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400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5732H

Issued JAN 1963
Revised JUL 2001

Superseding AMS 5732G

Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing, and Rings
15Cr - 25.5Ni - 1.2Mo - 2.1Ti - 0.006B - 0.30V
Consumable Electrode Melted
1800 °F (982 °C) Solution and Precipitation Heat Treated

(Composition similar to UNS S66286)

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat resistant steel in the form of bars, wire, forgings, mechanical tubing, flash welded rings, and stock for forging, flash welded rings, or heading.

1.2 Application:

These products have been used typically for parts, such as turbine discs, shafts, spacers, dowels, and fittings, requiring moderate strength up to 1300 °F (704 °C) and oxidation resistance up to 1500 °F (816 °C), but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

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

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

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2.1 (Continued):

AMS 2248	Chemical Check Analysis Limits, Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2374	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steel and Alloy Forgings
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, Austenitic-Type Iron, Nickel, or Cobalt Alloys, or Precipitation-Hardenable Alloys

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 370	Mechanical Testing of Steel Products
ASTM E 139	Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E 292	Conducting Time-for-Rupture Notch Tension Tests of Materials
ASTM E 353	Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	--	0.08
Manganese	--	2.00
Silicon	--	1.00
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	13.50	16.00
Nickel	24.00	27.00
Molybdenum	1.00	1.50
Titanium	1.90	2.35
Boron	0.003	0.010
Vanadium	0.10	0.50
Cobalt	--	1.00
Aluminum	--	0.35
Copper	--	0.50

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2248.

3.2 Melting Practice:

Steel shall be produced by multiple melting using consumable electrode practice in the remelt cycle.

3.3 Condition:

The product shall be supplied in the following condition:

3.3.1 Bars, Wire, Forgings, Mechanical Tubing, and Flash Welded Rings: Solution and precipitation heat treated.

3.3.1.1 Bars and Wire:

3.3.1.1.1 All hexagons regardless of size, and other bars 2.750 inches (69.85 mm) and under in nominal diameter or least distance between parallel sides, and wire shall be cold finished.

3.3.1.1.2 Bars, other than hexagons, over 2.750 inches (69.85 mm) in nominal diameter or least distance between parallel sides shall be hot finished and descaled.

3.3.1.2 Forgings: Shall be descaled.

3.3.1.3 Mechanical Tubing: Shall be cold finished.

3.3.1.4 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.

3.3.2 Stock for Forging, Flash Welded Rings, or Heading: As ordered by the forging, flash welded ring, or heading manufacturer.

3.4 Heat Treatment:

Bars, wire, forgings, mechanical tubing, and flash welded rings shall be heat treated as follows; pyrometry shall be in accordance with AMS 2750:

3.4.1 Solution Heat Treatment: Heat to 1800 °F ± 25 (982 °C ± 14), hold at heat for a time commensurate with cross-sectional thickness, and quench in oil, water, or other medium acceptable to purchaser.

3.4.2 Precipitation Heat Treatment: Heat to a temperature within the range 1300 to 1400 °F (704 to 760 °C), hold at temperature for a total of not less than 16 hours, and cool at a rate equivalent to cooling in air.

3.5 Properties:

The product shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A 370:

3.5.1 Bars, Wire, Forgings, Mechanical Tubing, and Flash Welded Rings:

3.5.1.1 Tensile Properties: Shall be as shown in Table 2, except as permitted by 3.5.1.1.1, for product 5.00 inches (127.0 mm) and under in nominal diameter or least distance between parallel sides; requirements apply in both the longitudinal and transverse direction but tests in the transverse direction need be made only on product from which a specimen not less than 2.50 inches (63.5 mm) in length can be obtained. Tests in the longitudinal direction are not required on product tested in the transverse direction.

TABLE 2 - Minimum Room Temperature Tensile Properties

Property	Value
Tensile Strength	130 ksi (896 MPa)
Yield Strength at 0.2% Offset	85 ksi (586 MPa)
Elongation in 4D	15%
Reduction of Area	20%

3.5.1.1.1 When tensile specimens are machined from the center area of disk and hub forgings and this area lies within a 4-inch (102-mm) radius or 25% of the forging radius, whichever is the smaller dimension, elongation may be as low as 12% and reduction of area as low as 15%.

3.5.1.2 Hardness: Shall be 248 to 341 HB, or equivalent (See 8.2). Product shall not be rejected on the basis of hardness if the tensile properties of 3.5.1.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.5.1.3 Stress-Rupture Properties at 1200 °F (649 °C): Shall be as follows; testing of notched specimens and of combination smooth-and-notched specimens shall be performed in accordance with ASTM E 292 and of smooth specimens in accordance with ASTM E 139:

3.5.1.3.1 A standard cylindrical combination smooth-and-notched specimen conforming to ASTM E 292, maintained at 1200 °F ± 3 (649 °C ± 2) while a load sufficient to produce an initial axial stress of 70.0 ksi (483 MPa) or higher is applied continuously, shall not rupture in less than 23 hours. The test shall be continued to rupture without change of load. Rupture shall occur in the smooth section and elongation of this section after rupture, measured at room temperature, shall be not less than 5% in 4D if the specimen ruptures in 48 hours or less and not less than 3% in 4D if the specimen ruptures in more than 48 hours.

