



AEROSPACE STANDARD

AS7482™**REV. C**

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Superseding AS7482B

(R) Studs, Steel, UNS S66286
Tensile Strength 130 ksi
1800 °F Solution Heat Treated, Aged Before Roll Threading
Procurement Specification

FSC 5307

RATIONALE

Extensive changes, both technical and editorial, throughout to harmonize with similar procurement specifications for externally threaded fasteners, add definition for a rateable lap, update references, and clarify microscopic examination and testing requirements.

1. SCOPE

This specification covers studs made from a corrosion and heat resistant, precipitation hardenable iron base alloy of the type identified under the Unified Numbering System as UNS S66286.

1.1 Type

The following specification designations and their properties are covered:

AS7482 130 ksi minimum ultimate tensile strength at room temperature
70 ksi stress-rupture strength at 1200 °F

AS7482-1 130 ksi minimum ultimate tensile strength at room temperature
78 ksi minimum ultimate shear strength at room temperature

AS7482-2 130 ksi minimum ultimate tensile strength at room temperature

1.1.1 Classification

130 ksi minimum tensile strength at room temperature.
1200 °F maximum test temperature of parts.

1.2 Application

Primarily for aerospace propulsion system applications where a good combination of strength and resistance to corrosion are required. AS7482 studs are intended for use at elevated temperatures in corrosion resistant steel parts. AS7482-1 studs are intended for studs loaded in shear. AS7482-2 studs are intended for use where the coefficient of expansion of the stud is more compatible for use in aluminum or magnesium alloys.

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Documents

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1.3 Safety - Hazardous Materials

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA and Canada), www.sae.org.

AMS2700	Passivation of Corrosion Resistant Steels
AMS2759/3	Heat Treatment, Precipitation Hardening, Corrosion-Resistant, Maraging, and Secondary Hardening Steel Parts
AMS5731	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 Heat Treated
AMS5732	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
AS1132	Bolts, Screws, and Nuts - External Wrenching UNJ Thread, Inch - Design Standard
AS3062	Bolts, Screws, and Studs, Screw Thread Requirements
AS3063	Bolts, Screws, and Studs, Geometric Control Requirements
AS6416	Bolts, Screws, Studs, and Nuts, Definitions for Design, Testing and Procurement
AS8879	Screw Threads - UNJ Profile, Inch - Controlled Radius Root with Increased Minor Diameter

2.1.2 AIA/NAS Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NASM1312-6	Fastener Test Methods, Method 6, Hardness
NASM1312-8	Fastener Test Methods, Method 8, Tensile Strength
NASM1312-10	Fastener Test Methods, Method 10, Stress Rupture
NASM1312-13	Fastener Test Methods, Method 13, Double Shear Test

2.1.3 ASME Publications

Available from ASME, P.O. Box 2900, 22 Law Drive, Fairfield, NJ 07007-2900. Tel. 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 974-882-1170 (outside North America), www.asme.org.

ASME B46.1 Surface Texture (Surface Roughness, Waviness, and Lay)

2.1.4 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A380/A380M Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

ASTM A967/A967M Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts

ASTM D3951 Commercial Packaging

ASTM E8/E8M Tension Testing of Metallic Materials

ASTM E112 Determining Average Grain Size

ASTM E139 Conducting Creep-Rupture, and Stress-Rupture Tests of Metallic Materials

ASTM E140 Standard Hardness Tables for Metals

ASTM E1417/E1417M Liquid Penetrant Examination

2.2 Definitions

Definitions shall be in accordance with AS6416.

2.3 Unit Symbols and Abbreviations

°C degree Celsius

°F degree Fahrenheit

% percent (1% = 1/100)

lbf pounds force

ksi kips (1000 pounds) per square inch

sp gr specific gravity

HRC hardness Rockwell C scale

3. TECHNICAL REQUIREMENTS

3.1 Material

Shall be AMS5731 corrosion and heat resistant steel heading stock or AMS5732 corrosion and heat resistant steel.

3.2 Design

Finished (completely manufactured) parts shall conform to the following requirements:

3.2.1 Dimensions

The dimensions of finished parts, after all processing including plating or coating, shall conform to the part drawing. Dimensions apply after plating but before coating with dry film lubricants.

3.2.2 Surface Texture

Surface texture of finished parts, prior to plating or coating, shall conform to the requirements as specified on the part drawing, determined in accordance with ASME B46.1.

3.2.3 Threads

Screw thread shall be UNJ profile and dimensions shall be in accordance with AS8879, unless otherwise specified on the part drawing. Tolerances for pitch diameter of the stud end thread shall be as specified on the part drawing. The special stud end thread variations shall be in accordance with AS3062 for the following requirements:

- a. Lead and half-angle variation
- b. Taper
- c. Out-of-roundness
- d. Stud lead threads
- e. Stud thread runout

3.2.3.1 The requirements for thread crest variations, locking holes in the nut end thread, incomplete lead threads, and thread runout in the nut end threads shall be as specified in AS3062.

3.2.3.2 Chamfer

The entering end of the thread shall be chamfered as specified on the part drawing.

3.2.4 Geometric Tolerances

Part features shall be within the geometric tolerances specified on the part drawing and, where applicable, controlled in accordance with AS3063.

3.3 Fabrication

3.3.1 Blanks

Blanks shall be machined sufficiently to remove surface defects. Blanks may be produced by machining, hot or cold forging, extruding, or a combination of these methods. Flash or chip clearance in machined recesses shall not cause recess dimensions to exceed the specified limits. Heading stock to be hot forged shall be heated to a temperature not higher than 2100 °F.

