



AEROSPACE STANDARD	AS45909™	REV. A
	Issued	2007-07
	Cancelled	2015-12
Superseded by NASM45909		
Stud, Locked In, Ring Locked, Serrated, General Specification For		

RATIONALE

This document is cancelled and is superseded by NASM45909 available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

CANCELLATION NOTICE

This Technical Report has been declared "CANCELLED" as of December 2015 and has been superseded by NASM45909. By this action, this document will remain listed in the respective index, if applicable. Cancelled Technical Reports are available from SAE.

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Documents

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1. SCOPE

1.1 Scope

The specification covers the requirements for locked-in studs. The method of locking in the stud is by means of a serrated collar and an accessory locking with matching serrations installed within the parent material to prevent rotation.

2. APPLICABLE DOCUMENTS

2.1 Government Documents

2.1.1 Specifications, Standards and Handbooks

The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MS51497	Stud, Locked in - Ring Locked, Serrated, High Strength, Oversize Replacer
MS51551	Stud, Locked in - Ring Locked, Serrated, UNJF Thread Nut Eng, Increased Stud End Length
MS51994	Hole Preparation - Ring Locked Inserts and Studs, Standard Dimensions for
MS51995	Fasteners, Ring Locked - Inserts and Studs, Installation of
MS51996	Hole Preparation - Ring Locked Inserts and Studs, High Strength, Standard Dimensions for
MIL-STD-2073-1	Standard Practice for Military Packaging

STANDARDS

FEDERAL

FED-STD-H28/2	Screw-Thread Standards for Federal Services, Section 2, Unified Inch Screw Threads-UN and UNR Thread Forms
FED-STD-H28/20	Screw-Thread Standards for Federal Services, Section 20, Inspection Methods for Acceptability of UN, UNR, UNJ, M and MJ Screw-Threads

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.2 Non-Government Publications

The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASQ Z1.4	Sampling Procedures and Tables for Inspection by Attributes
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(Application for copies should be addressed to ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.)

2.2.1 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.

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

AEROSPACE MATERIAL SPECIFICATION (AMS)

AMS-H-81200	Heat Treatment of Titanium and Titanium Alloys
AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
AMS 2401	Cadmium Plating, Low Hydrogen Content Deposit
AMS 2488	Anodic Treatment of Titanium and Titanium Alloys
AMS 2700	Passivation Treatments for Corrosion Resistant Steel
AMS 4965	Titanium Alloy Bars, Wire, Forgings, and Rings
AMS 4967	Titanium Alloy Bars, Forgings, and Rings
AMS 5662	Ni Alloy Bars, Forgings, and Rings, Corrosion and Heat Resistant
AMS 5663	Ni Alloy Bars, Forgings, and Rings, Corrosion and Heat Resistant
AMS 5731	Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant



AMS 5732	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing and Rings
AMS 5734	Steel Bars, Forgings, and Tubing, Corrosion and Heat Resistant
AMS 5737	Steel, Corrosion-Resistant, Bars, Wire, Forgings and Tubing
AMS 6322	Steel Bars, Forgings, and Rings
AMS 6370	Steel, Chrome-Nickel-Molybdenum (8740) Bars, Rods, and Forging Stock (For Aircraft Applications)
AMS 9047	Titanium and Titanium Alloy Bars (Rolled or Forged) and Reforging Stock, Aircraft Quality
AS Standards	
AS8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter, General specification For
AS51989	Stud, Locked in - Ring Locked, Serrated
AS51990	Ring, Lock, Serrated
AS51992	Stud, Locked in - Ring Locked, Serrated, High Strength
AS51997	Ring, Lock, Serrated - High Strength
ASTM	
ASTME 1444	Inspection, Magnetic Particle
ASTME 1417	Inspection, Liquid Penetrant
(Application for copies should be addressed to ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org)	
NAS	
NASM1312-6	Fastener Test Methods - Method 6 Hardness
NASM1312-8	Fastener Test Methods - Method 8 Tensile Strength
(Application for copies should be addressed to Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org)	
ASME	
ASME B46.1	Surface Texture

Publications: Available on-line at www.asme.org or from American Society of Mechanical Engineers, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170

Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other information services.)

2.3 Order of Precedence

In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, part standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained in which case the exception will be identified in the text and cited in the solicitation.

3. REQUIREMENTS

3.1 AS and MS Standard

The individual item requirements shall be as specified herein and in accordance with the applicable part standard. In the event any conflict between the requirements of this specification and the applicable standard, the latter shall govern.

3.2 Material

The stud shall be a one piece, all metal unit, made from the following materials as specified in the applicable part standard (see 3.1) when inspected in conformance with 4.10.

3.2.1 Alloy Steel

Alloy steel shall be grade 4130 (UNS G41300) in accordance with AMS 6370 or grade 8740 (UNS G87400) in accordance with AMS 6322.

3.2.2 Corrosion-resistant Steel

Corrosion and heat resistant steel shall be type A286 (UNS S66286) in accordance with AMS 5731, AMS 5732, AMS 5734 or AMS 5737.

3.2.2.1 Nickel Base Alloy

Nickel base alloy shall be corrosion and heat resistant type 718 (UNS N07718) in accordance with AMS 5662 or AMS 5663.

3.2.3 Titanium Alloy

Titanium alloy shall be type Ti-6Al-4V (UNS R56400) in accordance with AMS-T-9047, AMS 4967 or AMS 4965.

3.3 Heat Treatment

The stud or raw material shall be heat treated to develop the mechanical properties herein when inspected in conformance with 4.10.

