

Submitted for recognition as an American National Standard

**ALLOY PM SHAPES, CORROSION, WEAR, AND HEAT RESISTANT
60Co - 29Cr - 4.5W (0.90 - 1.40C)**

1. SCOPE:

1.1 Form: This specification covers a corrosion, wear, and heat resistant cobalt alloy in the form of powder-metallurgy shapes.

1.2 Application: Primarily for parts, such as nozzles, rubbing seals, rollers, guides, and supports, requiring wear, corrosion, and oxidation resistance for use up to 1600°F (870°C).

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

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2269 - Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys

AMS 2350 - Standards and Test Methods

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

ASTM B328 - Density and Interconnected Porosity of Sintered Powder Metal Structural Parts and Oil-Impregnated Bearings

ASTM E3 - Preparation of Metallographic Specimens

ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic and Other Similar Iron, Nickel, and Cobalt Alloys

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

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shapes shall be produced by consolidation of powder and sintering to produce shapes meeting the requirements of 3.2, 3.4, and 3.5.

3.2 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E354 or by spectrographic or other analytical methods approved by purchaser:

	min	max
Carbon	0.90	1.40
Manganese	--	1.00
Silicon	--	1.50
Chromium	27.00	31.00
Tungsten	3.50	5.50
Nickel	--	3.00
Boron	--	1.00
Iron	--	3.00
Cobalt	remainder	

3.2.1 Check Analysis: Composition variations shall meet the requirements of AMS 2269.

3.3 Condition: As pressed and sintered or as extruded and sintered.

3.4 Properties: Shapes shall conform to the following requirements:

3.4.1 Hardness: Shall be not lower than 38 HRC or equivalent, determined in accordance with ASTM E18.

3.4.2 Density: Shall be not lower than 0.288 lb per cu in. (7.96 gm/cm³), determined in accordance with ASTM E328 or by other method agreed upon by purchaser and vendor.

3.4.3 Metallographic Examination: Shapes examined metallographically in accordance with ASTM E3 shall show no evidence of original powder particle shape. Specimens shall be examined at the center of the thickest section. Porosity, if present, shall be distributed uniformly. Shapes shall be free from cracks and evidence of contamination. Surface shall be free of oxidation resulting from sintering.

3.4.4 Porosity: Porosity, if detected, shall be uniformly distributed with pores no larger than 0.010 in. (0.25 mm).

3.5 Quality: Shapes, as received by purchaser, shall be uniform in quality and condition, clean, sound, and free from foreign materials and from imperfections detrimental to usage of the shapes.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of shapes shall supply all samples for vendor's tests 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 sample and to perform any confirmatory testing deemed necessary to ensure that the shapes conform to the requirements of this specification.

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 and shall be performed prior to or on the initial shipment of shapes to a purchaser, on each lot, when a change in material, processing, or both requires reapproval as in 4.4.2, 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 shapes shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Two shapes each for hardness and density of each lot.

4.3.2 One shape for metallographic examination from each lot.

4.4 Approval:

4.4.1 Sample shapes from new or reworked tooling and the processing procedure shall be approved by purchaser before shapes for production use are supplied, unless such approval be waived by purchaser. Results of tests on production shapes shall be essentially equivalent to those on the approved sample shapes.

4.4.2 Vendor shall establish for production of sample shapes of each part number parameters for the process control factors which will produce acceptable shapes; these shall constitute the approved processing procedure and shall be used for producing production shapes. If necessary to make any change in parameters for the process control factors, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested, sample shapes. Production shapes incorporating the revised operations shall not be shipped prior to receipt of reapproval.

4.4.2.1 Control factors for producing consolidated and sintered shapes include, but are not limited to, the following:

- Source of powder, processing, and properties
- Type of compaction equipment
- Processing sequence or number of operations, including thermal operations that would result in different cross-sectional structure
- Protective atmosphere
- Secondary finishing and cleaning operations
- Methods of inspection

4.4.2.1.1 Any of the above process control factors for which parameters are considered proprietary by the vendor may be assigned a code designation. Each variation in such parameters shall be assigned a modified code designation. The vendor shall maintain complete records of all proprietary processes and parameters.

4.5 Reports:

4.5.1 The vendor of the shapes shall furnish with each shipment a report showing the results of tests for chemical composition of each lot and the results of tests to determine conformance to the other technical requirements of this specification. This report shall include the purchase order number, lot number, AMS 7239, powder source and powder lot number, part number, and quantity.

4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 7239, contractor or other direct supplier of shapes, lot number, powder lot number, part number, and quantity. When shapes for making parts are produced or purchased by the parts vendor, that vendor shall inspect each lot of shapes to determine conformance to the requirements of this specification and shall include in the report either a statement that the shapes conform or copies of laboratory reports showing the results of tests to determine conformance.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the shapes 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 shapes represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Shall be as agreed upon by purchaser and vendor.

5.2 Packaging: