INCH-POUND

MIL-S-45915A
21 August 1991
SUPERSEDING
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1 December 1967

MILITARY SPECIFICATION

STUD, LOCKED IN - KEY LOCKED, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope - This specification covers locked in studs which have integrated locking keys to prevent rotation of the stud when installed in the tapped holes.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. 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

FEDERAL

QQ-A-225/8 - Aluminum Alloy 6061, Bar, Rod, Wire and Special Shapes, Rolled, Drawn or Cold Finished
QQ-P-35 - Passivation Treatments for Corrosion Resistant Steel
QQ-P-416 - Plating, Cadmium (Electrodeposited)
PPP-H-1581 - Hardware (Fasteners and Related Items), Packaging of

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Armament Research, Development and Engineering Center, ATTN: SMCAR-BAC-S, Picatinny Arsenal, NJ 07806-5000 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5307

MILITARY

MIL-S-5626 - Steel, Chrome-Molybdenum (4140) Bars and Reforging Stock (For Aircraft Applications)
MIL-H-6875 - Heat Treatment of Steels (Aircraft Practice), Process for
MIL-S-8879 - Screw Threads, Controlled Radius Root and Increased Minor Diameter, General Specification for
MIL-I-17214 - Indicator, Permeability; Low MU (Go-No Go)

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.

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-1312/6 - Fastener Test Methods, Method 6, Hardness
MIL-STD-1312/8 - Fastener Test Methods, Method 8, Tensile Strength
MIL-STD-1312/13 - Fastener Test Methods, Method 13, Double Shear
MIL-STD-1949 - Inspection, Magnetic Particle
MIL-STD-6866 - Inspection, Liquid Penetrant
MS51833 - Stud, Locked In, Key Locked, Lightweight
MS51834 - Stud, Locked In, Key Locked, Heavy Duty
MS51835 - Insert and Stud, Locked In, Key Locked, Hole Dimensions for and Assembly of

HANDBOOKS

MILITARY

MIL-HDBK-57 - Listing of Fastener Manufacturers' Identification Symbols

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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

AMERICAN MATERIAL SPECIFICATION (AMS)

AMS 5640 - Steel Bars, Wire, and Forgings, Free Machining, Corrosion Resistant
AMS 5731 - Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant
AMS 5734 - Steel Bars, Forgings, and Tubing, Corrosion and Heat Resistant
AMS 5737 - Steel Bars, Wire, Forgings, and Tubing, Corrosion and Heat Resistant
AMS 5738 - Steel Bars, Free Machining, Corrosion Resistant
AMS 6322 - Steel Bars, Forgings and Rings

(Applications for copies should be addressed to SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI/ASME B46.1 - Surface Texture (Surface Roughness, Waviness and Lay)

(Applications for copies should be addressed to the American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036. or the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 580 - Stainless and Heat-Resisting Steel Wire
ASTM A 582 - Stainless and Heat-Resisting Steel Bars

(Applications for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.)

(Non-Government standards and other publications are normally available from the organizations that prepare or that distribute the documents. These documents may also be available in or through libraries or other informational 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, specification sheets or MS 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.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern (see 6.2).

3.2 Material. Recycled and reclaimed materials shall be used to the maximum extent practicable. Studs shall be fabricated of the following materials, as specified (see 3.1).

3.2.1 Alloy steel. Alloy steel shall be grade 4140 (UNS G41400) in accordance with MIL-S-5626 or grade 8740 (UNS G87400) in accordance with AMS 6322.

3.2.2 Corrosion-resistant steel. Corrosion-resistant steel shall be type 303 (UNS S30300) in accordance with AMS 5640 (Type 1) or ASTM A 582, or type 303SE (UNS S30323) in accordance with AMS 5640 (Type 2), AMS 5738 or ASTM A 582. Type A286 (UNS S66286) shall be in accordance with AMS 5731, AMS 5734 or AMS 5737. Type A286 shall have magnetic permeability of 2.0 maximum (Air = 1.0) for a field of H=200 oersteds.

3.2.3 Locking keys. Stud locking keys shall be made from corrosion-resistant steel, type 302, chemical composition of ASTM A 580 only.

3.3 Heat treatment. Studs made of alloy steel conforming to MIL-S-5626 or AMS 6322, and corrosion-resistant steel conforming to AMS 5731 or AMS 5734 shall be heat treated in accordance with MIL-H-6875 to develop the mechanical properties specified herein.

3.4 Cadmium plating and surface treatment. Studs shall be furnished with a cadmium plating or surface treatment as specified herein and 3.1.

3.4.1 Alloy steel. Studs fabricated from alloy steel shall be cadmium plated in accordance with QQ-P-416, Type II, Class 3, except stress durability test is not required. The entire stud shall be cadmium plated. The locking keys may or may not be cadmium plated.

3.4.2 Corrosion-resistant steel. Studs fabricated from corrosion-resistant steel, less the keys, shall be passivated in accordance with QQ-P-35. The key wire material shall be passivated in accordance with QQ-P-35 prior to assembly in the stud.

3.5 Design, dimensions and tolerance. Studs and locking keys shall be in accordance with the design, dimensions and tolerances specified in MS51833 or MS51834 as applicable (see 3.1). Dimensions and tolerances shall apply after application of the cadmium plating or surface treatment specified in 3.4.

3.5.1 Threads. Threads shall be right handed in accordance with the applicable specification sheet (see 3.1).

3.5.1.1 Nut end threads. Nut end threads shall conform to MIL-S-8879, and shall be of the sizes specified in the applicable specification sheet (see 3.1).

3.5.1.2 Stud end threads. Stud end threads shall conform to FED-STD-H28/2. Minor diameters shall be as specified in the applicable specification sheet (see 3.1).

3.5.1.3 Thread forming. Threads for the nut end shall be fully formed by a single rolling process subsequent to heat treatment and prior to plating or surface treatment. Threads for the stud end may be produced either by machining, grinding, or fully formed by a single rolling process prior to plating or surface treatment.

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 threads, including chamfer, 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 be continuous and shall follow the general thread contour with the maximum density at the bottom of the root radius as shown in figure 1.

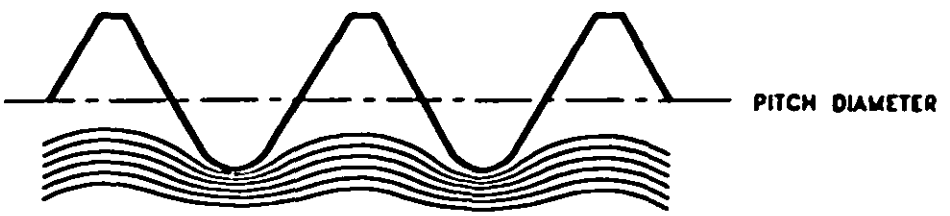


FIGURE 1. Thread grain flow

3.5.2 Surface texture. The surface texture of the stud prior to plating, shall not exceed the values specified in the applicable specification sheet (see 3.1) and shall be in accordance with ANSI/ASME B46.1 when tested in conformance with 4.3.2.6.

3.5.3 Straightness. The straightness of the stud shall be within the values specified in table I when tested in conformance with 4.3.2.5.

TABLE I. Allowable deviation of the stud

Basic Stud Size (Nut End)	Deviation of Stud - Maximum (Inches per Inch of Nut End Length)
.190 and smaller	0.0040
.250 - .3125	0.0030
.375 - .4375	0.0025
.500 and larger	0.0020

3.6 Mechanical properties. Studs conforming to the design and dimensions specified in the applicable specification sheet (see 3.1) and having load ratings as specified in tables IIa and IIb shall be capable of developing for a ultimate tensile strength and a minimum proof strength the values for ultimate tensile stress specified in tables IIa and IIb.

3.6.1 Tensile strength. The stud shall be capable of withstanding proof loads as specified in tables IIa and IIb when tested in conformance with 4.3.3.1.

TABLE IIa. Minimum tensile strength of studs - coarse threads (UNJC)

Basic Size (Nut End)	Stress Area in^2 1/ UNJC	Tensile Load - Lbs		
		80,000 psi (303/303SE) 2/	140,000 psi (A286) 2/	160,000 psi (4140/8740) 2/
.164	.0140	1,120	1,960	2,240
.190	.0175	1,400	2,450	2,800
.250	.0318	2,544	4,452	5,088
.3125	.0524	4,192	7,336	8,384
.375	.0775	6,200	10,850	12,400
.4375	.1063	8,504	14,882	17,008
.500	.1419	11,352	19,866	22,704
.5625	.1820	14,560	25,480	29,120
.625	.2260	18,080	31,640	36,160
.750	.3340	26,720	46,760	53,440
.875	.4620	36,960	64,680	73,920
1.000	.6060	48,480	84,840	96,960

1/ Tensile stress areas per ASME B1.1

2/ Stud material minimum ultimate tensile strength.