3.3.1.1 When a shoulder or shoulders are produced by upsetting, the metal removed from the bearing surface shall be as little as practicable to provide a clean, smooth surface.

3.3.2 Heat Treatment

Blanks shall, before finishing the shank and any bearing surface, cold rolling any fillet radii, and rolling the threads, conform to the technical requirements and other provisions specified in AMS2759/3 for A-286, 1800 °F solution treatment, and 1325 °F aging treatment.

3.3.2.1 Solution Heat Treatment

Blanks, unless machined from solution heat treated stock or AMS5732 steel, shall be solution heat treated as in 3.3.2.

3.3.2.2 Aging Treatment

After solution heat treatment as in 3.3.2.1, shall be heat treated by aging as in 3.3.2.

3.3.3 Oxide Removal

Surface oxide and oxide penetration resulting from prior heat treatment shall be removed from the full body diameter, thread roll diameter, and bearing surface of shoulders, as applicable, of the solution heat treated and aged blanks prior to rolling the threads. The oxide removal process shall produce no intergranular attack or corrosion of the blanks.

3.3.4 Thread Rolling

Threads shall be formed on the heat treated and finished blanks by a single cold rolling process for each end after removal of oxide as in 3.3.3.

3.3.5 Cleaning

Parts, after finishing, shall be cleaned in one of the following solutions for the time and temperature shown and then thoroughly rinsed:

- a. One volume of nitric acid (sp gr 1.42) and nine volumes of water for not less than 20 minutes at room temperature.
- b. One volume of nitric acid (sp gr 1.42) and four volumes of water for 30 to 40 minutes at room temperature.
- c. One volume of nitric acid (sp gr 1.42) and four volumes of water for 10 to 15 minutes at 140 to 160 °F.
- d. ASTM A967/A967M, ASTM A380/A380M, or AMS2700 for cleaning parts only, excluding any additional verification requirements (such as salt spray).

3.4 Plating or Coating

Where required, surfaces shall be plated as specified by the part drawing. Where coating with solid film lubricants is required, the under-head bearing surface (if applicable), the unthreaded shank, and the threads shall be coated as specified on the part drawing. Coating other surfaces is optional, unless otherwise specified. Plating thickness shall be determined in accordance with the requirements in the applicable plating specification.

3.5 Product Marking

Each part shall be marked for oversize on the stud end thread and for material code on the nut end thread as specified by the part drawing. The markings may be formed by stamping, depressed 0.010 inch maximum, with rounded root form on depressed characters.

3.6 Mechanical Properties

Where AS7482 is specified, parts shall conform to the requirements of 3.6.1, 3.6.2, and 3.6.3. Where AS7482-1 is specified, parts shall conform to the requirements of 3.6.1, 3.6.2, and 3.6.4. Where AS7482-2 is specified, parts shall conform to the requirements of 3.6.1 and 3.6.2. Threaded members of gripping fixtures for tensile and stress-rupture tests shall be of sufficient size and strength to develop the full strength of the part without stripping the thread.

AS7482 finished parts shall be tested in accordance with the following test methods:

- a. Hardness: MIL-STD-1312-6 in accordance with NASM1312-6.
- b. Ultimate tensile strength at room temperature: MIL-STD-1312-8 in accordance with NASM1312-8.
- c. Stress-rupture strength at 1200 °F: MIL-STD-1312-10 in accordance with NASM1312-10.

AS7482-1 finished parts shall be tested in accordance with the following test methods:

- a. Hardness: MIL-STD-1312-6 in accordance with NASM1312-6.
- b. Ultimate tensile strength at room temperature: MIL-STD-1312-8 in accordance with NASM1312-8.
- c. Ultimate double shear strength at room temperature: MIL-STD-1312-13 in accordance with NASM1312-13.

AS7482-2 finished parts shall be tested in accordance with the following test methods:

- a. Hardness: MIL-STD-1312-6 in accordance with NASM1312-6.
- b. Ultimate tensile strength at room temperature: MIL-STD-1312-8 in accordance with NASM1312-8.

3.6.1 Ultimate Tensile Strength at Room Temperature

3.6.1.1 Finished Parts

Parts shall have an ultimate tensile load not lower than that specified in Table 1 and shall be tested to failure in order to observe fracture location, first measuring and recording the maximum tensile load achieved. If the size or shape of the part is such that failure would occur outside the threaded section but the part can be tested satisfactorily, such as parts having a shank diameter equal to or less than the thread root diameter (smaller thread root diameter for studs with unequal size threads) or having an undercut, parts shall have an ultimate tensile strength not lower than 130 ksi; for such parts, the diameter of the area on which stress is based shall be the actual measured minimum diameter of the part.

3.6.1.2 Machined Test Specimens

If the size or shape of the part is such that a tensile test cannot be made on the part, tensile tests shall be conducted in accordance with ASTM E8/E8M on specimens prepared as in 4.4.7. Specimens may be required by the purchaser to perform confirmatory tests. Such specimens shall meet the following requirements:

- a. Ultimate tensile strength, minimum: 130 ksi.
- b. Yield strength at 0.2% Offset, minimum: 85 ksi.
- c. Elongation in 2 inches or 4D, minimum: 15%.
- d. Reduction of area, minimum: 20%.

3.6.1.2.1 When permitted by purchaser, hardness tests on the end of parts may be substituted for tensile tests of machined specimens.

3.6.2 Hardness

Shall be uniform within the range 24 to 37 HRC (see 8.1), but hardness of the threaded section may be higher as a result of the cold rolling operations. Parts shall not be rejected on the basis of hardness if the tensile strength properties specified in 3.6.1 are met.