3.4 Protective Finish or Surface Treatment

NOTICE

This document references a part which contains cadmium as a plating material. Consult local officials if you have questions concerning cadmium's use.

The stud shall be furnished with a protective plating or surface treatment as specified in the applicable part standard (see 3.1) when inspected in conformance with 4.6.3.

3.4.1 Alloy Steel

Alloy steel studs heat treated below 180 ksi UTS shall be cadmium plated in accordance with AMS-QQ-P-416, Type II, Class 3. Alloy steel studs heat treated 180 ksi UTS or greater shall be cadmium plated in accordance with AMS 2401.

3.4.2 Corrosion-resistant Steel

Corrosion-resistant steel studs shall be passivated in accordance with AMS 2700 Type 2 or 8.

3.4.3 Titanium Alloy

None required. Anodic treatment per AMS 2488, type 2 when specified on applicable part standard (see 3.1).

3.5 Design, Dimensions, and Tolerances

Design, dimensions, and tolerances shall conform to the requirements of the applicable part standard (see 3.1) and shall apply after application of the protective finish and surface treatment specified in 3.4.

3.5.1 Threads

Threads shall be right hand in accordance with the applicable part standard (see 3.1).

3.5.1.1 Nut End Threads

Nut end threads shall conform to AS8879 as specified in the applicable AS standard (see 3.1).

3.5.1.2 Stud End Threads

Stud end threads shall conform to FED-STD-H28/2. Pitch diameter and minor diameter shall be as specified in the applicable part standard (see 3.1). Acceptability of threads shall be in accordance with FED-STD-H28/20, system 21.

3.5.1.3 Thread Forming

Threads for nut end shall be fully formed by a single rolling process. Threads for stud end may be produced either by machining, grinding, or fully formed by a single rolling process.

3.5.1.4 Incomplete Threads

The runout threads shall be faired into the shank within a minimum of one and a maximum of two pitches without an abrupt change in cross sectional area. Lead thread shall not exceed two pitches. The root and flanks of the runout thread may deviate from true thread form but shall be smooth and free of tool marks.

3.5.1.5 Grain Flow

The grain flow in rolled threads shall follow the general thread contour with the maximum density at the bottom of the root radius as shown in Figure 1.

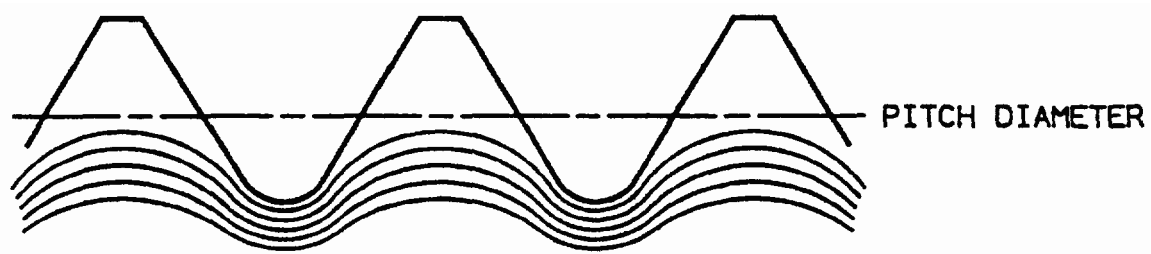


FIGURE 1 - THREAD GRAIN FLOW

3.5.2 Locking Serrations

Locking serration dimensions shall conform in size to the applicable part standard (see 3.1) and shall be of full form.

3.5.3 Surface Texture

The surface texture of the stud prior to plating shall not exceed the values specified in the applicable part standard (see 3.1) and shall be in accordance with ANSI/ASME B46.1 when tested in accordance with 4.6.6.

3.5.4 Straightness

The straightness of the nut end of the stud shall be within the values specified in Table 1 when tested in accordance with 4.6.5.

TABLE 1 - STRAIGHTNESS

Stud Size Nut End	Deviation of Stud from Plate, Maximum (inches per inch of stud nut end length)
0.1900 and smaller	0.0040
0.2500 - 0.3125	0.0030
0.3750 - 0.4375	0.0025
0.5000 and larger	0.0020

3.6 Mechanical Properties

Studs conforming to the design and dimensions specified in the applicable standard (see 3.1) and having load ratings as specified in Table 2 shall be capable of developing a minimum tensile strength, a minimum proof strength, and have minimum shear engagement areas in accordance with Table 2.

TABLE 2 - MECHANICAL PROPERTIES

Load Rating ksi	Minimum Tensile Strength ksi	Minimum Proof Strength ksi	Minimum Shear Engagement Area (Stud End)					
			MS51497					
			500 Numbers	640 Numbers	800 Numbers			
140	140	95	Table 5	Table 5	Table 5			
160	160	130	Col. 1	Col. 2	Col. 3			
180	180	145						
			MS51551					
			100 Numbers	100A Numbers	100B Numbers	200 Numbers	200A Numbers	200B Numbers
125	125	75	Table 5	Table 5	Table 5	Table 5	Table 5	Table 5
140	140	95	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
160	160	130						
			AS51989					
			100 & 300 Numbers	200 & 400 Numbers				
125	125	75	Table 5	Table 5				
			Col. 10	Col. 11				
			AS51992					
			500 Numbers	640 Numbers	800 Numbers			
140	140	95	Table 5	Table 5	Table 5			
160	160	130	Col. 12	Col. 13	Col. 14			
180	180	145						