TABLE IIb. Minimum tensile strength of studs - fine threads (UNJF)

Basic Size (Nut End)	Stress Area in² 1/ UNJF	Tensile Load - Lbs		
		80,000 psi (303/303SE) 2/	140,000 psi (A286) 2/	160,000 psi (4140/8740) 2/
.164	.01474	1,179	2,063	2,358
.190	.0200	1,600	2,800	3,200
.250	.0364	2,912	5,096	5,824
.3125	.0580	4,640	8,120	9,280
.375	.0878	7,024	12,292	14,048
.4375	.1187	9,496	16,618	18,992
.500	.1599	12,792	22,386	25,584
.5625	.2030	16,240	28,420	32,480
.625	.2560	20,480	35,840	40,960
.750	.3730	29,840	52,220	59,680
.875	.5090	40,720	71,260	81,440
1.000	.6630	53,040	92,820	106,080

1/ Tensile stress areas per ASME B1.1

2/ Stud material minimum ultimate tensile strength.

3.6.2 Resistance to pullout. The installed stud (with or without locking keys installed) shall have a minimum resistance to pullout as specified in table III when installed in a test block and tested in conformance with 4.3.3.2.

TABLE III. Resistance to pullout

Basic Size (Nut End)	Studs Per MS51833		Studs Per MS51834	
	Minimum Shear Engagement Area in² 1/	Minimum Pullout Load Lbs. 2/	Minimum Shear Engagement Area in² 1/	Minimum Pullout Load Lbs. 2/
.164	--	--	.1517	4,096
.190	.1517	4,096	.1901	5,133
.250	.2371	6,402	.2842	7,673
.3125	.3049	8,232	.3588	9,688
.375	.4299	11,607	.4975	13,433
.4375	.5665	15,296	.7172	19,364
.500	.7172	19,364	.8884	23,987
.5625			1.2493	33,731
.625			1.4866	40,138
.750			2.4901	67,233
.875			3.1370	84,699
1.000			3.8381	103,629

1/ Shear engagement area is an unassembled dimensional value for the overall engaged area of the mating thread member. It does not represent a dimension of either of the members in an unassembled condition.

2/ Pullout load = (Shear engagement area) x (27,000 psi). To compute minimum pullout load in other materials, multiply shear engagement area by the applicable minimum ultimate shear strength of the material.

3.6.3 Rotational resistance. The installed stud shall have a minimum resistance to torque out as specified in table IV when tested in conformance with 4.3.3.3.

TABLE IV. Minimum torque out requirements

Basic Size (Nut End)	Studs Per MS51833	Studs Per MS51834
	Torque, Inch-pounds	Torque, Inch-pounds
.164	--	72
.190	72	110
.250	120	180
.3125	240	360
.375	320	480
.4375	400	600
.500	600	900
.5625		1,200
.625		1,800
.750		2,400
.875		3,600
1.000		4,800

3.6.4 Hardness. Alloy steel studs shall meet the hardness as specified in the applicable specification sheet (see 3.1) when tested in conformance with 4.3.3.4.

3.7 Metallurgical properties.

3.7.1 Discontinuities. Studs shall not contain discontinuities which exceed the following limitations when examined in conformance with 4.3.3.6.

3.7.1.1 Cracks (see 6.3.1). Studs shall be free of cracks in any direction or location when examined in conformance with 4.3.3.6.

3.7.1.2 Laps and seams (see 6.3.2 and 6.3.3). Studs may possess laps and seams, except in locations as shown in figure 2. Permissible laps and seams as shown in figure 2 shall not exceed the depths specified in table V. Care must be exercised not to confuse cracks with inclusions, as specified herein.

TABLE V. Maximum discontinuity depth

Basic stud size (Nut end)	Discontinuity depth in inches, max 1/
.164 thru .3125	0.005
.375	0.006
.4375	0.007
.500 thru 1.000	0.008

1/ Depth of discontinuity shall be measured normal to the surface at a point of greatest penetration.

3.7.1.3 Inclusions (see 6.3.4). Studs shall show no evidence of surface or subsurface inclusions at the thread root as shown in figure 2 when examined in conformance with 4.3.3.6.

3.7.2 Grinding Burns. The studs shall show no visual evidence of grinding burns.

3.8 Source identification mark. The stud shall be marked on the key tang or stud. The source identification insignia for a manufacturer shall be in accordance with MIL-HDBK-57 or a private label distributor's insignia as applicable. The source identification mark shall be legible and permanent.

3.9 Workmanship. Workmanship shall be consistent with the type of product, finish, and class of thread fit specified. Studs shall be of uniform quality and free from defects which would be detrimental to the performance of the stud.

