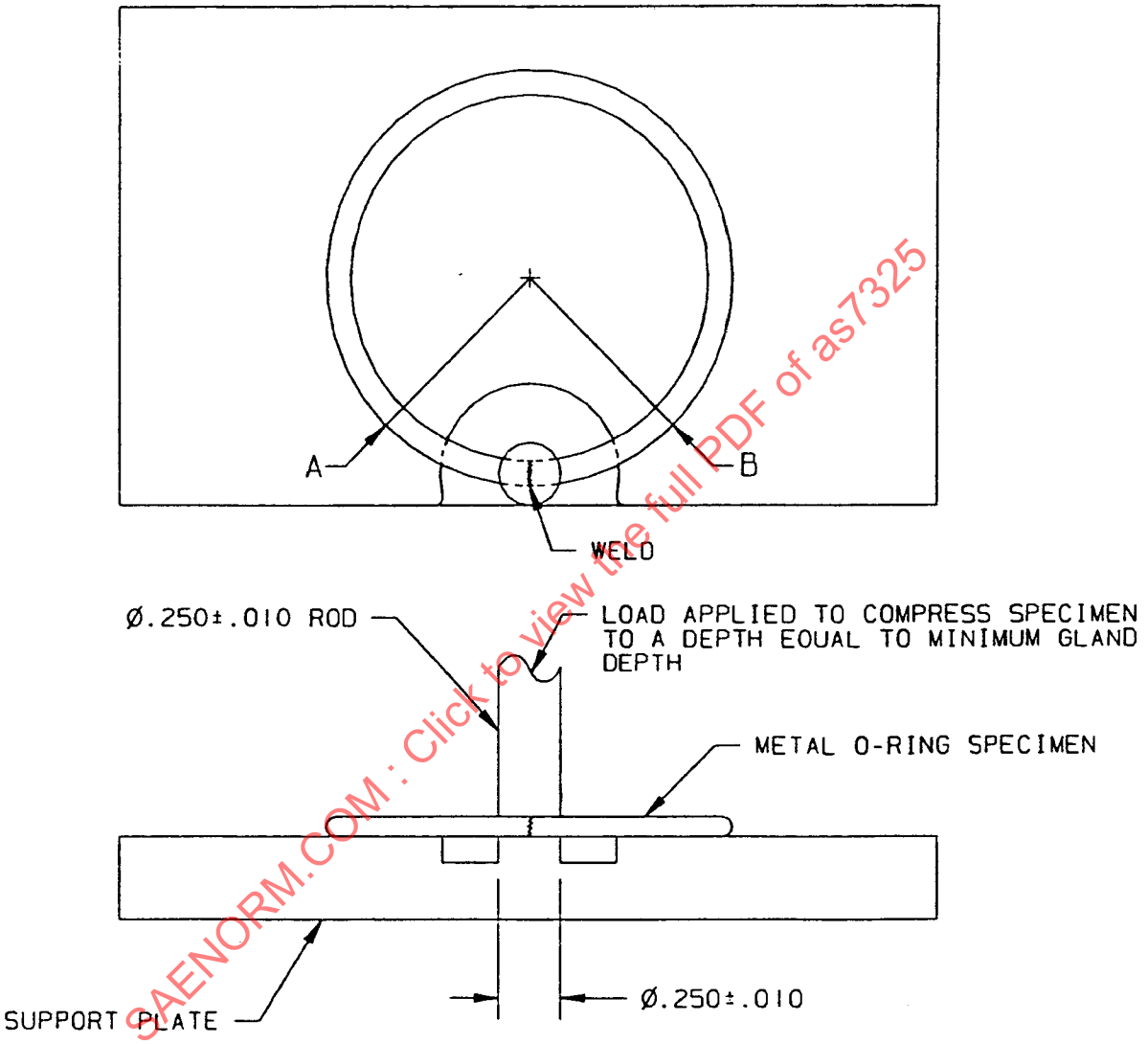
No marking is permitted on the part, except as required in 3.6.1.1. The part number and lot number shall be marked on an adhesive label and applied to the inner package (see 5.1).

3.6 Quality:

Gaskets, as received by purchaser, shall be uniform in quality and condition, clean, sound, smooth, and free from foreign materials and from imperfections detrimental to usage of the gaskets. Weld shall show complete fusion through the joint.

3.6.1 Gaskets shall be produced under radiographic control. This control shall consist of radiographic examination of the weld joint in accordance with AMS 2635 until proper welding technique, which will produce gaskets with weld joints free from harmful imperfections, is established for each part number of production gaskets, as necessary to ensure maintenance of satisfactory quality.

3.6.1.1 To assist in locating the weld, each gasket 2.500 inch and over in outside diameter shall bear a mark of yellow paint or ink on the outside diameter located 180° ± 10° from the weld.






RECORD LOAD TO COMPRESS METAL O-RING SPECIMEN TO A DEPTH EQUAL TO MINIMUM GLAND DEPTH (SEE TABLE 1) AT POINTS A AND B, AND THEN AT THE WELD. POINTS A AND B ARE ABOUT 1.00 INCH AWAY FROM THE WELD.

FIGURE 1 - Compression Deflection Test

3.6.2 Fluorescent Penetrant Inspection: Parts shall be fluorescent penetrant inspected in accordance with AMS 2645; any required plating shall be removed for this inspection. Parts shall be free of cracks, laps, seams, inclusions, and flaws.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of parts shall supply all samples for vendor's test and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the parts conform to the requirements of this specification.

