SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5772B

Issued 5-15-71
Revised 1-1-89

Superseding AMS 5772A

ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT
40Co - 22Cr - 22Ni - 14.5W - 0.07 La
Solution Heat Treated

UNS R30188

SAENORM.COM : Click to view the full PDF of ams5772b

1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant cobalt alloy in the form of bars, forgings, flash welded rings, and stock for forging or flash welded rings.

1.2 Appplication: Primarily for parts requiring high strength up to 1800°F (982°C) and oxidation resistance up to 2000°F (1093°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 2261 - Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars and Forging Stock
MAM 2261 - Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Bars and Forging Stock
AMS 2350 - Standards and Test Methods
AMS 2269 - Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys
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 2375 - Control of Forgings Requiring First Article Approval

SAE Technical Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

AMS documents are protected under United States and international copyright laws. Reproduction of these documents by any means is strictly prohibited without the written consent of the publisher.

Copyright 1989 Society of Automotive Engineers, Inc.
All rights reserved.

Printed in U.S.A.

2.1.1 Aerospace Material Specifications (Cont'd.):

AMS 2750 - Pyrometry
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
AMS 7490 - Rings, Flash Welded, Corrosion and Heat Resistant Austenitic Steels and Austenitic-Type Alloys

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

ASTM E8 - Tension Testing of Metallic Materials
ASTM E8M - Tension Testing of Metallic Materials (Metric)
ASTM E10 - Brinell Hardness of Metallic Materials
ASTM E139 - Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

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 conform to the following percentages by weight, Ø determined by wet chemical methods in accordance with ASTM E354, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Carbon	0.05	0.15
Manganese	--	1.25
Silicon	0.20	0.50
Phosphorus	--	0.020
Sulfur	--	0.015
Chromium	20.00	24.00
Nickel	20.00	24.00
Tungsten	13.00	16.00
Lanthanum	0.02	0.12
Boron	--	0.015
Iron	--	3.00
Cobalt	remainder	

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

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

SAENORM.COM : Click to view the full PDF of ams5772b

3.2.1 Bars: Hot finished and solution heat treated; round bars shall be ground or turned.

3.2.2 Forgings and Flash Welded Rings: Solution heat treated. Surface finish shall be as agreed upon by purchaser and the forging or flash welded ring manufacturer.

3.2.2.1 Flash welded rings shall not be supplied unless specified or permitted on purchaser's part drawing. When supplied, rings shall be manufactured in accordance with AMS 7490.

3.2.3 Stock for Forging or Flash Welded Rings: As ordered by the forging or flash welded ring manufacturer.

3.3 Heat Treatment: Bars, forgings, and flash welded rings shall be solution Ø heat treated by heating to 2150°F ± 25 (1177°C ± 14), holding at heat for a time commensurate with cross-sectional thickness, and cooling at a rate which will produce product meeting the requirements of 3.4.1.1, 3.4.1.2, and 3.4.1.3. Pyrometry shall be in accordance with AMS 2750.

3.3.1 Any thermal treatment following solution heat treatment as in 3.3 shall not involve use of temperatures higher than 2050°F ± 25 (1121°C ± 14).

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

3.4.1 Bars, Forgings, and Flash Welded Rings:

3.4.1.1 Tensile Properties: Specimens taken in the longitudinal direction from bars, in the circumferential direction from parent metal of flash welded rings, and from forgings in locations agreed upon by purchaser and vendor shall have the following properties, determined in accordance with ASTM E8 or ASTM E8M:

Tensile Strength, minimum	125,000 psi (862 MPa)
Yield Strength at 0.2% Offset, minimum	55,000 psi (379 MPa)
Elongation in 4D, minimum	45%

3.4.1.2 Hardness: Shall be as follows, determined in accordance with ASTM E10:

3.4.1.2.1 Bars: Not higher than 302 HB, or equivalent, determined approximately midway between center and surface.

3.4.1.2.2 Forgings and Flash Welded Rings: Not higher than 293 HB, or equivalent.

3.4.1.3 Stress-Rupture Properties at 1700°F (927°C): A tensile specimen, maintained at 1700°F ± 3 (927°C ± 2) while a load sufficient to produce an initial axial stress of 13,000 psi (90 MPa) is applied continuously to specimens from bars and flash welded rings and of 12,000 psi (83 MPa) is similarly applied to specimens from forgings, shall not rupture in less than 23 hours. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than 15% in 4D. Test shall be conducted in accordance with ASTM E139.