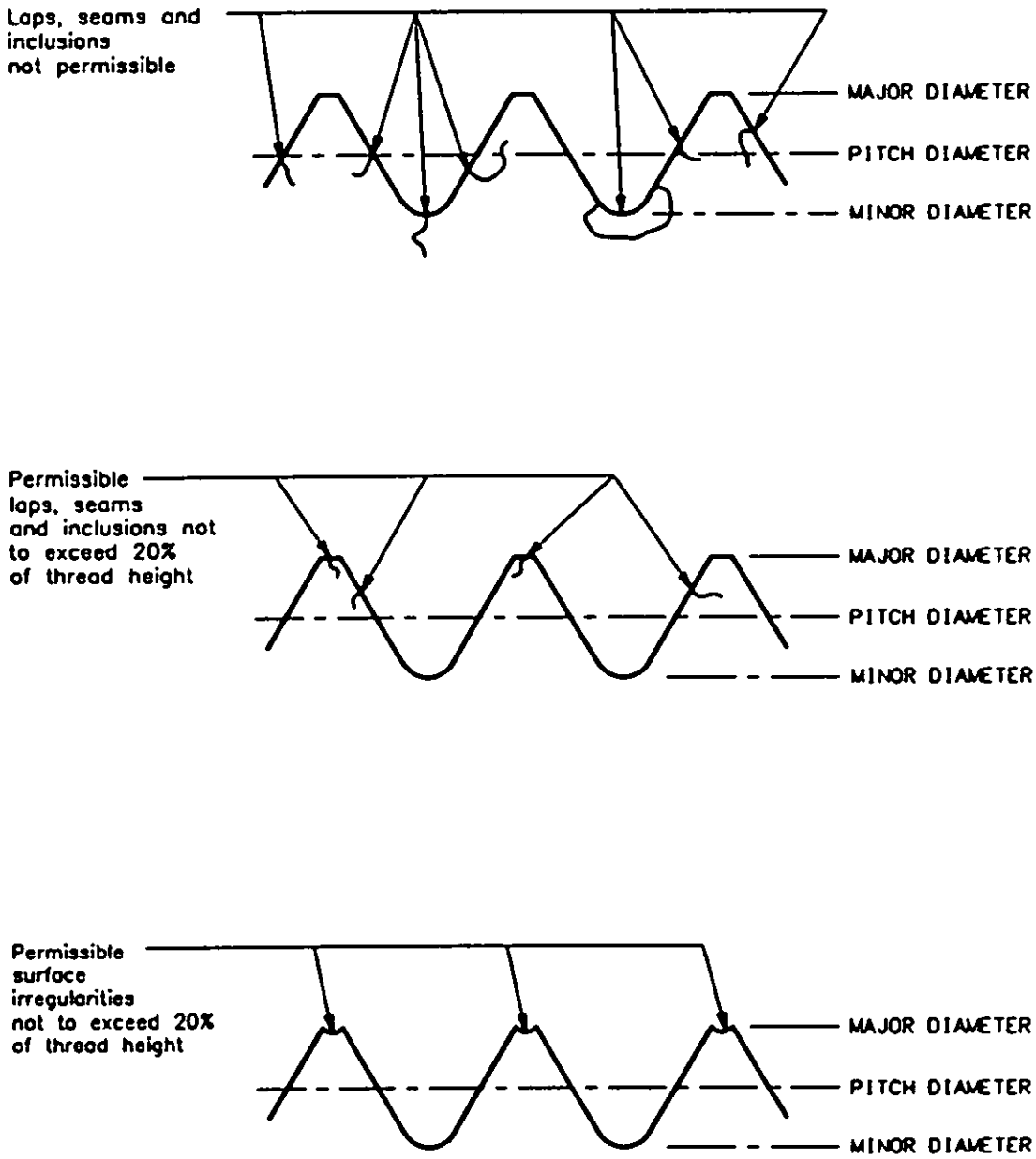


FIGURE 2. Laps, seams, inclusions and surface irregularities in threads

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Quality conformance inspection. Quality conformance inspection shall be as specified in table VI. MIL-STD-105 shall be used as a guide in the development of contractors' statistical techniques to assure the stud meets all requirements specified herein. When specified in the contract, a sampling plan shall be documented in the contractors' quality assurance plan, certified by the contractor, and subject to the approval of the Government.

4.2.1 Lot

4.2.1.1 Inspection lot. An inspection lot shall consist of all studs covered by a single specification sheet, of the same heat number of material and finish, nominal size and thread series, fabricated by the same production process under essentially the same conditions, and submitted for acceptance at one time. An inspection lot shall be considered as being originally part of a manufacturing lot (4.2.1.2). Any evidence of defects in the lot submitted shall constitute cause for rejection of the entire lot.

4.2.1.2 Manufacturing lot. A manufacturing lot is one continuous run of processed studs covered by a single specification sheet of the same heat number of material and finish, nominal size and thread series, fabricated by the same production process where evidence of specified destructive type sample testing (4.2.4 and 4.2.5) has been conducted and submitted for acceptance at one time. Any evidence of defects in the lot submitted shall constitute cause for rejection of the entire lot.