4.2 Responsibility for Compliance:

The manufacturer's system for parts production shall be based on preventing product defects, rather than detecting the defects at final inspection and then requiring corrective action to be invoked. An effective manufacturing in-process control system shall be established, subject to the approval of the purchaser, and used during the production of parts.

4.3 Production Acceptance Tests:

The purpose of production acceptance tests is to check, as simply as possible, using a method which is inexpensive and representative of the part usage, with the uncertainty inherent in random sampling, that the parts comprising a production inspection lot satisfy the requirements of this specification.

4.3.1 Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each production inspection lot. A summary of acceptance tests is specified in Table 2.

4.4 Acceptance Test Sampling:

4.4.1 Material: Sampling shall be in accordance with AMS 5570 and AMS 5576.

4.4.2 Nondestructive Tests - Visual and Dimensional: A random sample shall be selected from each production inspection lot; the size of the sample shall be as specified in Table 3. Classification of inspection characteristics shall be as specified in Table 4. All dimensional characteristics are considered defective when out of tolerance.

CAUTION: Use extra care not to damage the seals in handling. Clean, lint-free gloves should be used during handling to prevent any residue from adhering to the gaskets. Micrometers which have a broad flat anvil to distribute the load should be used to measure the parts rather than verniers which would be apt to dig into the plating.

TABLE 2 - Summary of Acceptance Tests

| Characteristic | Req. Para. | Sample Size | Test Method |
|---|---|---|---|
| **Nondestructive Tests** | | | |
| Design & Dimensions | 3.2 | Tables 3 & 4 | Conventional measuring methods |
| Plating | 3.2.1 | Table 5 | Per AMS 2410 |
| Fluorescent Penetrant Inspection | 3.6.2 | Tables 3 & 4 | Per AMS 2645 |
| Quality | 3.6 | Tables 3 & 4 | Visual |
| Packaging and Identification | 5.1 | None | Visual |
| Radiographic Inspection | 3.6.1 | Table 5 | Per AMS 2635 |
| **Destructive Tests** | | | |
| Material Composition | 3.1 | 4.4.1 | Per material specification |
| Compression Deflection | 3.4.1 | Table 5 | Per 3.4.1 |



TABLE 3 - Sampling Data

Nondestructive Tests
Visual and Dimensional Characteristics
For Classes Major A, Major B, Minor A, and Minor B

| Production Inspection Lot | Major A Sample Size | Major B Sample Size | Minor A Sample Size | Minor B Sample Size |
|---|---|---|---|---|
| 2 to 8 | All | All | 5 | 3 |
| 9 to 15 | All | 13 | 5 | 3 |
| 16 to 25 | All | 13 | 5 | 3 |
| 26 to 50 | All | 13 | 5 | 5 |
| 51 to 90 | 80 | 13 | 7 | 6 |
| 91 to 150 | 80 | 13 | 11 | 7 |
| 151 to 280 | 80 | 20 | 13 | 10 |
| 281 to 500 | 80 | 29 | 16 | 11 |
| 501 to 1200 | 80 | 34 | 19 | 15 |
| 1201 to 3200 | 120 | 42 | 23 | 18 |
| 3201 to 10000 | 189 | 50 | 29 | 22 |
| 10001 to 35000 | 189 | 60 | 35 | 29 |
| 35001 to 150000 | 218 | 74 | 40 | 29 |
| 150001 to 500000 | 270 | 90 | 40 | 29 |
| 500001 & over | 303 | 102 | 40 | 29 |

TABLE 4 - Classification of Visual and Dimensional Characteristics

| Class | Characteristic |
|---|---|
| Major A | |
| 101 | Surface discontinuities revealed by fluorescent penetrant inspection. |
| 102 | Surface texture, sealing surface. |
| 103 | Face thickness after coining. |
| Major B | |
| 201 | Face thickness in weld blend area. |
| 202 | Flatness. |
| 203 | Free state roundness of gasket OD. |
| 204 | Quality of weld fusion. |
| 205 | Plating thickness, if applicable. |
| Minor A | |
| 301 | Compression load increase in weld area. |
| 302 | Tube wall thickness. |
| 303 | Gasket outside diameter limits. |
| Minor B | |
| 401 | Other dimensional characteristics not listed. |



4.4.3 Fluorescent Penetrant Inspection: A random sample shall be selected from each production inspection lot; the size of the sample shall be as specified in Table 3. The classification of inspection characteristics shall be as specified in Table 4. The sample units may be selected from those that have been subjected to and passed the visual and dimensional inspection, with additional units selected at random from the production inspection lot as necessary.

4.4.4 Radiographic Inspection: A random sample of parts shall be selected from each production inspection lot; the size of the sample to be as specified in Table 5. The sample units may be selected from those that have been subjected to and passed the visual and dimensional tests with additional units selected at random from the production inspection lot as necessary.

TABLE 5 - Sampling Data

Destructive Tests,
Mechanical and Metallurgical Characteristics

| Production Inspection Lot | Sample Size |
|---|---|
| Up to 500 | 3 |
| 501 to 3200 | 5 |
| 3201 to 35000 | 8 |
| 35001 & over | 13 |