SAENORM.COM : Click to view the full PDF of ams5772b

3.4.1.3.1 The test of 3.4.1.3 may be conducted using a load higher than required to produce the applicable initial axial stress specified in 3.4.1.3 but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in 3.4.1.3.

3.4.1.3.2 When permitted by purchaser, the test of 3.4.1.3 may be conducted using incremental loading. In such case, the load required to produce the applicable initial axial stress specified in 3.4.1.3 shall be used to rupture or for 23 hours, whichever occurs first. After the 23 hours and at intervals of 8 - 16 hours, preferably 8 - 10 hours, thereafter, the stress shall be increased in increments of 2000 psi (13.8 MPa). Time to rupture and elongation requirements shall be as specified in 3.4.1.3.

3.4.1.4 Oxidation Resistance: Shall be as follows, determined in accordance with 4.5.1:

3.4.1.4.1 Metal converted to oxide scale plus any continuous intergranular oxidation shall not exceed an average of 0.0015 inch (0.038 mm) per side or 0.003 inch (0.08 mm) per specimen.

3.4.1.4.2 Specimens displaying localized areas greater than 0.062 inch (1.57 mm) in diameter with excessive oxidation attack, unless such attack can be attributed to contact with ceramic supports, shall be considered invalid and the test repeated. If the condition is duplicated, the product is not acceptable.

3.4.2 Forging Stock: When a sample of stock is forged to a test coupon and solution heat treated as in 3.3, specimens taken from the heat treated coupon shall conform to the requirements of 3.4.1.1, 3.4.1.2.2, 3.4.1.3, and 3.4.1.4. If specimens taken from the stock after heat treatment as in 3.3 conform to the requirements of 3.4.1.1, 3.4.1.2.2, 3.4.1.3, and 3.4.1.4, the tests shall be accepted as equivalent to tests of a forged coupon.

3.4.3 Ø Stock for Flash Welded Rings: Specimens taken from the stock after solution heat treatment as in 3.3 shall conform to the requirements of 3.4.1.1, 3.4.1.2.2, 3.4.1.3, and 3.4.1.4.

3.5 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.

3.5.1 Ø Forgings shall have substantially uniform macrostructure. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.5.2 Ø Grain flow of die forgings, except in areas which contain flash-line end grain, shall follow the general contour of the forgings showing no evidence of re-entrant grain flow.

SAENORM.COM : Click to view the full PDF of ams5772b

3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars 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).

3.7 Tolerances: Bars and forging stock shall conform to all applicable requirements of AMS 2261 or MAM 2261.

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 4.6. 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:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.4.1.1), hardness (3.4.1.2), stress-rupture properties (3.4.1.3), and oxidation resistance (3.4.1.4) are classified as acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tests of forging stock (3.4.2) and of stock for flash welded rings (3.4.3) to demonstrate ability to develop required properties are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: Tests of forgings to determine conformance to all applicable technical requirements of this specification when AMS2375 is specified are classified as preproduction tests and shall be performed prior to or on the first-article shipment of a forging to a purchaser, when a change in material and/or processing requires reapproval as in 4.4, and when purchaser deems confirmatory testing to be required.

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

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Bars, Flash Welded Rings, and Stock for Flash Welded Rings: AMS 2371.

4.3.2 Forgings and Forging Stock: AMS 2374.

4.4 Approval: When specified, approval and control of forgings shall be in accordance with AMS 2375.

4.5 Test Methods:

SAENORM.COM : Click to view the full PDF of ams5772b