4.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for inspection. Resubmitted lots shall be in accordance with 4.2. Such lots shall be separate from new lots, and shall be clearly identified as re-inspected lots.

TABLE VI. Quality conformance inspection

Inspection	Requirement Paragraph	Test Paragraph
Group A		
Material	3.2	4.3.3.5
Heat treatment	3.3	4.3.3.4
Cadmium plating	3.4.1	4.3.2.3
Passivation	3.4.2	4.3.2.4
Dimensions	3.5	4.3.2.7
Straightness	3.5.3	4.3.2.5
Grinding burns	3.7.2	4.3.2.7
Source identification	3.8	4.3.2.7
Workmanship	3.9	4.3.2.7
Group B		
Magnetic permeability	3.2.2	4.3.3.8
Threads	3.5.1	4.3.2.2
Surface texture	3.5.2	4.3.2.6
Group C		
Grain flow	3.5.1.5	4.3.3.7
Tensile strength (proof)	3.6.1	4.3.3.1
Resistance to pullout (proof)	3.6.2	4.3.3.2
Rotational resistance (proof)	3.6.3	4.3.3.3
Hardness	3.6.4	4.3.3.4
Discontinuities	3.7.1	4.3.3.6
Cracks	3.7.1.1	4.3.3.6
Laps and seams	3.7.1.2	4.3.3.6
Inclusions	3.7.1.3	4.3.3.6

4.2.3 Sampling for visual and dimensional examination. Samples of studs shall be taken from each lot and examined in accordance with table VII, and 4.2.

TABLE VII. Visual and dimensional examination

Defect	Inspection Method
Thread size and form not as specified (see 3.5.1)	C.I.E. 1/
Heat treatment nonconforming (see 3.3)	C.I.E.
Passivation or cadmium plating missing or incomplete (see 3.4)	Visual
Length of stud nonconforming (see 3.5)	C.I.E.
Stud end length nonconforming (see 3.5)	C.I.E.
Nut end thread length nonconforming (see 3.5)	C.I.E.
Shank diameter nonconforming (see 3.5)	C.I.E.
Drilled hole in nut end missing (when required) (see 3.5)	Visual
Drilled hole diameter and location nonconforming	C.I.E.
Incomplete threads (see 3.5.1.4)	C.I.E.
Discontinuities (see 3.7.1)	C.I.E.
Surface texture nonconforming (see 3.5.2)	C.I.E./Visual
Straightness of stud nonconforming (see 3.5.3)	C.I.E.
Workmanship nonconforming (see 3.9)	Visual
Chamfer on thread ends nonconforming (see 3.5)	Visual
Grinding burns (see 3.7.2)	Visual
Source identification mark not as specified (see 3.8)	Visual

1/ Commercial Inspection Equipment

4.2.4 Sampling for tests of tensile strength, pullout and torque out. Sampling for these tests shall be in accordance with table VI, 4.2 and 4.2.1.2.

4.2.5 Sampling for hardness. Samples of studs shall be tested for hardness in accordance with table VI, 4.2 and 4.2.1.2.

4.2.6 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of PPP-H-1581.

4.3 Method of inspection.

4.3.1 Test materials.

4.3.1.1 Test blocks. Test blocks shall be fabricated in accordance with figure 3 as applicable. The aluminum alloy used to prepare the test blocks shall be tested (by heat lot), to determine the ultimate shear strength. The 6061 (UNS A96061) T6 and T651 tempers, in accordance with QQ-A-225/8, shall have a minimum shear strength of 27,000 psi. Three shear test specimens, per heat lot, of aluminum material shall be made and tested in conformance with MIL-STD-1312, test method 13.

4.3.1.2 Test specimens. Test specimens shall consist of studs installed in conformance with MS51835 in test blocks specified in 4.3.1.1 (figure 3) or as specified in MIL-STD-1312, test method 8.

4.3.2 Examination methods.

4.3.2.1 Visual and dimensional examination. Samples of studs shall be examined to verify conformance with this specification. Examination shall be conducted in accordance with table VII and the following.

4.3.2.2 Thread inspection.

4.3.2.2.1 Stud end threads. Prior to assembly of the keys, samples of the studs' stud end threads shall be inspected for thread form in conformance with the gaging requirements of FED-STD-H28/20, System 22. The minor diameter dimensions shall be as specified in the applicable specification sheet (see 3.1). Assembled studs (after key installation) shall be checked in a tapped hole gage in accordance with MS51835.

