Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 7310F
Superseding AMS 7310E
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PISTON RINGS, CAST IRON

1. SCOPE:

1.1 Type: This specification covers piston rings made from individual castings of cast iron.

1.2 Application: Primarily for use as compression rings, oil scraper rings, and dual oil control rings in aircraft piston engines.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM A247 - Evaluating the Microstructure of Graphite in Iron Castings
ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E351 - Chemical Analysis of Cast Iron - All Types

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E351, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Total Carbon	3.50	3.90
Silicon	2.20	3.10
Manganese	0.40	0.80
Phosphorus	0.30	0.80
Sulfur	--	0.13

3.1.1 Alloying elements may be added, with the approval of the purchaser, to produce a high-quality iron meeting the requirements of this specification.

3.2 Fabrication: Rings shall be machined from individual castings, in the as-cast condition.

3.2.1 Finish: Sides of rings shall be ground or lapped. Periphery shall be turned smooth.

3.3 Properties:

3.3.1 Finished Rings:

Ø 3.3.1.1 Hardness: Shall be 97 - 104 HRB or equivalent, determined in accordance with ASTM E18.

3.3.1.2 Microstructure: Shall be free from abnormal segregation. Matrices shall be essentially fine pearlite with no appreciable amounts of massive cementite, determined in accordance with ASTM A247. Both phosphide eutectic and graphite shall be evenly distributed and the latter shall be present for the most part in the form of randomly oriented flakes.

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3.3.1.3 Circularity: The diameter through the gap shall exceed the diameter 90 deg (1.57 rad) from the gap by not less than 0.0025 in. per inch (0.0025 mm/mm) of nominal ring diameter when finished ring is held around its periphery by a flexible steel band 0.0045 - 0.0055 in. (0.114 - 0.140 mm) thick and of a width approximately equal to that of the ring and whose inside circumference is equal to the nominal outside circumference of the ring ±0.003 in. (±0.08 mm).

3.3.1.4 Light-Tightness of Periphery: When finished ring is placed in a circular gage whose ID is equal to the nominal OD of the ring ±0.0005 in. (±0.013 mm), the portion of the periphery on each side of the gap equal to 20% of the nominal OD of the ring shall be light-tight. The space between the balance of ring periphery and ID of gage shall be not greater than 0.0005 in. (0.013 mm) at any point and not less than 85% of the periphery of the ring shall be light-tight. Intermittent or fuzzy light shall be considered the same as light-tight.

3.3.1.5 Flatness: When weight of not more than 0.50 lb per inch (8.9 kg/m) of nominal OD of ring is applied to a ring supported in a gage having the same nominal diameter +0.001 in. (+0.03 mm), -0.000, and having the same interior angle as the nominal angle between side face and periphery of ring, the ring shall show at least line contact around not less than 85% of the side face of the ring, determined by light gage, bluing, or other acceptable method. This contact may be anywhere between the inside and outside circumference and may vary between these limits on any one ring. This contact shall indicate that ring side faces are not wavy.

3.4 Quality: Rings shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to their performance.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of rings shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that the rings conform to the requirements of this specification.

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4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.

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4.3 Sampling: Shall be in accordance with the following:

4.3.1 Composition: At least one sample from each melt. If composition is determined on the melt, a chilled pencil-type specimen is preferred for carbon determinations but other types of samples of proven accuracy may be used. If composition is determined on rings or ring castings, a solid sample cut from the ring or casting shall be used.

4.3.2 Hardness: Not less than one ring of each part number in each shipment.

4.3.3 Dimensional Requirements: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample rings shall be approved by purchaser before rings for production use are supplied, unless such approval be waived.

4.4.2 Vendor shall use manufacturing procedures, processes, and methods of inspection on production rings which are essentially the same as those used on the approved sample rings. If any change is necessary in manufacturing procedures or processes, vendor shall submit for reapproval of the process a statement of the proposed changes in operations and, when requested, rings produced by the revised procedure. No rings made by the revised procedure shall be shipped prior to receipt of reapproval.

4.5 Reports:

4.5.1 The vendor, before the first shipment on each purchase order, shall furnish three copies of a statement that the rings will conform to the chemical composition and properties specified. This report shall include the purchase order number, material specification number and its revision letter, and part number.

4.5.2 The vendor shall furnish to the purchaser one copy of a weekly cumulative report showing the chemical composition and mechanical properties of typical rings cast during the period.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the rings may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the rings represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Protective Treatment: Rings shall be protected, during shipment and storage, by coating with a suitable corrosion-preventive compound which is readily removable in hydrocarbon solvents.

5.2 Packaging and Identification:

5.2.1 Each ring shall be packaged in a grease and oil-resistant envelope or a group of rings shall be roll-wrapped in such a manner as to ensure that the ring, during shipment and storage, will be protected against mechanical injury.

5.2.2 Packages of rings shall be prepared for shipment in accordance with commerical practice to assure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.