

**MAGNETIC ALLOY BARS, TUBING, AND FORGINGS
50Ni - 50Fe**

UNS K95000

1. SCOPE:

1.1 Form: This specification covers a magnetic nickel-iron alloy in the form of bars, rods, tubing, forgings, and forging stock.

1.2 Application: Primarily for parts used in magnetic circuits requiring high magnetic permeability and saturation induction after high temperature annealing in hydrogen.

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 documents shall be as specified in AMS 2350.

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

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2.1.1 Aerospace Material Specifications:

AMS 2241 - Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire

MAM 2241 - Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium and Titanium Alloy Bars and Wire

AMS 2243 - Tolerances, Corrosion and Heat Resistant Steel Tubing

MAM 2243 - Tolerances, Metric, Corrosion and Heat Resistant Steel Tubing

AMS 2350 - Standards and Test Methods

AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock

AMS 2374 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Forgings and Forging Stock

AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys

AMS 2808 - Identification, Forgings

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

ASTM A596 - Direct-Current Magnetic Properties of Materials Using Ring Test Procedures and the Ballistic Methods

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

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-163 - Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall be an alloy containing approximately 50% nickel and 50% iron with other alloying elements in such proportions as required to provide a product meeting the requirements of 3.3.

3.2 Condition: The product shall be supplied in the following condition:

3.2.1 Bars, Rods, and Tubing: Cold drawn, annealed, and centerless ground:
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3.2.2 Forgings: As ordered.

3.2.3 Forging Stock: As ordered by the forging manufacturer.

3.3 Properties: The product shall conform to the following requirements:

3.3.1 Hardness: Shall be as follows, determined in accordance with ASTM E18:

3.3.1.1 Bars and forgings 0.50 inch (12.7 mm) and under in nominal diameter or cross-sectional thickness and tubing shall have hardness not lower than 90 HRB.

3.3.1.2 Bars and forgings over 0.50 inch (12.7 mm) in nominal diameter or cross-sectional thickness shall have hardness not lower than 75 HRB.

3.3.2 Magnetic Properties: Shall be as follows, determined in accordance with
 Ø ASTM A596 on specimens as in 4.3.1 annealed by heating to $2150^{\circ}\text{F} \pm 25$ ($1177^{\circ}\text{C} \pm 14$) in a non-contaminating atmosphere having a dew point of -60°F (-51°C) or lower, holding at heat for 4 hours ± 0.25 , and cooling in a non-contaminating atmosphere at a rate not greater than 100 F (56 C) degrees per hour to 800°F (427°C) or lower or at a cooling rate recommended by the alloy producer:

3.3.2.1 Maximum Permeability: Shall be 50,000, minimum.

3.3.2.2 Permeability at 100 Gauss (0.01 T), minimum

Nominal Diameter or Distance Between Parallel Sides		
Inches	Millimetres	
Up to 5/16, excl	Up to 7.9, excl	6,000
5/16 and Over	7.9 and Over	4,000

3.3.2.3 Induction at 100 Oersteds (7958 A/m), minimum 15,000 gauss (1.5 T)

3.3.2.4 Coercive Force (Hc) From 10,000 Gauss (1.0 T), 0.070 Oersteds
 Ø maximum (5.57 A/m)

3.4 Quality: The product, 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 product.

3.5 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars, rods, and tubing will be acceptable in mill lengths of 6 - 20 feet (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 feet (3 m).

3.6 Tolerances: Shall conform to all applicable requirements of the following:

3.6.1 Bars and Rods: AMS 2241 or MAM 2241.

3.6.2 Tubing: AMS 2243 or MAM 2243.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product 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 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms 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 shall be performed on each lot.

4.3 Sampling: Shall be in accordance with the following; a lot shall be all product of the same nominal size from the same heat of alloy:

4.3.1 Bars, Rods, and Tubing: AMS 2371.

4.3.2 Forgings and Forging Stock: AMS 2374.

4.3.3 Samples for magnetic properties testing (3.3.2) shall be taken at random from finished product of the same nominal thickness from the same heat of alloy.

4.4 Reports: The vendor of the product shall furnish with each shipment a report showing the results of tests for hardness of each lot and the magnetic properties of each heat. This report shall include the purchase order number, heat number, AMS 7718C, cooling rate if other than 100 F (56 C) degrees per hour, thickness of sample used for magnetic properties testing, size, and quantity. If forgings are supplied, the part number and the size and melt source of stock used to make the forgings shall also be included.

4.5 Resampling and Retesting: Shall be in accordance with the following:

4.5.1 Bars, Rods, and Tubing: AMS 2371.

4.5.2 Forgings and Forging Stock: AMS 2374.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Shall be as follows:

5.1.1 Bars, Rods, and Tubing: In accordance with AMS 2806.

5.1.2 Forgings: In accordance with AMS 2808.

5.1.3 Forging Stock: As agreed upon by purchaser and vendor.