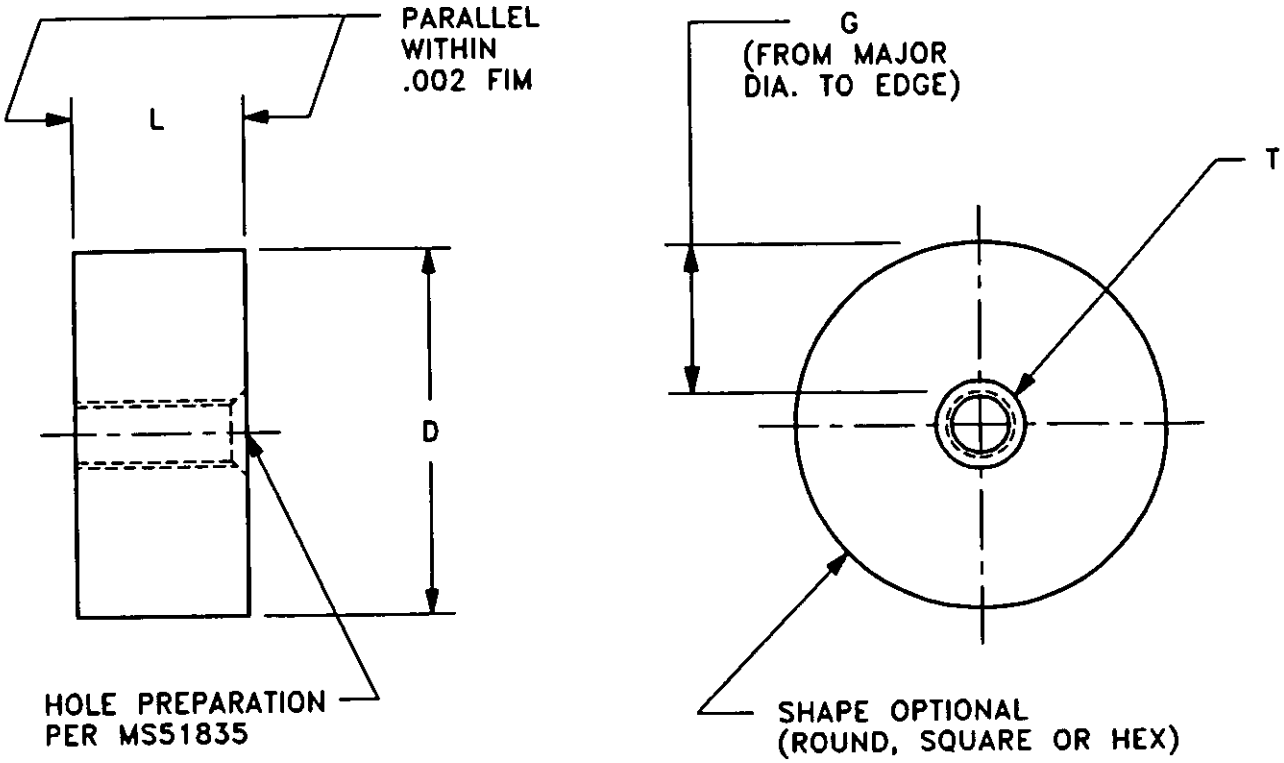
4.3.2.2.2 Nut end threads. Nut end threads shall be inspected in accordance with MIL-S-8879.

4.3.2.3 Cadmium plating inspection. Cadmium plating shall be inspected for conformance with the requirements of 3.4.1.

4.3.2.4 Passivation inspection. Passivation shall be inspected for conformance to the requirements of 3.4.2.

4.3.2.5 Straightness inspection. Samples of studs shall be inspected for straightness using commercial inspection equipment. The deviation shall not exceed the values specified in table I.

4.3.2.6 Surface texture inspection. Samples of studs shall be inspected for surface texture with any of the surface examination and measurement methods specified in ANSI/ASME B46.1 in accordance with 3.5.2.



1. Dimensions:

D = To be 1.00", 2.00", 3.00" or larger, as required.
G = To be a minimum of ½ T.
L = Length of applicable stud end thread plus .063" minimum.
T = Nominal stud end thread diameter of applicable stud.

2. Material:

Aluminum Alloy, 6061-T6 or 6061-T651 per QQ-A-225/8. (3.6.2 & 3.6.3)

FIGURE 3. Test block (coupon)

4.3.2.7 Dimensions, grinding burns, source identification mark and workmanship. Dimensions, grinding burns, source identification mark and workmanship shall be inspected visually to determine conformance with the requirements of 3.5, 3.7.2, 3.8 and 3.9.