3.5.1.3.2 As an alternate procedure, separate smooth and notched specimens, machined from adjacent sections of the same piece, with gage sections conforming to the respective dimensions of ASTM E 292, may be tested individually under the conditions of 3.5.1.3.1. The smooth specimen shall not rupture in less than 23 hours and elongation after rupture, measured at room temperature, shall be as specified in 3.5.1.3.1. The notched specimen shall not rupture in less time than the companion smooth specimen but need not be tested to rupture.

3.5.1.3.3 The tests of 3.5.1.3.1 and 3.5.1.3.2 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 70.0 ksi (483 MPa) or higher shall be used to rupture or for 48 hours, whichever occurs first. After the 48 hours and at intervals of 8 to 16 hours, preferably 8 to 10 hours, thereafter, the stress shall be increased in increments of 5.0 ksi (34.5 MPa). Time to rupture, rupture location, and elongation requirements shall be as specified in 3.5.1.3.1.

3.5.1.3.4 For tubing from which a solid round specimen cannot be cut, a full section of tubing shall be tested and shall meet the smooth bar requirements of 3.5.1.3.1.

3.5.2 Forging Stock: When a sample of stock is forged to a test coupon and heat treated as in 3.4, specimens taken from the heat treated coupon shall conform to the requirements of 3.5.1.1, 3.5.1.2, and 3.5.1.3. If specimens taken from the stock after heat treatment as in 3.4 conform to the requirements of 3.5.1.1, 3.5.1.2, and 3.5.1.3, the tests shall be accepted as equivalent to tests of a forged coupon.

3.5.3 Stock for Flash Welded Rings or Heading: Specimens taken from the stock after heat treatment as in 3.4 shall conform to the requirements of 3.5.1.1, 3.5.1.2, and 3.5.1.3.

3.6 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.

3.6.1 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 reentrant grain flow.

3.7 Tolerances:

Shall be as follows:

3.7.1 Bars and Wire: In accordance with AMS 2241 or MAM 2241.

3.7.2 Mechanical Tubing: In accordance with 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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: The following requirements are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.1.1 Composition (3.1) of each heat.

4.2.1.2 Tensile properties (3.5.1.1), hardness (3.5.1.2), and stress-rupture properties (3.5.1.3) of each lot of bars, wire, forgings, mechanical tubing, and flash welded rings.

4.2.1.3 Tolerances (3.7) of bars, wire, and mechanical tubing.

4.2.2 Periodic Tests: Tests of forging stock (3.5.2) and of stock for flash welded rings or heading (3.5.3) to demonstrate ability to develop required properties, and for grain flow of die forgings (3.6.1) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 Bars, Wire, Mechanical Tubing, Flash Welded Rings, and Stock for Forging, Flash Welded Rings, or Heading: In accordance with AMS 2371.

4.3.2 Forgings: In accordance with AMS 2374.

4.4 Reports:

The vendor of the product shall furnish with each shipment a report showing the results of tests for chemical composition of each heat, and for tensile properties, hardness, and stress-rupture properties of each lot, and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS 5732H, size, quantity, and the specific precipitation heat treatment temperature used. If forgings are supplied, the size and melt source of stock used to make the forgings shall also be included.

4.5 Resampling and Retesting:

Shall be as follows:

4.5.1 Bars, Wire, Mechanical Tubing, Flash Welded Rings, and Stock for Forging, Flash Welded Rings, or Heading: In accordance with AMS 2371.

4.5.2 Forgings: In accordance with AMS 2374.

5. PREPARATION FOR DELIVERY:

5.1 Sizes:

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

5.2 Identification:

Shall be as follows:

5.2.1 Bars, Wire, and Mechanical Tubing: In accordance with AMS 2806.

5.2.2 Forgings: In accordance with AMS 2808.

5.2.3 Flash Welded Rings and Stock for Forging, Flash Welded Rings, or Heading: As agreed upon by purchaser and vendor.

5.3 Packaging:

The product shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the product to ensure carrier acceptance and safe delivery.

6. ACKNOWLEDGMENT:

A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS:

Product not conforming to this specification, or to modifications authorized by purchaser, will be subject to rejection.

8. NOTES:

8.1 A change bar (**l**) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this specification. An (R) symbol to the left of the document title indicates a complete revision of the specification, including technical revisions. Change bars and (R) are not used in original publications, nor in specifications that contain editorial changes only.

8.2 Hardness conversion tables for metals are presented in ASTM E 140.

8.3 Terms used in AMS are clarified in ARP1917 and as follows:

8.3.1 The term "mechanical tubing" as used in AMS means a heavy-walled cylindrical tubing, intended primarily for the machining of circular rings, flanges, shafts, etc, having a wall thickness which is a substantial proportion of the outer diameter; such tubing is not normally used for the transmission of fluids and parts made from it are usually machined all over. This product is sometimes known as "hollow bar".

8.4 Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

8.5 Purchase documents should specify not less than the following:

AMS 5732H
Form and size or part number of product desired
Quantity of product desired.

PREPARED UNDER THE JURISDICTION OF AMS COMMITTEE “F”