4.3.3 Test methods.

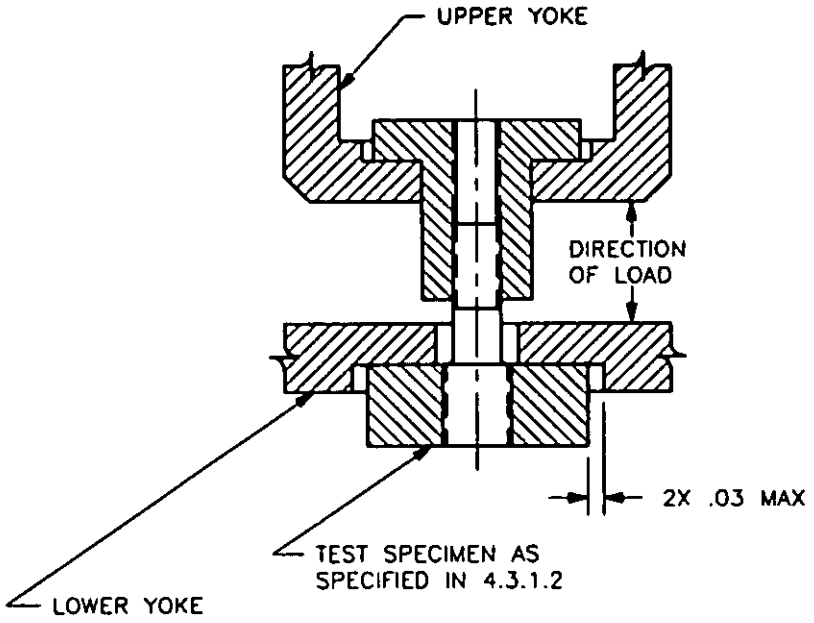
4.3.3.1 Tensile strength (proof) test. Nut end threads of the stud shall be tested in conformance with MIL-STD-1312, test method 8, in tension between the nut end and the stud end to meet the requirements of 3.6.1. Fixtures shown in figure 4 may also be used. Samples shall be of sufficient length to develop the full strength of the nut end thread of the stud without stripping the thread.

4.3.3.2 Resistance to pullout (proof) test. Test specimens of studs shall be installed in test blocks (figure 3) as specified in 4.3.1.1. The stud shall then be assembled in a fixture as shown in figure 4 or in accordance with MIL-STD-1312, test method 8. The axial load shall be applied at a rate not to exceed 100,000 psi per minute based on the minimum shank diameter of the stud to meet the requirements of 3.6.2. The test shall be considered successful if the stud pulls out or remains in the test block at the minimum values shown in table III or the nut end of the stud fails at or above the values shown in tables IIa or IIb.

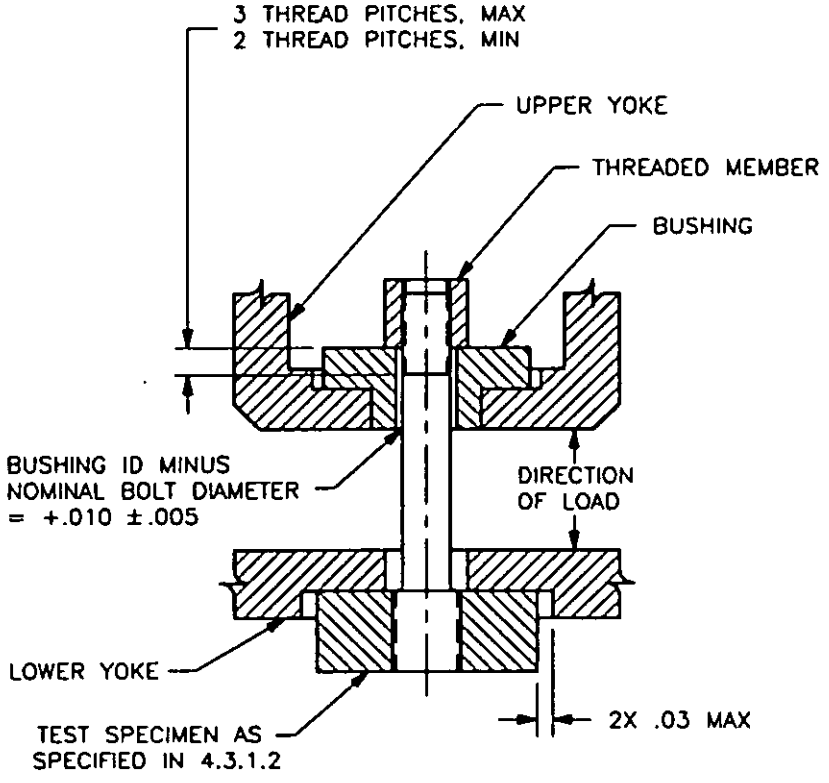
4.3.3.3 Rotational resistance (proof) test. Test specimens of studs shall be installed in test blocks (figure 3) as specified in 4.3.1.1. Torque-out values, with no axial load on the stud, shall meet the requirements specified in 3.6.3. The rotational force is to be applied with a torque wrench in a counter-clockwise direction. Failure of the stud to remain in the test block shall be cause for rejection.

4.3.3.4 Hardness test. Samples of alloy steel studs shall be tested for hardness requirements of 3.6.4. in accordance with MIL-STD-1312, test method 6.

4.3.3.5 Raw material inspection. Raw material chemical analysis certification may be accepted in lieu of test data.



OPTION 1



OPTION 2

FIGURE 4. Resistance to pullout fixture (options)

4.3.3.6 Discontinuities inspection. Samples of studs shall be inspected for discontinuities such as cracks, laps, seams and inclusions in accordance with 3.7. Any crack detected during visual examination shall be cause for rejection of the lot. When visual evidence of discontinuities show cause for further inspection, sample studs shall be subjected to magnetic particle inspection performed in accordance with MIL-STD-1949 for alloy steel, fluorescent penetrant inspection performed in accordance with MIL-STD-6866 for corrosion-resistant steel. Magnetic particle or penetrant inspection indications alone shall not be cause for rejection. If indications are considered cause for rejection, representative samples shall be taken from those studs showing indication and these samples shall be further examined. Studs may be sectioned as shown in figure 5 and shall be inspected parallel to the axis. Discontinuities are measured microscopically under 100 X magnification to determine conformance to the requirements of 3.7.1. The inspection shall be performed on finished studs subsequent to any processing operation which could adversely affect the studs.

4.3.3.7 Grain flow inspection. Sample studs shall be microexamined to determine compliance with the requirements of 3.5.1.5 grain flow for rolled threads. Specimens shall be taken from the stud as shown in figure 5. The studs shall be etched in a suitable etchant for sufficient time to reveal the macrostructure properly.

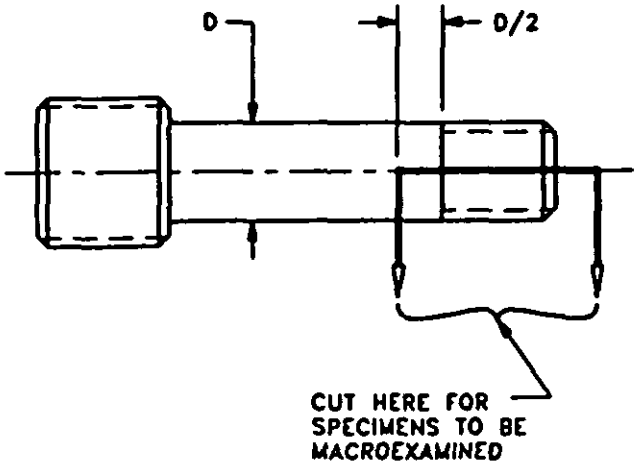


FIGURE 5. Metallurgical specimen

4.3.3.8 Magnetic permeability test. Austenitic corrosion-resistant steel studs, subjected to visual and dimensional examination, shall also be tested to determine magnetic permeability (see 3.2.2) in accordance with MIL-I-17214.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with PPP-H-1581 (see 6.2c).

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Studs covered by this specification are intended as a general purpose fastener with depth locating keys and a mechanical lock to resist rotation when installed.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this specification and applicable specification sheet.
b. Applicable specification sheet part number (see 3.1).
c. Level (degree) of protection in accordance with PPP-H-1581, ordering data (see 5.1).

6.3 Definitions

6.3.1 Crack. A crack is a clean crystalline break passing through the grain or grain boundary without the inclusion of foreign elements.

6.3.2 Lap. A lap is a surface defect appearing as a seam, caused by the folding over of metal fins or sharp corners and then rolling or forging them into the surface, but not welding them.

6.3.3 Seam. A seam is an unwelded fold or lap which appears as an opening in the raw material as received from the source.

6.3.4 Inclusions. Inclusions are non-metallic materials in a solid metallic matrix.

6.4 Key word listing.

Lightweight stud
Locked in stud
Locking keys
Heavy duty stud
Key locked stud

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - AR
Navy - AS
Air Force - 99

Review Activities
Army - AV, MI
Navy - SH
Air Force - 82
DLA - IS

User Activities
Army - AT, ER
Navy - MC

Preparing Activity:
Army - AR

(Project No. 5307-0542)

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-S-45912A	21 August 1991

3. DOCUMENT TITLE: STUD, LOCKED IN - KEY LOCKED, GENERAL SPECIFICATION FOR

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets if needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

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